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Command Control Interface
User and Reference Guide

Hitachi Virtual Storage Platform G1000
Hitachi Unified Storage VM
Hitachi Virtual Storage Platform
Hitachi Universal Storage Platform V/VM

FASTFIND LINKS

MK-90RD7010-18

Hitachi Data Systems

Contents

Preface

This document describes and provides instructions for using the Command Control Interface software to configure and perform operations on the Hitachi RAID storage systems.

Please read this document carefully to understand how to use this product, and maintain a copy for reference purposes.

Intended audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers who are involved in installing, configuring, and operating the Hitachi storage system.

Readers of this document should be familiar with the following:

- Data processing and understands RAID storage systems and their basic functions.
- The Hitachi RAID storage system and the manual for the storage system (for example, *Hitachi Virtual Storage Platform G1000 Product Overview*, *Hitachi Virtual Storage Platform User and Reference Guide*).
- The management software for the storage system (for example, Hitachi Command Suite, Hitachi Device Manager - Storage Navigator, Storage Navigator) and the applicable user manuals (for example, *Hitachi Command Suite User Guide*, *Hitachi Virtual Storage Platform G1000 Mainframe System Administrator Guide*, *Hitachi Storage Navigator User Guide* for VSP, HUS VM, USP V/VM.

Product version

This document revision applies to CCI version 01-32-03/01 or later.

Release notes

The Release Notes provide information about the microcode (DKCMAIN and SVP), including new features and functions and changes. The Release Notes are available on the Hitachi Data Systems Portal: https://portal.hds.com

Document revision level

Revision	Date	Description
MK-90RD7010-00	October 2010	Initial release
MK-90RD7010-01	December 2010	Supersedes and replaces MK-90RD7010-00
MK-90RD7010-02	January 2011	Supersedes and replaces MK-90RD7010-01
MK-90RD7010-03	April 2011	Supersedes and replaces MK-90RD7010-02
MK-90RD7010-04	August 2011	Supersedes and replaces MK-90RD7010-03
MK-90RD7010-05	November 2011	Supersedes and replaces MK-90RD7010-04
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MK-90RD7010-08	September 2012	Supersedes and replaces MK-90RD7010-07
MK-90RD7010-09	November 2012	Supersedes and replaces MK-90RD7010-08
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MK-90RD7010-11	January 2013	Supersedes and replaces MK-90RD7010-10
MK-90RD7010-12	February 2013	Supersedes and replaces MK-90RD7010-11
MK-90RD7010-13	March 2013	Supersedes and replaces MK-90RD7010-12

Revision	Date	Description
MK-90RD7010-14	July 2013	Supersedes and replaces MK-90RD7010-13
MK-90RD7010-15	October 2013	Supersedes and replaces MK-90RD7010-14
MK-90RD7010-16	December 2013	Supersedes and replaces MK-90RD7010-15
MK-90RD7010-17	April 2014	Supersedes and replaces MK-90RD7010-16
MK-90RD7010-18	August 2014	Supersedes and replaces MK-90RD7010-17

Changes in this revision

- Added support for global-active device operations (Remote replication on page 1-8, Using CCI with global-active device on page 6-5).
- Added a note about slow command response during out-of-band operations (Command execution using in-band and out-of-band methods on page 3-2).
- Added information about \HORCM\Tool\TRCLOG.bat and \HORCM\etc\rmsra.exe (CCI files for Windows-based systems on page 2-33).
- Updated the command to run on HP-UX when no $HORCMPERM file exists (Table 7-3 Without a $HORCMPERM file: Commands to run on different operating systems on page 7-13).
- Updated the tables of CCI error messages (Error messages and error codes on page 9-6).

Referenced documents

Hitachi Command Control Interface documents:

- *Command Control Interface Installation and Configuration Guide*, MK-90RD7008
- *Command Control Interface User and Reference Guide*, MK-90RD7010

Hitachi Virtual Storage Platform G1000 documents:

- *Hitachi Virtual Storage Platform G1000 Product Overview*, MK-92RD8051
- *Hitachi Command Suite User Guide*, MK-90HC172
- *Hitachi Command Suite Messages*, MK-90HC178
- *Hitachi Virtual Storage Platform G1000 Mainframe System Administrator Guide*, MK-92RD8016
- *Hitachi Thin Image User Guide*, MK-92RD8011
- *Hitachi Virtual Storage Platform G1000 Provisioning Guide for Open Systems*, MK-92RD8014
- *Hitachi TrueCopy® User Guide*, MK-92RD8019
- *Hitachi ShadowImage® User Guide*, MK-92RD8021
- *Hitachi Universal Replicator User Guide*, MK-92RD8023
- *Hitachi Universal Volume Manager User Guide*, MK-92RD8024

- *Global-Active Device User Guide*, MK-92RD8072

Hitachi Unified Storage VM documents:

- *Hitachi Unified Storage VM Block Module Provisioning Guide*, MK-92HM7012
- *Hitachi ShadowImage® User Guide*, MK-92HM7013
- *Hitachi Storage Navigator User Guide*, MK-92HM7016
- *Hitachi Storage Navigator Messages*, MK-92HM7017
- *Hitachi TrueCopy® User Guide*, MK-92HM7018
- *Hitachi Universal Replicator User Guide*, MK-92HM7019
- *Hitachi Universal Volume Manager User Guide*, MK-92HM7020

Hitachi Virtual Storage Platform documents:

- *Hitachi Copy-on-Write Snapshot User Guide*, MK-90RD7013
- *Provisioning Guide for Mainframe Systems*, MK-90RD7021
- *Provisioning Guide for Open Systems*, MK-90RD7022
- *Hitachi ShadowImage® for Mainframe User Guide*, MK-90RD7023
- *Hitachi ShadowImage® User Guide*, MK-90RD7024
- *Hitachi Storage Navigator User Guide*, MK-90RD7027
- *Hitachi Storage Navigator Messages*, MK-90RD7028
- *Hitachi TrueCopy® User Guide*, MK-90RD7029
- *Hitachi TrueCopy® for Mainframe User Guide*, MK-90RD7030
- *Hitachi Universal Replicator for Mainframe User Guide*, MK-90RD7031
- *Hitachi Universal Replicator User Guide*, MK-90RD7032
- *Hitachi Universal Volume Manager User Guide*, MK-90RD7033
- *Hitachi Thin Image User Guide*, MK-90RD7179

Hitachi Universal Storage Platform V/VM documents:

- *Hitachi Copy-on-Write Snapshot User Guide*, MK-96RD607
- *LUN Manager User's Guide*, MK-96RD615
- *Hitachi ShadowImage for IBM® z/OS® User Guide*, MK-96RD619
- *Hitachi ShadowImage® User Guide*, MK-96RD618
- *Hitachi Storage Navigator User Guide*, MK-96RD621
- *Hitachi Storage Navigator Messages*, MK-96RD613
- *Hitachi TrueCopy® User Guide*, MK-96RD622
- *Hitachi TrueCopy for IBM® z/OS® User's Guide*, MK-96RD623
- *Hitachi Universal Replicator for IBM® z/OS® User's Guide*, MK-96RD625
- *Hitachi Universal Replicator User Guide*, MK-96RD624
- *Hitachi Universal Volume Manager User Guide*, MK-96RD626

Document conventions

This document uses the following terminology conventions:

Convention	Description
Hitachi RAID storage system	Refers to all supported models, unless otherwise noted. The Hitachi RAID storage systems include the following models: • Hitachi Virtual Storage Platform G1000 • Hitachi Unified Storage VM • Hitachi Virtual Storage Platform • Hitachi Universal Storage Platform V/VM • Hitachi TagmaStore® Universal Storage Platform • Hitachi TagmaStore® Network Storage Controller
Hitachi enterprise storage system	Refers to the Hitachi RAID storage systems except for the Hitachi Unified Storage VM.

This document uses the following typographic conventions:

Convention	Description
Regular text bold	In text: keyboard key, parameter name, property name, hardware label, hardware button, hardware switch In a procedure: user interface item
Italic	Variable, emphasis, reference to document title, called-out term
`Screen text`	Command name and option, drive name, file name, folder name, directory name, code, file content, system and application output, user input
< > (angle brackets)	Variable (used when italic is not enough to identify variable)
[ ] (square brackets)	Optional value
{ } (braces)	Required or expected value
| (vertical bar)	Choice between two or more options or arguments

This document uses the following icons to draw attention to information:

Icon	Meaning	Description
	Tip	Provides helpful information, guidelines, or suggestions for performing tasks more effectively.
	Note	Provides information that is essential to the completion of a task.
	Caution	Warns that failure to take or avoid a specified action can result in adverse conditions or consequences (for example, loss of access to data).
	WARNING	Warns that failure to take or avoid a specified action can result in severe conditions or consequences (for example, loss of data).

Convention for storage capacity values

Physical storage capacity values (for example, disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 KB	1,000 bytes
1 MB	1,000 KB or $1,000^2$ bytes
1 GB	1,000 MB or $1,000^3$ bytes
1 TB	1,000 GB or $1,000^4$ bytes
1 PB	1,000 TB or $1,000^5$ bytes
1 EB	1,000 PB or $1,000^6$ bytes

Logical storage capacity values (for example, logical device capacity) are calculated based on the following values:

Logical capacity unit	Value
1 KB	1,024 bytes
1 MB	1,024 KB or $1,024^2$ bytes
1 GB	1,024 MB or $1,024^3$ bytes
1 TB	1,024 GB or $1,024^4$ bytes
1 PB	1,024 TB or $1,024^5$ bytes
1 EB	1,024 PB or $1,024^6$ bytes
1 block	512 bytes
1 cylinder (cyl)	Open-systems: • OPEN-V: 960 KB • Other than OPEN-V: 720 KB Mainframe: 870 KB

Accessing product documentation

The user documentation for CCI and the Hitachi storage systems is available on the Hitachi Data Systems Portal: https://portal.hds.com. Check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting help

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the Hitachi Data Systems Portal for contact information: https://portal.hds.com

Comments

Please send us your comments on this document: doc.comments@hds.com. Include the document title and number, including the revision level (for example, -07), and refer to specific sections and paragraphs whenever possible. All comments become the property of Hitachi Data Systems Corporation.

Thank you!

1

Overview

This chapter provides an overview of the Command Control Interface software and CCI operations on the Hitachi RAID storage systems.

About Command Control Interface

The Command Control Interface software enables you to perform storage system configuration and data management operations by issuing commands to the Hitachi RAID storage systems:

- Hitachi Virtual Storage Platform G1000 (VSP G1000)
- Hitachi Unified Storage VM (HUS VM)
- Hitachi Virtual Storage Platform (VSP)
- Hitachi Universal Storage Platform V/VM (USP V/VM)
- Hitachi TagmaStore® Universal Storage Platform (TagmaStore USP)
- Hitachi TagmaStore® Network Storage Controller (TagmaStore NSC)

CCI continues to provide the proven functionality that has been available for the USP V/VM and previous storage system models, including in-system replication, remote replication, and data protection operations.

In addition, CCI for VSP and later now provides command-line access to the same provisioning and storage management operations that are available in the Hitachi Storage Navigator graphical user interface. CCI commands can be used interactively or in scripts to automate and standardize storage administration functions, thereby simplifying the job of the storage administrator and reducing administration costs.

Caution: Some storage systems may reject commands from CCI. If a CCI command is rejected, verify the software licenses for the storage system (for example, TrueCopy) and the status of the software product and storage system.

CCI functions

CCI functions matrix

The following table lists and describes CCI functions available on each storage system.

Table 1-1 Available CCI functions on each storage system

Function	Storage system				
	TagmaStore USP/NSC	USP V/VM	VSP	HUS VM	VSP G1000
Local copy (open)	Yes	Yes	Yes	Yes	Yes
Local copy (mainframe)	No	No	Yes*	No	Yes
Remote copy (open)	Yes	Yes	Yes	Yes	Yes
Remote copy (mainframe)	No	No	Yes*	No	Yes
Data protection	Yes	Yes	Yes	Yes	Yes
VSS configuration	Yes	Yes	Yes	Yes	Yes
SRM SRA	Yes	Yes	Yes	Yes	Yes

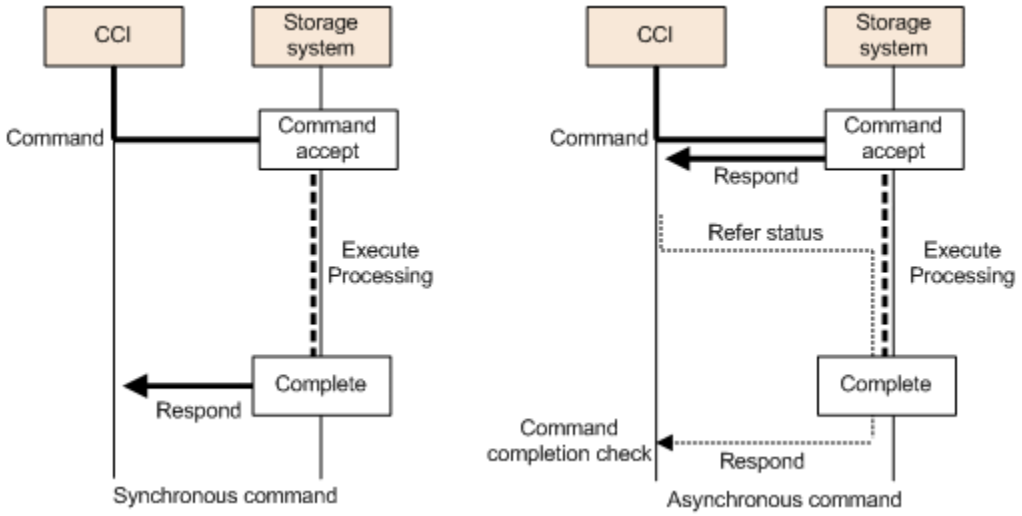
Function	Storage system				
	TagmaStore USP/NSC	USP V/VM	VSP	HUS VM	VSP G1000
Provisioning (raidcom)	No	No	Yes	Yes	Yes
Out-of-band method	No	No	Yes	Yes	Yes
User authentication	No	No	Yes	Yes	Yes
LDEV nickname	No	No	Yes	Yes	Yes
LDEV group	No	No	Yes	Yes	Yes
Resource group	No	No	Yes	Yes	Yes
Resource lock	No	No	Yes	Yes	Yes
*If DKCMAIN Microcode version of the VSP storage system is 70-03-3x-xx/xx or later, the operation of TrueCopy for Mainframe, Universal Replicator for Mainframe, and ShadowImage for Mainframe can be performed from Command Control Interface.					

Provisioning function

By executing a configuration setting command (**raidcom** command) from CCI, the provisioning function such as setting commands or creating LDEVs can be done. For the information about the configuration setting command (**raidcom** command), see Overview of the configuration setting command on page 5-2.

Asynchronous command processing

Within the configuration setting commands (**raidcom** commands), using asynchronous commands is a method of command processing applied to a command that takes much time in processing on the storage system. Once this processing method of command is issued, an additional command can be executed without having to wait for the command completion that executed just before. It is also possible to monitor the completion status by using a status reference command.



Command execution modes

CCI provides two command execution modes: transaction mode that executes by specifying a script file with -zt option, and line-by-line mode that executes a command row-by-row for the configuration setting commands (**raidcom** commands). The transaction mode can execute the following checking.

- **Context check:** This check is executed when a script file is specified by -zt option. It checks the context of preceding commands and determines whether a subsequent command can be executed.

  Specifying example:

  > raidcom -zt <script_file>

- **Configuration check:** This check verifies that the actual storage system confirmation is valid (implemented) for the resources specified in the commands (LDEVs, ports, pools, etc.).

  Syntax example:

  > raidcom get ldev -ldev_id -cnt 65280 -store<work_file>

  > raidcom -zt <script_file> -load<work_file>

Precheck function

CCI provides a precheck function that checks a configuration command before executing the command for the configuration setting commands (**raidcom** commands):

In previous versions of CCI, an error was returned when the syntax of a command to be executed was not correct. Now the precheck function checks the command syntax before the command is issued. To use this function, specify either the -checkmode precheck option or the -zt option.

The following table shows the checking function combinations between the precheck function and the transaction mode.

Table 1-2 Summary of the checking functions

Command syntax	Syntax check	Context check	Config check	Execution
raidcom <command>	Executed	Not executed	Not executed	Executed
raidcom <command> -checkmode precheck	Executed	Not executed	Not executed	Not executed
raidcom -zt <script file>	Executed	Executed	Not executed	Executed
raidcom get ldev -ldev_id -cnt 65280 -store<work_file> raidcom -zt <script_file> -load <work_file>	Executed	Executed	Executed	Executed
raidcom -zt <script file> -checkmode precheck	Executed	Executed	Not executed	Not executed

Command syntax	Syntax check	Context check	Config check	Execution
`raidcom get ldev -ldev_id -cnt 65280 -store<work_file>` `raidcom -zt <script_file> -load <work_file> -checkmode precheck`	Executed	Executed	Executed	Not executed

Command execution by the out-of-band method

In the CCI before supporting Hitachi Virtual Storage Platform, a command can be executed only from the host connected by the fibre channel directly. This is known as *in-band* operations. In the CCI supporting Hitachi Virtual Storage Platform, a command can be executed from any client PC connected to the storage system via LAN, not just from connected hosts. This is known as *out-of-band* operations.

- For in-band CCI operations, the command device is used, which is a user-selected and dedicated logical volume on the storage system that functions as the interface to the storage system on the UNIX/PC host. The command device accepts read and write commands that are executed by the storage system.
- For out-of-band CCI operations, a virtual command device is used. The virtual command device is defined in the configuration definition file by an IP address on the SVP. CCI commands are issued from the client or the host server and transferred via LAN to the virtual command device, and the requested operations are then performed by the storage system.

The following figure illustrates in-band and out-of-band CCI operations.

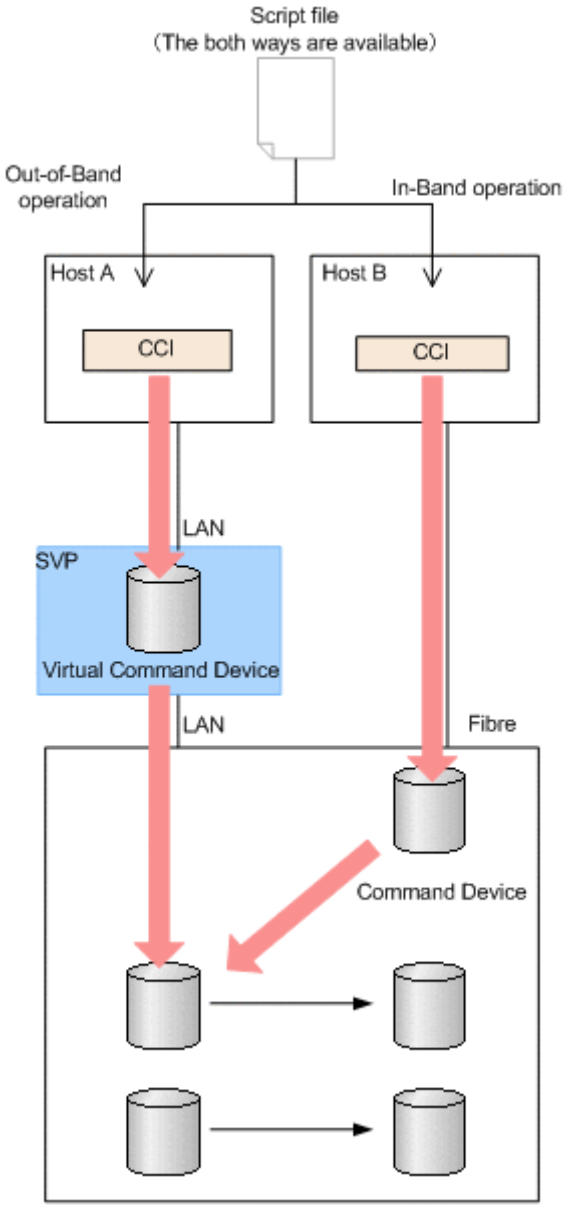


Figure 1-1 Overview of out-of-band and in-band operations

The following table provides a comparison of in-band and out-of-band operations.

Table 1-3 Comparison of in-band and out-of-band operations

Route	Command	Specification
In-band (issued from the host as if it were a command for the command device)	Replication	The required or not required of user authentication is changed by the setting of user authentication.
	Provisioning	User authentication is required.
Out-of-band (communicating directly with the SVP)	Replication	User authentication is required.
	Provisioning	User authentication is required.

User authentication

To enable user authentication, it is required to enable the user authentication mode for the command device of CCI. A virtual command device always enables the user authentication mode. If the authentication is disabled, provisioning commands and out-of-band commands cannot be executed.

The user information to be used (user ID and password) are the same as those used for Storage Navigator and the SVP.

LDEV nickname function

A unique nickname with up to 32 characters can be given to an LDEV.

LDEV grouping function

In CCI before supporting Hitachi Virtual Storage Platform, it was required to define a copy group for the configuration definition file on each host. When changing copy group information, editing of the configuration definition file was required on each host. In CCI supporting VSP, the group information that is registered into the storage system can be used as it is. The LDEV grouping function for VSP can minimize the description of the configuration definition file of CCI on each host. When the copy group information changes, you need to update only one configuration file, saving time and eliminating the chance for error due to mismatching edits.

This new functionality is implemented using device names, device groups, and copy groups:

- Device name:
  - A name that can be given in one LDEV per the device group.
  - Each name is associated with a device group in which the LDEV belongs to.
  - An LDEV nickname can be given to the LDEV as a unique name for the LDEV that is not related with device group. Only one LDEV nickname can be given for each LDEV.
- Device group:
  - A group of one or more LDEVs. One LDEV can belong to multiple device groups.
  - A device group can belong to only one copy group.
  - If you want to construct a mirror or cascade, you need to define a different device group and a device name in each copy group.
- Copy group: A group that is defined by specifying two device groups: one device group at the primary side and one device group at the secondary side.

Resource group function

Using Resource Group function, the storage administrator for each resource group can access only the resources in the resource group. The storage administrator cannot access resources in other resource groups. This prevents the risk of destroying the data by another storage administrator in the other resource groups or of leaking out the data.

Resource locking function

The resource locking function prevents conflict among multiple users:

User scripts cannot be guaranteed to work correctly when there are multiple users (Storage Navigator and SVP). You can use the lock command while the script is running to ensure completion.To use the lock command, user authentication is required.

CCI functions available on all RAID storage systems

CCI provides the following functionality on all Hitachi Data Systems RAID storage systems.

- In-system replication
- Remote replication
- Data protection

In-system replication

CCI provides command-line control for in-system (local) replication operations, including ShadowImage, Thin Image, and Copy-on-Write Snapshot. CCI displays local replication information and allows you to perform operations by issuing commands or by executing script files.

Remote replication

CCI provides command-line control for remote replication operations, including TrueCopy, Universal Replicator, and global-active device. CCI displays remote replication information and allows you to perform operations by issuing commands or by executing script files.

For remote copy operations, CCI interfaces with the system software and high-availability (HA) software on the host as well as the software on the RAID storage system. CCI provides failover operation commands that support mutual hot standby in conjunction with industry-standard failover products (for example, MC/ServiceGuard, HACMP, FirstWatch®). CCI also supports a scripting function for defining multiple operations in a script (or text) file. Using CCI scripting, you can set up and execute a large number of commands in a short period of time while integrating host-based high-availability control over copy operations.

Data protection

CCI supports data protection operations, including Hitachi Database Validator and Hitachi Data Retention Utility.

- Database Validator. The CCI software provides commands to set and verify parameters for volume-level validation checking of Oracle® database operations. Once validation checking is enabled, all write operations to the specified volumes must have valid Oracle checksums. CCI reports a validation check error to the syslog file each time an error is detected. Database Validator requires the operation of CCI software product but cannot be controlled via the Storage Navigator software.
- Data Retention Utility. The CCI software enables you to set and verify the parameters for guarding at the volume level. Once guarding is enabled, the RAID storage system conceals the target volumes from SCSI commands such as SCSI Inquiry and SCSI Read Capacity, prevents reading and writing to the volume, and protects the volume from being used as a copy volume (the TrueCopy, Universal Replicator or ShadowImage paircreate operation fails).

2

CCI software environment

This chapter describes the CCI software environment.

Overview of the CCI software environment

The CCI software environment includes components on the Hitachi RAID storage systems and the CCI software on the host servers and/or on the Storage Navigator computer. The CCI components on the storage systems include the user data volumes and CCI command devices.

Each CCI instance on a host server includes:

- CCI application files, referred to as *HORC Manager (HORCM)*:
  - Log and trace files
  - A command server
  - Error monitoring and event reporting files
  - A configuration management feature
- Configuration definition file (user-defined)
- User execution environments for the HDS features, including the commands, a command log, and a monitoring function.

The CCI commands also have interface considerations (see CCI and the SCSI command interface on page 2-6).

CCI components on the RAID storage system

Command device

CCI commands are issued by the CCI software to the RAID storage system command device. The command device is a user-selected, dedicated logical volume on the storage system that functions as the interface to the CCI software on the host. The command device is dedicated to CCI communications and cannot be used by any other applications. The command device accepts CCI read and write commands that are issued by the storage system. The command device also returns read requests to the host. The volume designated as the command device is used only by the storage system and is blocked from the user. The command device uses 16 MB, and the remaining volume space is reserved for CCI and its utilities. The command device can be any OPEN-x device (for example, OPEN-V) that is accessible to the host. A LUN Expansion volume cannot be used as a command device. A Virtual LVI/Virtual LUN volume as small as 36 MB (for example, OPEN-3-CVS) can be used as a command device.

WARNING: Make sure the volume to be selected as the command device does not contain any user data. The command device will be inaccessible to the host.

The CCI software on the host issues read and write commands to the command device. When CCI receives an error notification in reply to a read or write request to the RAID storage system, the CCI software switches to an alternate command device, if one is defined. If a command device is blocked (for example, for online maintenance), you can switch to an alternate command device manually. If no alternate command device is defined or available, all TrueCopy and ShadowImage commands terminate abnormally, and the host will not be able to issue commands to the storage

system. Therefore, one or more alternate command devices (see Alternate command device function on page 2-5) must be set to avoid data loss and storage system downtime.

Each command device must be set using the LUN Manager software on Storage Navigator. In addition, for using a Provisioning command, user authentication is required. Set the security attribute of the command device with user authentication. For information and instructions on setting a command device, see the Provisioning Guide for the storage system.

Each command device must also be defined in the HORCM_CMD section of the configuration file for the CCI instance on the attached host. If an alternate command device is not defined in the configuration file, the CCI software may not be able to use the device.

The CCI Data Protection Facility uses an enhanced command device that has an attribute to indicate protection ON or OFF.

Note:

- For Solaris operations, the command device must be labeled.

To enable dual path of the command device, make sure to include all paths to the command device on a single line in the HORCM_CMD section of the configuration file. The following shows an example with two controller paths to the command device. Putting the path information on separate lines may cause parsing issues, and failover may not occur unless the HORCM startup script is restarted.

```
HORCM_CMD  #dev_name dev_name dev_name  /dev/rdsk/c1t66d36s2 /
dev/rdsk/c2t66d36s2
```

Command device guarding

In the customer environment, a command device may be attacked by the maintenance program of the Solaris Server, after that usable instance will be exhausted, and CCI instance would not start up on all servers (except attacked server). This may happen due to incorrect operation of the maintenance personnel for the UNIX Server. In this case, the command device should be protected against operator error, as long as it can be seen as the device file from the maintenance personnel.

Thus, the RAID microcode (for the command device) and CCI support this protection in order to guard from similar access.

Guarding method

Currently, assignment of the instance via the command device is ONE phase. Therefore, if the command device reads a special allocation area of the instance through the maintenance tool and so on, then it causes a fault of full space of the instance, because the command device interprets as assignment of the instance from CCI.

CCI has TWO phases that it reads to acquire usable LBA, and writes with the acquired LBA in attaching sequence to the command device, so the command device can confirm whether it was required as the assignment for CCI or not, by detecting and adding two status bits to the instance assignment table.

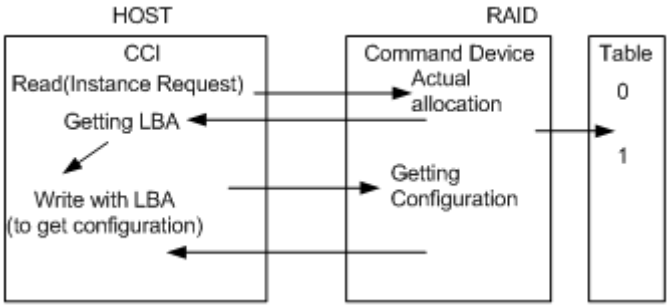


Figure 2-1 Current assignment sequence

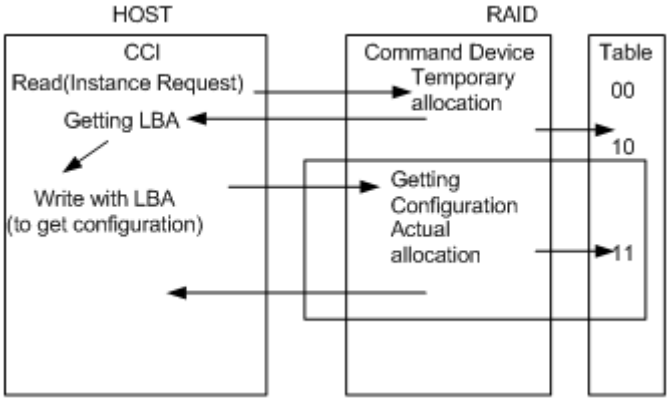


Figure 2-2 Improved assignment sequence

The command device performs the assignment of an instance through TWO phases that have "temporary allocation (1 0)" and "actual allocation (1 1)" to the instance assignment table.

If the command device is attacked, the instance assignment table is filled with "temporary allocation (1 0)" status. After that, the command device will detect a fault of full space as the instance assignment, clear up all "temporary allocation (1 0)", and then reassign the required instance automatically.

This does not require a service representative to switch the command device "OFF/ON" to clear up the instance table.

Verifying the CCI instance number

CCI provides a way to verify the number of "temporary allocations (1 0)" and "actual allocations (1 1)" on the instance table so that you can confirm validity of the CCI instance number in use. The `horcctl -DI` command shows the number of CCI instances since HORCM was started as follows.

Example without command device security:

```
# horcctl -DI
Current control device = /dev/rdsk/c0t0d0 AI = 14 TI = 0 CI = 1
```

Example with command device security:

```
# horcctl -DI
Current control device = /dev/rdsk/c0t0d0* AI = 14 TI = 0 CI = 1
```

AI : NUM of actual instances in use TI : NUM of temporary instances in RAID
CI : NUM of instances using current (own) instance

Alternate command device function

The CCI software issues commands to the command device via the UNIX/PC raw I/O interface. If the command device fails in any way, all CCI commands are terminated abnormally, and you cannot use any commands. Because the use of alternate I/O path is platform dependent, restrictions are placed upon it. For example, on HP-UX systems, only devices subject to the LVM can use the alternate path PV-LINK. To avoid command device failure, CCI supports an alternate command device function.

- **Definition of alternate command devices.** To use an alternate command device, you must define two or more command devices for the HORCM_CMD item in the configuration definition file. When two or more devices are defined, they are recognized as alternate command devices.
- **Timing of alternate command devices.** When the HORCM receives an error notification in reply from the operating system via the raw I/O interface, the alternate command device is used. It is possible to force a switch to use the alternate the command device by issuing the horcctl -C switch command provided by CCI.
- **Operation of alternating command.** If the command device is blocked due to online maintenance, the switch command should be issued in advance. If the switch command is issued again after completion of the online maintenance, the previous command device is activated.
- **Multiple command devices on HORCM startup.** If at least one command device is available during one or more command devices described to the configuration definition file, then HORCM can start with a warning message to the startup log by using the available command device. Confirm that all command devices can be changed by using the **`horcctl -C`** command option, or HORCM has been started without the warning message to the HORCM startup log.

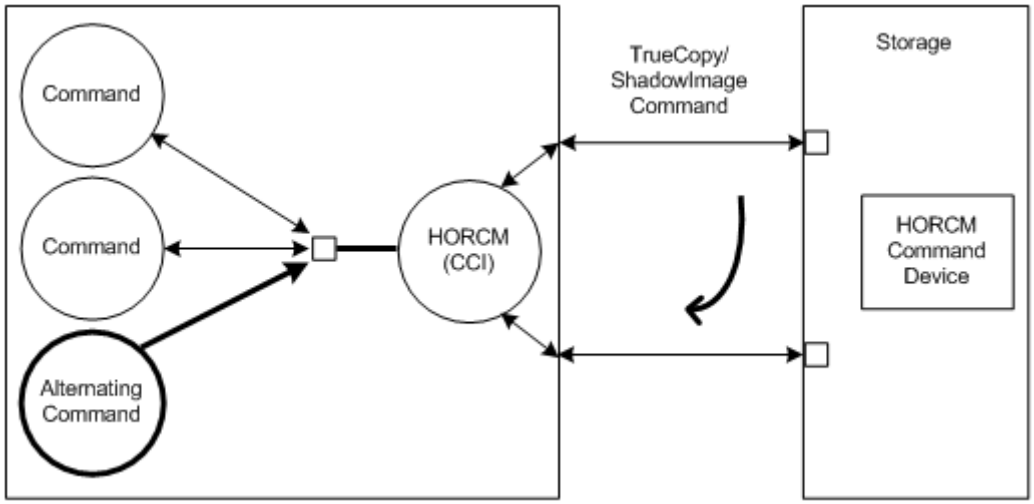


Figure 2-3 Alternate Command Device Function

Define the remote command device

The command device of external storage system that is mapped as a command device of the local storage system is called as remote command device. By issuing a command to the remote command device, the operation at the external storage system is realized.

The remote command device is defined by the Storage Navigator. For more information, see the *Hitachi Universal Volume Manager User Guide*.

CCI and the SCSI command interface

When CCI commands are converted into a special SCSI command format, a SCSI through driver that can send specially formatted SCSI commands to the RAID storage system is needed. As a result, OS support for CCI depends on the OS capabilities. It is necessary to use a read/write command that can easily be issued by many UNIX/PC server platforms. For example, ioctl() can be used for the following platforms: HP-UX, Linux, Solaris, Windows, IRIX64, OpenVMS and zLinux.

SCSI command format used. Use a RD/WR command that can be used with special LDEVs, since they should be discriminated from the normal RD/WR command.

Recognition of the control command area (LBA#). The host issues control commands through the raw I/O special file of a special LDEV. Since the specific LU (command device) receiving these commands is viewed as a normal disk by the SCSI interface, the OS can access its local control area. The RAID storage system must distinguish such accesses from the control command accesses. Normally, several megabytes of the OS control area are used starting at the initial LBA#. To avoid using this area, a specific LBA# area is decided and control commands are issued within this area. The command LBA# recognized by the storage system is shown below, provided the maximum OS control area is 16 MB.

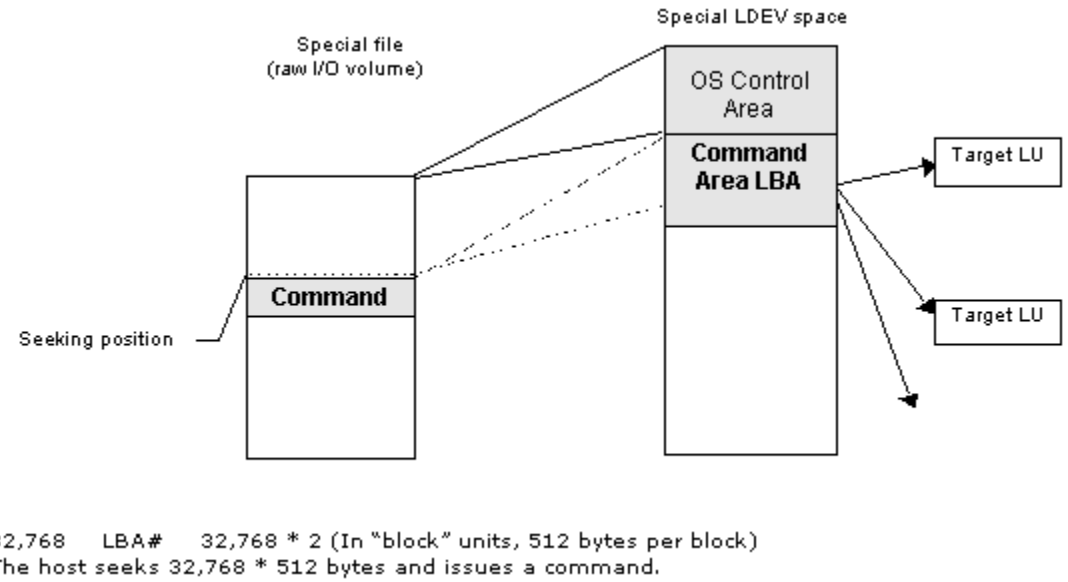


Figure 2-4 Relationship of the special file to the special LDEV

Acceptance of commands. A command is issued in the LBA area of the special LDEV explained above. The RD/WR command meeting this requirement should be received especially as a CCI command. A command is issued in the form of WR or WR-RD. When a command is issued in the form of RD, it is regarded as an inquiry (equivalent to a SCSI inquiry), and a CCI recognition character string is returned.

Command competition

The CCI commands are asynchronous commands issued via the SCSI interface. As a result, if several processes issue these commands to a single LDEV, the storage system cannot take the proper action. To avoid such a problem, two or more write commands should not be issued to a single LDEV. The command initiators should not issue two or more write commands to a single LDEV unless the storage system can receive commands with independent initiator number * LDEV number simultaneously.

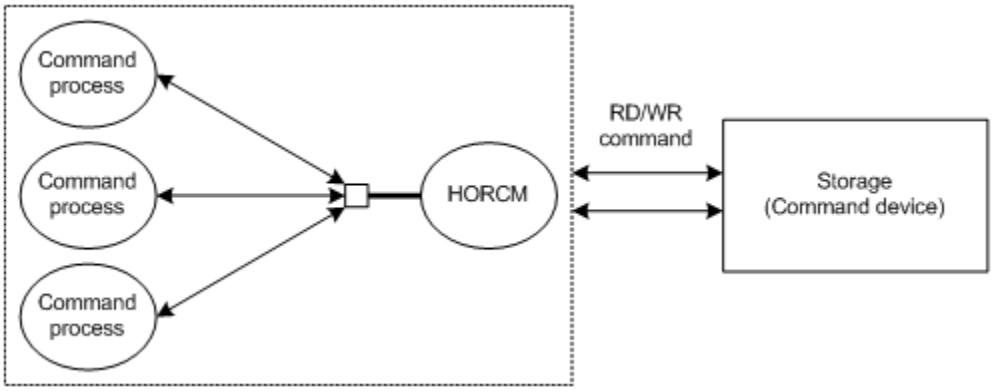


Figure 2-5 HORCM and command issue process

Command flow

This figure shows the flow of read/write command control for a specified LBA#.

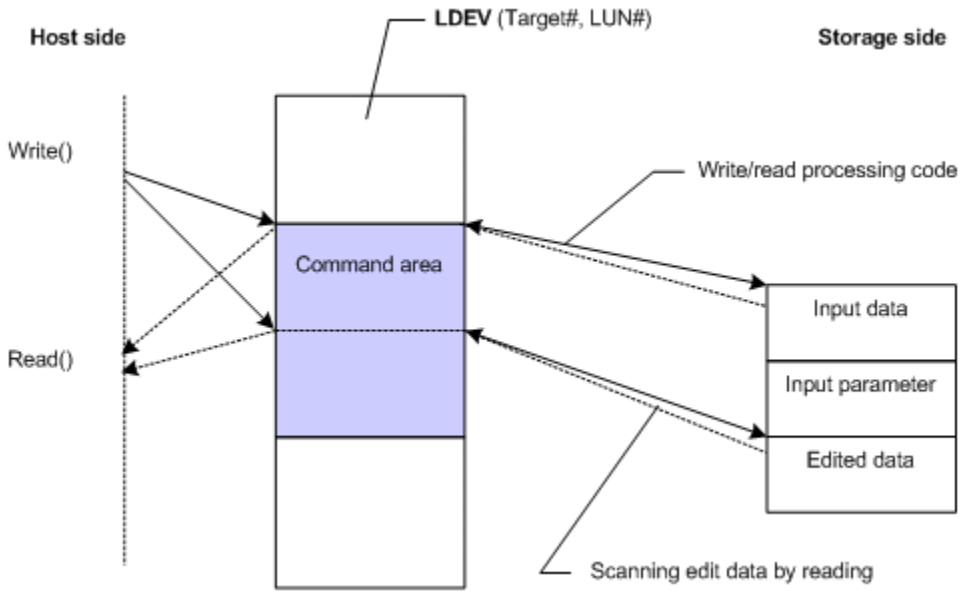


Figure 2-6 Command flow

Issuing commands for LDEVs within a LUSE device

A LUSE device is a group of LDEVs regarded as a single logical unit. Because it is necessary to know the configuration of the LDEVs when issuing a command, a new command is used to specify a target LU and acquire LDEV configuration data, as shown in the following figure.

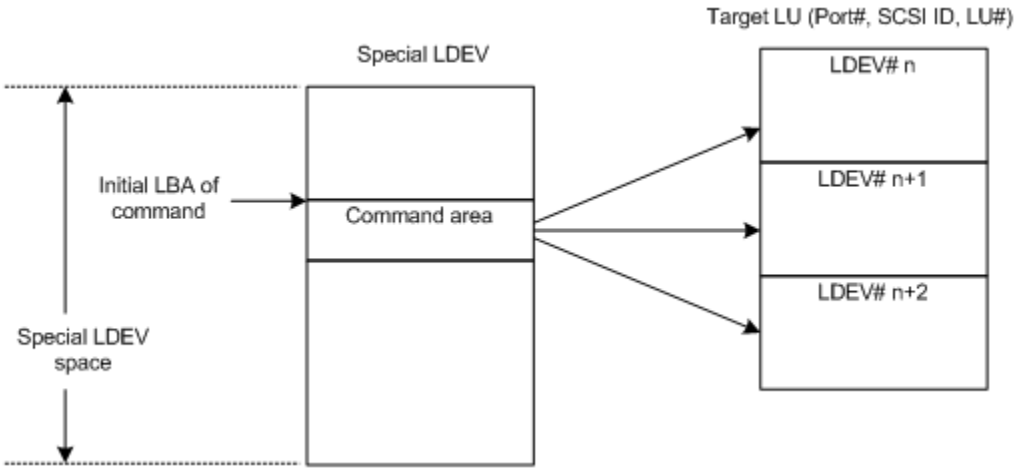


Figure 2-7 LUSE Device and Command Issue

CCI instance components on the host server

HORCM operational environment

The HORCM operates as a daemon process on the host server and is activated either automatically when the server machine starts up or manually by the startup script. HORCM reads the definitions specified in the configuration file upon startup. The environment variable HORCM_CONF is used to define the location of the configuration file to be referenced.

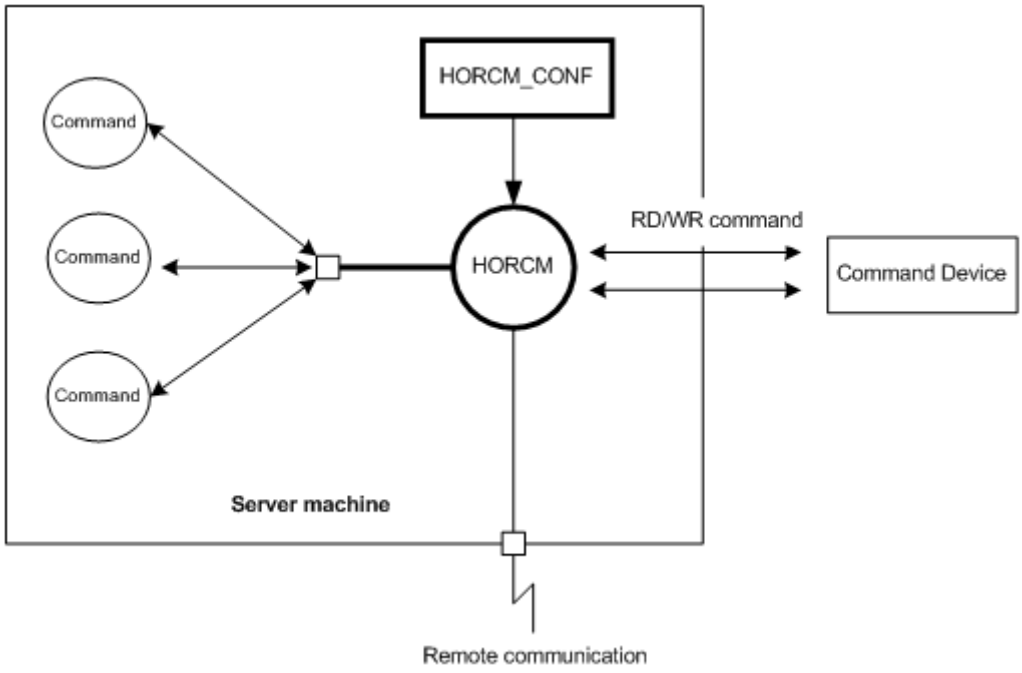


Figure 2-8 HORCM operational environment

CCI instance configurations

The basic unit of the CCI software structure is the CCI instance. A CCI instance consists of HORC manager (HORCM), CCI commands, the user-defined configuration definition file, and the log function for maintenance. Each instance uses its own configuration definition file to manage volume relationships while maintaining awareness of the other CCI instances. Each CCI instance normally resides on separate servers (one node per instance). If two or more instances are run on a single server (for example, for test operations), it is possible to activate two or more instances using instance numbers. The CCI commands to be used are selected by the environment variable (HORCC_MRCF). The default command execution environment for CCI is TrueCopy.

The CCI instance shown in the following figure has a remote execution link and a connection to the RAID storage system. The remote execution link is a network connection to another PC to allow you to execute CCI functions remotely. The connection between the CCI instance and the storage system illustrates the connection between the CCI software on the host and the command device. The command device accepts CCI commands and communicates read and write I/Os between the host and the volumes on

the storage system. The host does not communicate CCI commands directly to the volumes on the storage system -- the CCI commands always go through the command device.

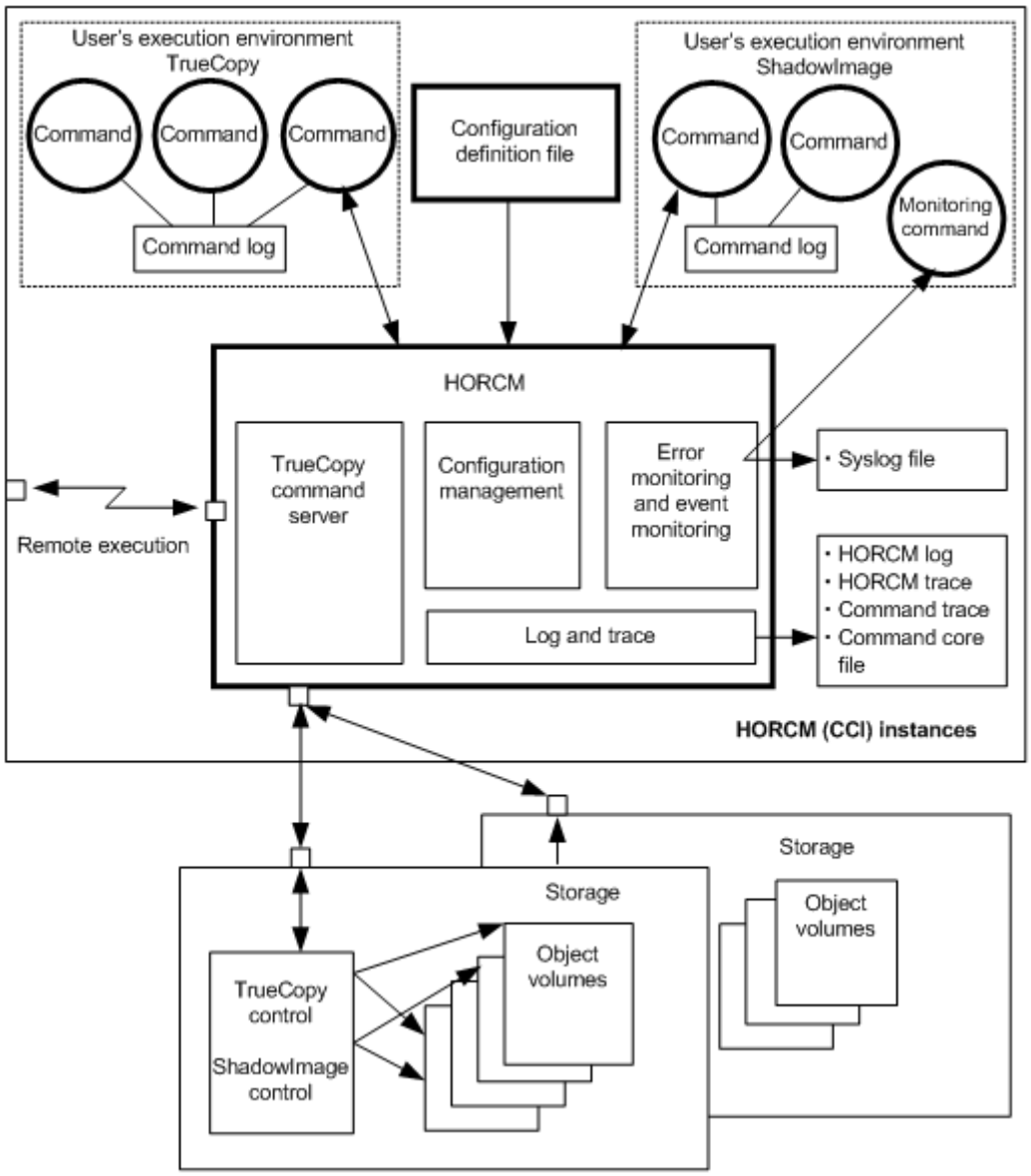


Figure 2-9 CCI instance configuration & components

The four possible CCI instance configurations are:

- One host connected to one storage system. Connecting one host to one storage system allows you to maintain multiple copies of your data for testing purposes or as an offline backup. Each CCI instance has its own operation manager, server software, and scripts and commands, and each CCI instance communicates independently with the command device. The RAID storage system contains the command device that communicates with the CCI instances as well as the primary and secondary volumes of both CCI instances.

- One host connected to two storage systems. Connecting the host to two storage systems enables you to migrate data or implement disaster recovery by maintaining duplicate sets of data in two different storage systems. You can implement disaster recovery solutions by placing the storage systems in different geographic areas. Each CCI instance has its own operation manager, server software, and scripts and commands, and each CCI instance communicates independently with the command device. Each RAID storage system has a command device that communicates with each CCI instance independently. Each storage system contains the primary volumes of its connected CCI instance and the secondary volumes of the other CCI instance (located on the same host in this case).
- Two hosts connected to one storage system. Having two attached hosts to one storage system, one host for the primary volume and the other host for the secondary volume, allows you to maintain and administer the primary volumes while the secondary volumes can be taken offline for testing. The CCI instances of separate hosts are connected via the LAN so that they can maintain awareness of each other. The RAID storage system contains the command device that communicates with both CCI instances (one on each host) and the primary and secondary volumes of both CCI instances
- Two hosts connected to two storage systems. Two hosts connected to two storage systems also allows the most flexible disaster recovery plan, because both sets of data are administered by different hosts. This guards against storage system failure as well as host failure.The CCI instances of separate hosts are connected via the LAN so that they can maintain awareness of each other. Each RAID storage system has a command device that communicates with each CCI instance independently. Each storage system contains the primary volumes of its connected CCI instance and the secondary volumes of the other CCI instance (located on a different host in this case).

Host machines that can be paired

When you perform a pair operation, the version of CCI should be the same on the primary and secondary sites. As a particular application uses HORC, users sometimes use a HORC volume as the data backup volume for the server. In this case, CCI requires that the CCI instance correspond to each OS platform that is located on the secondary site for the pair operation of data backup on the primary servers of each OS platform.

However, it is possible to prepare only one server at a secondary site by supporting CCI communications among different OSs (including the converter for *little-endian* vs. *big-endian*).

Figure 2-10 CCI communication among different operating systems on page 2-12 represents CCI's communication among different OSs, and Table 2-1 Supported CCI (HORCM) communication on page 2-12 shows the supported communication (32-bit, 64-bit) among different OSs. Please note the following terms that are used in the example:

- RM-H: Value of HORCMFCTBL environment variable for an HP-UX CCI instance on Windows

- RM-S: Value of HORCMFCTBL environment variable for a Solaris CCI instance on Windows

Restriction: CCI's communications among different operating systems is supported on HP-UX, Solaris, AIX, Linux, and Windows (this is not supported on Tru64 UNIX/Digital UNIX). Also, CCI does not require that the HORCMFCTBL environment variable be set—except for RM-H and RM-S instances (to ensure that the behavior of the operating system platform is consistent across different operating systems).

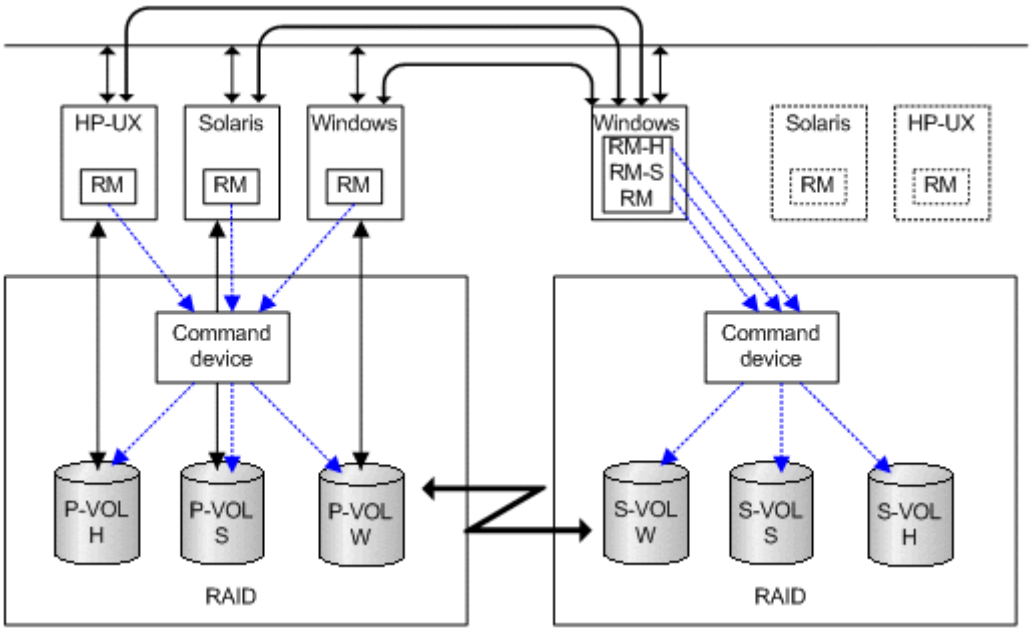


Figure 2-10 CCI communication among different operating systems

Table 2-1 Supported CCI (HORCM) communication

HORCM		HORCM 32 bit		HORCM 64 bit	
		little	big	little	big
32 bit	little	AV	AV	AV	-
	big	AV	AV	AV	-
64 bit	little	AV	AV	AV	-
	big	-	-	-	-

Configuration definition file

Overview

The CCI configuration definition file is a text file that defines a CCI instance. The connected hosts, volumes and groups known to the CCI instance are defined in the configuration definition file. Physical volumes (special files) used independently by the servers are combined when paired logical volume names and group names are given to them. The configuration definition file describes the correspondence between the physical volumes used by the servers and the paired logical volumes and the names of the

remote servers connected to the volumes. See the *Command Control Interface Installation and Configuration Guide* for instructions on creating the CCI configuration definition file.

Figure 2-11 Configuration definition of paired volumes on page 2-13 illustrates the configuration definition of paired volumes.

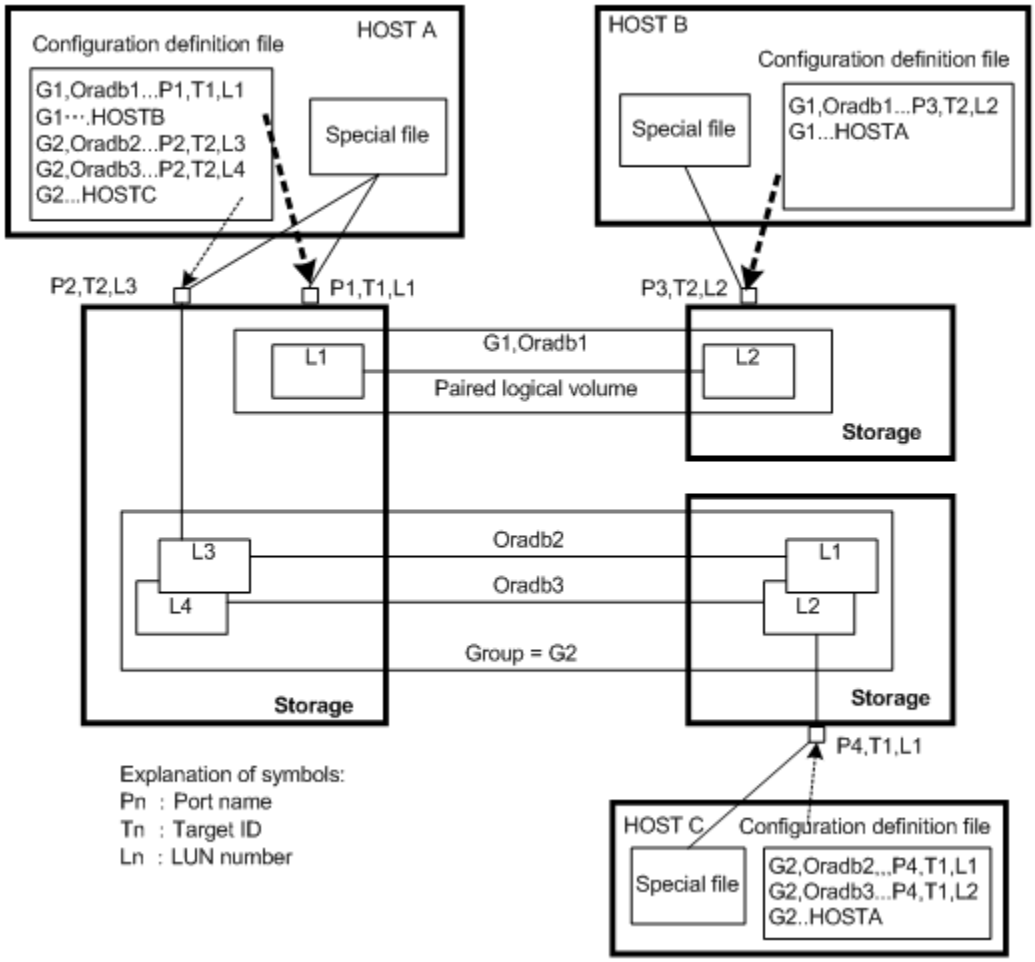


Figure 2-11 Configuration definition of paired volumes

Configuration file example — UNIX-based servers

Note that # at the beginning of a line indicates a comment.

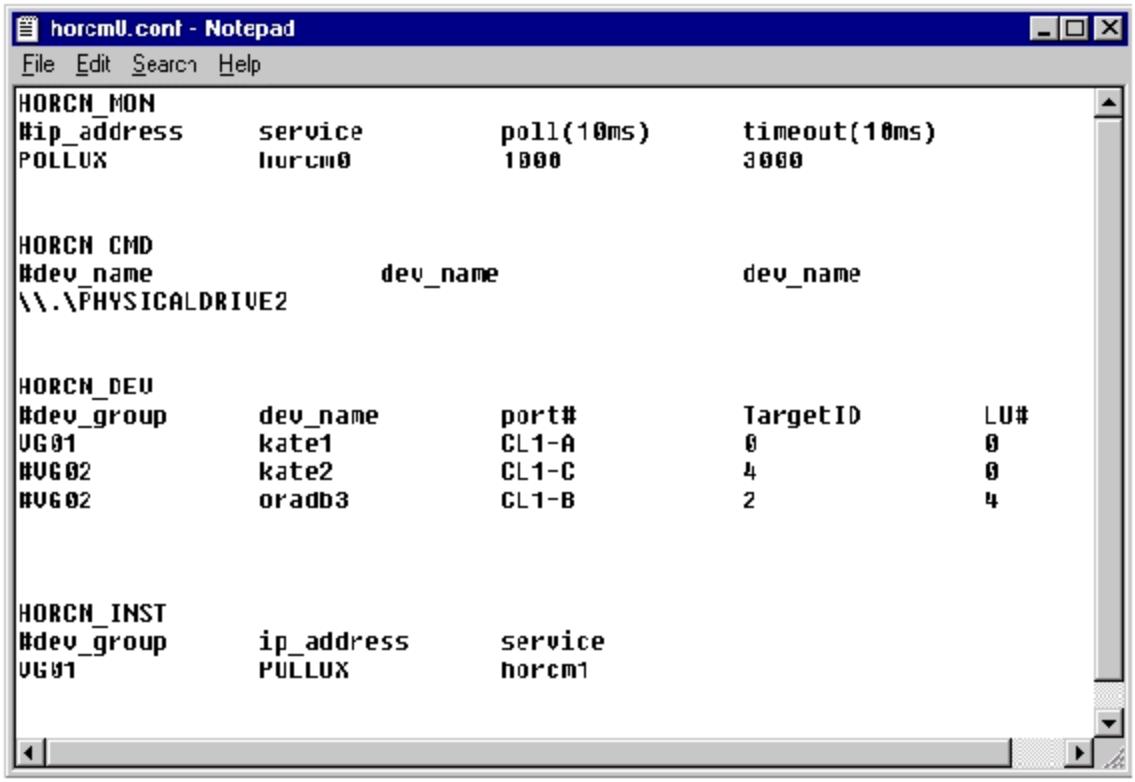
```
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
HST1         horcm  1000       3000

HORCM_CMD
#unitID 0... (seq#30014)
#dev_name dev_name dev_name
/dev/rdsk/c0t0d0
#unitID 1... (seq#30015)
#dev_name dev_name dev_name
/dev/rdsk/c1t0d0

HORCM_DEV
#dev_group dev_name port# TargetID LU# MU#
oradb      oradb1   CL1-A       3   1   0
oradb      oradb2   CL1-A       3   1   1
```

```
oralog     oralog1  CL1-A       5   0
oralog     oralog2  CL1-A1      5   0
oralog     oralog3  CL1-A1      5   1
oralog     oralog4  CL1-A1      5   1  h1
HORCM_INST
#dev_group ip_address service
oradb      HST2        horcm
oradb      HST3        horcm
oralog     HST3        horcm
```

Configuration file example — Windows servers



The following table lists the parameters defined in the configuration file and specifies the default value, type, and limit for each parameter.

Table 2-2 Configuration (HORCM_CONF) parameters

Parameter	Default	Type	Limit
ip_address	None	Character string	63 characters
Service	None	Character string or numeric value	15 characters
poll (10 ms)	1000	Numeric value[1]	None
timeout (10 ms)	3000	Numeric value[1]	None
dev_name for HORCM_CMD	None	Character string	63 characters Recommended value = 8 char. or fewer
dev_name for HORCM_DEV	None	Character string	31 characters

Parameter	Default	Type	Limit
dev_group	None	Character string	31 characters Recommended value = 8 char. or less
port #	None	Character string	31 characters
target ID	None	Numeric value[1]	7 characters
LU#	None	Numeric value[1]	7 characters
MU#	0	Numeric value[1]	7 characters
Serial#[2]	None	Numeric value	12 characters
CU:LDEV(LDEV#)	None	Numeric value	6 characters
dev_name for HORCM_CMD	None	Character string	63 characters Recommended value = 8 char. or less

Notes:

1. Use decimal notation for numeric values (not hexadecimal).
2. For VSP G1000, add a "3" at the beginning of the serial number. For example, for serial number 12345, enter 312345.

Do not edit the configuration definition file while CCI is running. Shut down CCI, edit the configuration file as needed, and then restart CCI.

Do not mix pairs created with the "At-Time Split" option (-m grp) and pairs created without this option in the same group defined in the CCI configuration file. If you do, a pairsplit operation might end abnormally, or S-VOLs of the P-VOLs in the same consistency group (CTG) might not be created correctly at the time the pairsplit request is received.

Configuration definition file settings

(1) HORCM_MON

The monitor parameter (HORCM_MON) defines the following values:

- **Ip_address:** The IP address of the local host. When HORCM has two or more network addresses on different subnets for communication, this must be set to NONE.
- **Service:** Specifies the UDP port name assigned to the HORCM communication path, which is registered in "/etc/services" ("%windir%\system32\drivers\etc\services" in Windows, "SYS$SYSROOT:[000000.TCPIP$ETC]SERVICES.DAT" in OpenVMS). If a port number is specified instead of a port name, the port number will be used.
- **Poll:** The interval for monitoring paired volumes. To reduce the HORCM daemon load, make this interval longer. If set to -1, the paired volumes are not monitored. The value of -1 is specified when two or more CCI instances run on a single machine.
- **Timeout:** The time-out period of communication with the remote server.

If HORCM_MON is not specified, then the following are set as defaults.

```
HORCM_MON
#ip_address    service         poll(10ms)    timeout(10ms)
NONE           default_port        1000             3000H
```

Default_port:

For none specified HORCM instance: "31000 + 0"

For instance HORCM X : "31000 + X + 1"

(2) HORCM_CMD

When using the in-band method, this command parameter (HORCM_CMD) defines the UNIX device path or Windows physical device number and specifies a command device that can access the CCI.

In-band method

The command device must be mapped to the SCSI/fibre using LUN Manager. You can define more than one command device to provide failover in case the original command device becomes unavailable (see Alternate command device function on page 2-5). The mapped command devices can be identified by the "-CM" of product ID field of the inqraid command.

```
# ls /dev/rdsk/c1t0* | /HORCM/usr/bin/inqraid -CLI -sort
DEVICE_FILE PORT SERIAL LDEV CTG H/M/12 SSID R:Group PRODUCT_ID
c1t0d0s2 CL2-E 63502 576 - - - - OPEN-V-CM
c1t0d1s2 CL2-E 63502 577 - s/s/ss 0006 1:02-01 OPEN-V -SUN
c1t0d2s2 CL2-E 63502 578 - s/s/ss 0006 1:02-01 OPEN-V -SUN
```

The command device of UNIX host (Solaris) is described in the following.

```
/dev/rdsk/c1t1d0s2
```

The command device of Windows host is described as follows.

```
\\.\PhysicalDrive2 or \\.\CMD-63502
```

After the process of command device mapping, set HORCM_CMD of the configuration definition file as follows.

- \\.\CMD-<Serial Number>:<Device special file name>

  <Serial Number>: Sets the serial number. For VSP G1000, add a “3” at the beginning of the serial number. For example, for serial number 12345, enter 312345.

  <Device special file name>: Sets the device special file name of a command device.

Example

When the serial number 64015 and device special file name, /dev/rdsk/*is specified:

```
HORCM_CMD
#dev_name                                dev_name          dev_name
\\.\CMD-64015:/dev/rdsk/*
```

Out-of-band method

When executing commands using the out-of-band method, create a virtual command device. To create a virtual command device, specify as the following to HORCM_CMD of the configuration definition file.

- \\.\IPCMD-<SVP IP address>-<UDP communication port number>[-Unit ID]

  <SVP IP address>: Sets an IP address of SVP.

  <UDP communication port number>: Sets the UDP communication port number. This value is fixed (31001).

  [-Unit ID]: Sets the unit ID of the storage system for the multiple units connection configuration. This can be omitted.

Example for IPv4:

```
HORCM_CMD#dev_name                                    dev_name
dev_name
\\.\IPCMD-158.214.135.113-31001
```

Example for IPv6:

```
HORCM_CMD#dev_name                                    dev_name
dev_name
\\.\IPCMD-fe80::209:6bff:febe:3c17-31001
```

Note: To enable dual path of the command device under Solaris systems, make sure to include all paths to the command device on a single line in the HORCM_CMD section of the config file. Putting the path information on separate lines may cause parsing issues, and failover may not occur unless the HORCM startup script is restarted on the Solaris system.

When a server is connected to two or more storage systems, the HORCM identifies each storage system using the unit ID (see Figure 2-12 Configuration and unit IDs for multiple storage systems on page 2-18). The unit ID is assigned sequentially in the order described in this section of the configuration definition file. When the storage system is shared by two or more servers, each server must be able to verify that the unit ID is the same Serial# (Seq#) among servers. This can be verified using the **raidqry** command.

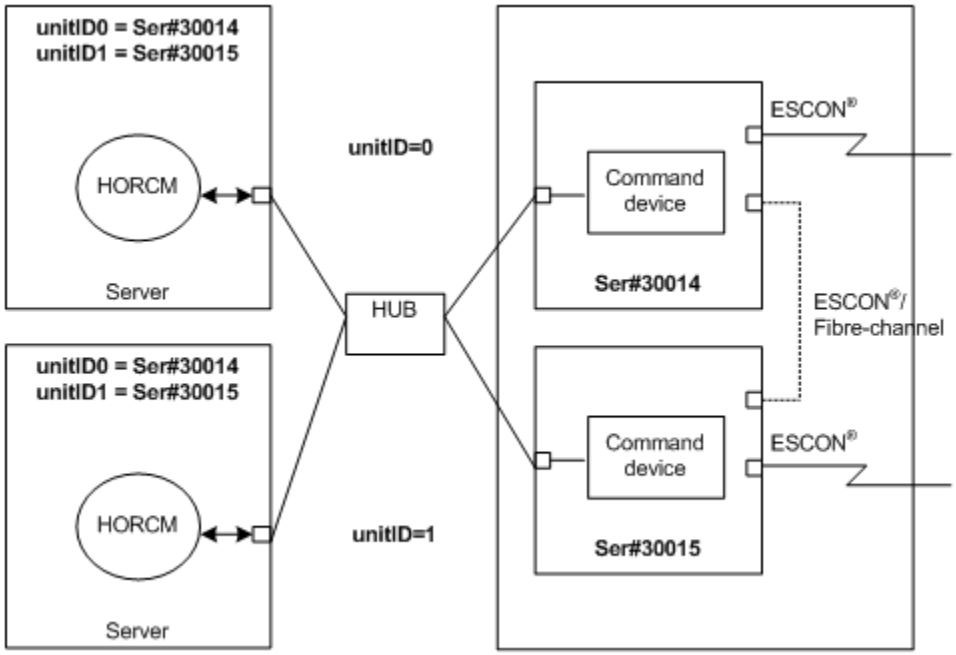


Figure 2-12 Configuration and unit IDs for multiple storage systems

dev_name for Windows

In Windows SAN environment, "Volume{guid}" will be changed on every reboot under MSCS/Windows 2003, if Windows finds the same signature on the command device connected with Multi-Path.Therefore, find NEW "Volume{guid}", and change "Volume{guid}" described in the CCI configuration file. Thus, CCI supports the following naming format specifying Serial#/LDEV#/Port# as notation of the command device only for Windows. For VSP G1000, add a "3" at the beginning of the serial number. For example, for serial number 12345, enter 312345.

```
\\.\CMD-Ser#-ldev#-Port#
```

```
HORCM_CMD
#dev_name                    dev_name              dev_name
\\.\CMD-30095-250-CL1-A
```

To allow more flexibility, CCI allows the following format.

- For minimum specification

  Specifies to use any command device for Serial#30095 `\\.\CMD-30095` If Windows has two different array models that share the same serial number, fully define the serial number, ldev#, port and host group for the CMDDEV.

- For under Multi Path Driver

  Specifies to use any port as the command device for Serial#30095, LDEV#250 `\\.\CMD-30095-250`

- For full specification

  Specifies the command device for Serial#30095, LDEV#250 connected to Port CL1-A, Host group#1 `\\.\CMD-30095-250-CL1-A-1`

- Other example

  \\.\CMD-30095-250-CL1-A

  \\.\CMD-30095-250-CL1

dev_name for UNIX

In the UNIX SAN environment, a device file name is changed at the failover operation under the UNIX SAN environment, or each reboot process under the Linux when the SAM is reconfigured. CCI user is required to change the HORCM_CMD described in the CCI configuration file by searching new "Device special file". Therefore, CCI supports the following naming format to specify "Serial#/LDEV#/Port#:HINT" as an expression way of command device for UNIX. For VSP G1000, add a "3" at the beginning of the serial number. For example, for serial number 12345, enter 312345.

\\.\CMD-Ser#-ldev#-Port#:HINT

```
HORCM_CMD
#dev_name                                   dev_name        dev_name
\\.\CMD-30095-250-CL1-A-1:/dev/rdsk/
```

Once this name is specified, HORCM finds the "\CMD-Serial#-Ldev#-Port#" from the device file specified by the HINT at the time of HORCM startup. HINT must specify to be end with "/" for the directory of the device file name or the directory that includes the pattern of device filename, as shown in the following.

Finds CMD, which is specified by /dev/rdsk/:/dev/rdsk/*

Finds CMD, which is specified by /dev/rdsk/c10:/dev/rdsk/c10*

Finds CMD, which is specified by /dev/rhdisk:/dev/rhdisk*

A device file is displayed while HINT is filtered with the following pattern.

HP-UX: /dev/rdsk/* or /dev/rdisk/disk*

Solaris: /dev/rdsk/*s2, AIX: /dev/rhdisk*

Linux: /dev/sd...., zLinux : /dev/sd....

Tru64: /dev/rrz*c or /dev/rdisk/dsk*c or /dev/cport/scp*

IRIX64: /dev/rdsk/*vol or /dev/rdsk/node_wwn/*vol/*

If HINT is already specified, ":HINT" can be omitted with the following command devices, and the command devices are retrieved from the already stored Inquiry information, which is not required to execute device scanning.

```
HORCM_CMD
#dev_name                          dev_name              dev_name
\\.\CMD-30095-250-CL1:/dev/rdsk/   \\.\CMD-30095-250-CL2
```

- Basic Specification

  Specifies when an optional command device of Serial#30095 is used.

  \\.\CMD-30095:/dev/rdsk/

- Driver in the multi-path environment

  Specifies when an optional port is used as a command device for Serial#30095, LDEV#250.

  \\.\CMD-30095-250:/dev/rdsk/

- For full specification

  Specifies a command device for Serial#30095, LDEV#250:, which is connected to Port CL1-A, Host group#1.

- Other example

  \\.\CMD-30095-250-CL1:/dev/rdsk/ \\.\CMD-30095-250-CL2

  \\.\CMD-30095:/dev/rdsk/c1 \\.\CMD-30095:/dev/rdsk/c2

(3) HORCM_DEV

The device parameter (HORCM_DEV) defines the RAID storage system device addresses for the paired logical volume names. When the server is connected to two or more storage systems, the unit ID is expressed by port# extension. Each group name is a unique name discriminated by a server that uses the volumes, the attributes of the volumes (such as database data, redo log file, UNIX file), recovery level, etc. The group and paired logical volume names described in this item must reside in the remote server. The hardware SCSI/fibre port, target ID, and LUN as hardware components need not be the same.

The following values are defined in the HORCM_DEV parameter:

- dev_group: Names a group of paired logical volumes. A command is executed for all corresponding volumes according to this group name.
- dev_name: Names the paired logical volume within a group (that is, name of the special file or unique logical volume). The name of paired logical volume must be different to the dev name in another group.
- Port#: Defines the RAID storage system port number of the volume that connects to the dev_name volume. The following "n" shows unit ID when the server is connected to two or more storage systems (for example, CL1-A1 = CL1-A in unit ID 1). If the "n" option is omitted, the unit ID is 0. The port is not case sensitive (for example, CL1-A= cl1-a= CL1-a= cl1-A).

-	Basic				Option				Option				Option			
CL1	An	Bn	Cn	Dn	En	Fn	Gn	Hn	Jn	Kn	Ln	Mn	Nn	Pn	Qn	Rn
CL2	An	Bn	Cn	Dn	En	Fn	Gn	Hn	Jn	Kn	Ln	Mn	Nn	Pn	Qn	Rn

The following ports can be specified only for the 9900V:

-	Basic				Option				Option				Option			
CL3	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CL4	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn

For 9900V, CCI supports four types of port names for host groups:

- Specifying the port name without a host group: CL1-A CL1-A**n**, where **n** is the unit ID if there are multiple RAID storage systems
- Specifying the port name with a host group: CL1-A-**g**, where **g** is the host group CL1-A**n**-**g**, where **n**-**g** is the host group **g** on CL1-A in unit ID=**n**

The following ports can be specified for USP V/VM and TagmaStore USP/ TagmaStore NSC:

-	Basic				Option				Option				Option			
CL5	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CL6	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CL7	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CL8	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CL9	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CLA	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CLB	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CLC	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CLD	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CLE	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CLF	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn
CLG	an	bn	cn	dn	en	fn	gn	hn	jn	kn	ln	mn	nn	pn	qn	rn

- Target ID: Defines the SCSI/fibre target ID (TID) number of the physical volume on the specified port.
- LU#: Defines the SCSI/fibre logical unit number (LU#) of the physical volume on the specified target ID and port.

Note: In case of fibre channel, if the TID and LU# displayed on the system are different than the TID on the fibre address conversion table, then you must use the TID and LU# indicated by the **`raidscan`** command in the CCI configuration file.

- MU# for ShadowImage (HOMRCF): Defines the mirror unit number (0 - 2) to use the redundant mirror for the identical LU on the ShadowImage. If this number is omitted, it is assumed to be zero (0). The cascaded mirroring of the S-VOL is expressed as virtual volumes using the mirror descriptors (MU#1-2) in the configuration definition file. The MU#0 of a mirror descriptor is used for connection of the S-VOL. The mirror descriptor (MU#0-2) can be used in ShadowImage and Copy-on-Write Snapshot. MU#3-63 can be used in Copy-on-Write Snapshot only.

Feature	SMPL		P-VOL		S-VOL	
	MU#0-2	MU#3 - 63	MU#0-2	MU#3 - 63	MU# 0	MU#1 - 63
ShadowImage	Valid	**Not valid**	Valid	**Not valid**	Valid	**Not valid**
Copy-on-Write Snapshot	Valid	Valid	Valid	Valid	Valid	**Not valid**

- MU#for TrueCopy/UR : Defines the mirror unit number (0 - 3) to use the redundant mirror for the identical LU on TrueCopy/UR. If this number is omitted, it is assumed to be zero (0). The UR mirror description is described in the MU# column by adding "h" in order to identify identical LUs as the mirror descriptor for UR. The MU# for TrueCopy must be specified only "0". TrueCopy has only one mirror description, but UR has four mirrors as shown below.

Feature	SMPL		P-VOL		S-VOL	
	MU#0	MU#h1 - h3	MU#0	MU#h1 - h3	MU#0	MU#h1 - h3
TrueCopy	Valid	**Not valid**	Valid	**Not valid**	Valid	**Not valid**
UR	Valid	Valid	Valid	Valid	Valid	Valid

(4) HORCM_INST

The instance parameter (HORCM_INST) defines the network address (IP address) of the remote server (active or standby). It is used to view or change the status of the paired volume in the remote server (active or standby). When the primary volume is shared by two or more servers, there are two or more remote servers using the secondary volume. Thus, it is necessary to describe the addresses of all of these servers.

The following values are defined in the HORCM_INST parameter:

- dev_group: The server name described in dev_group of HORC_DEV.
- ip_address: The network address of the specified remote server.
- service: The port name assigned to the HORCM communication path (registered in the /etc/services file). If a port number is specified instead of a port name, the port number will be used.

When HORCM has two or more network addresses on different subnets for communication, the ip_address of HORCM_MON must be NONE. This configuration for multiple networks can be found using the raidqry -r <group> command option on each host. The current HORCM network address can be changed using horcctl -NC <group> on each host.

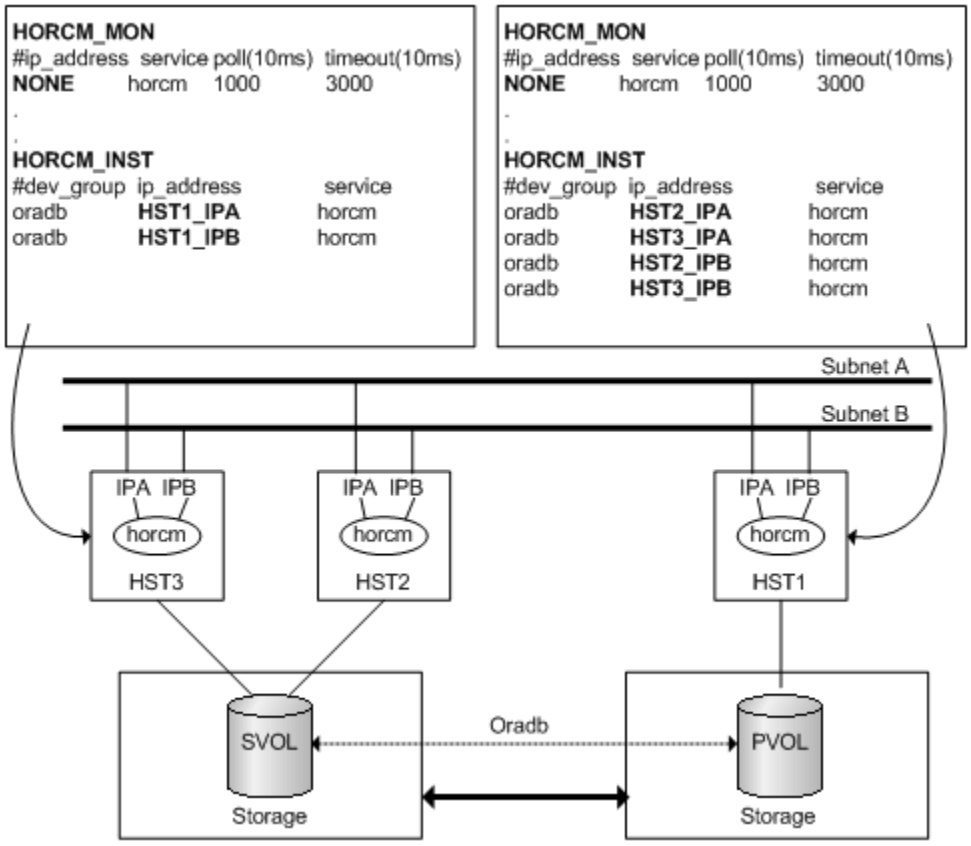


Figure 2-13 Configuration for multiple networks

(5) HORCM_LDEV

The HORCM_LDEV parameter is used for specifying stable LDEV# and Serial# as the physical volumes corresponding to the paired logical volume names. Each group name is unique and typically has a name fitting its use (for example, database data, Redo log file, UNIX file). The group and paired logical volume names described in this item must also be known to the remote server.

- dev_group: This parameter is the same as HORCM_DEV parameter.
- dev_name: This parameter is the same as HORCM_DEV parameter.
- MU#: This parameter is the same as HORCM_DEV parameter.
- Serial#: This parameter is used to specify the serial number of RAID box. For VSP G1000, add a "3" at the beginning of the serial number. For example, for serial number 12345, enter 312345.
- CU:LDEV(LDEV#): This parameter is used to describe the LDEV number in the RAID storage system and supports three types of format as LDEV#.

```
#dev_group    dev_name     Serial#         CU:LDEV(LDEV#)    MU#
     oradb    dev1         30095           02:40               0
     oradb    dev2         30095           02:41               0
```

  - Specifying "CU:LDEV" in hex used by SVP or Web console Example for LDEV# 260 01: 04

- Specifying "LDEV" in decimal used by the inqraid command of CCI Example for LDEV# 260 260
- Specifying "LDEV" in hex used by the inqraid command of CCI Example for LDEV# 260 0x104

Note: The HORCM_LDEV format can only be used on the TagmaStore USP/TagmaStore NSC. LDEV# will be converted to "Port#, Targ#, Lun#" mapping to this LDEV internally, because the RAID storage system needs to specify "Port#, Targ#, Lun#" for the target device. This feature is TagmaStore USP/TagmaStore NSC microcode dependent; if HORCM fails to start, HORCM_DEV needs to be used.

(6) HORCM_LDEVG

The HORCM_LDEVG parameter defines the device group information that the CCI instance reads. For details about device group, see LDEV grouping function on page 3-25.

The following values are defined.

- Copy group: specifies a name of copy group. This is equivalent to the dev_group of HORCM_DEV and HORCM_LDEV parameters.

  CCI operates by using the information defined here.
- ldev_group: Specifies a name of device group that the CCI instance reads.
- Serial#: Specifies a storage system serial number. For VSP G1000, add a “3” at the beginning of the serial number. For example, for serial number 12345, enter 312345.

```
HORCM_LDEVG
#Copy_Group  ldev_group  Serial#
ora          grp1        64034
```

(7) HORCM_INSTP

The HORCM_INSTP parameter is used when specifying a path ID for the link of TrueCopy as well as HORCM_INST parameter. You can specify from 1 to 255 for the path ID. If you do not specify the Path ID, the behavior is the same as when 'HORCM_INST' is used.

```
HORCM_INSTP
dev_group        ip_address      service   pathID
VG01             HSTA            horcm     1
VG02             HSTA            horcm     2
```

Note: The path ID can be specified at TrueCopy, Universal Replicator, and Universal Replicator for Mainframe. However, the path ID cannot be specified at UR/URz when connecting USP V/VM and USP/NSC. The same path ID must be specified between the site of P-VOL and S-VOL because the path ID is used at the **paircreate** command.

(8) HORCM_ALLOW_INST

The HORCM_ALLOW_INST parameter is used to restrict the users using the virtual command device. The allowed IP addresses and port numbers are as follows.

For IPv4

```
HORCM_ALLOW_INST
#ip_address       service
158.214.135.113   34000
158.214.135.114   34000
```

For IPv6

```
HORCM_ALLOW_INST
#ip_address       service
fe80::209:6bff:febe:3c17   34000
```

Note: If CCI clients not defined HORCM_ALLOW_INST, HORCM instance starting up is rejected by SCSI check condition (SKEY=0x05, ASX=0xfe) and CCI cannot be started up.

Configuration definition for cascading volume pairs

The CCI software (HORCM) is capable of keeping track of up to seven pair associations per LDEV (1 for TrueCopy/UR, 3 for UR, 3 for ShadowImage/ Copy-on-Write Snapshot, 1 for Copy-on-Write Snapshot). By this management, CCI can be assigned to seven groups per actual LU that is described in the configuration definition file.

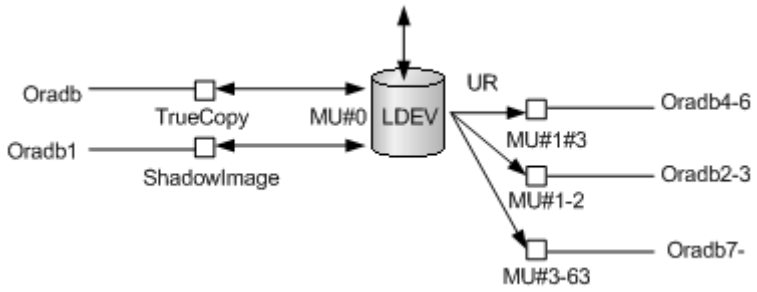


Figure 2-14 Mirror descriptors and group assignment

Configuration file and mirror descriptors

The group name and MU# described in the HORCM_DEV parameter of a configuration definition file are assigned the corresponding mirror descriptors, as outlined in Table 2-3 Mirror descriptors and group assignments on page 2-26. "Omission of MU#" is handled as MU#0, and the specified group is registered to MU#0 on ShadowImage and TrueCopy. Also, the MU# that is noted for HORCM_DEV in Table 2-3 Mirror descriptors and group assignments on page 2-26 reflects a random numbering sequence (for example, 2, 1, 0).

Table 2-3 Mirror descriptors and group assignments

HORCM_DEV parameter in configuration file	MU#0		SI (Snapshot) only	UR only
	TC/ UR	SI	MU#1-#2 (MU#3-#63)	MU#1-#3
HORCM_DEV #dev_group dev_name port# TargetID LU# MU# Oradb oradev1 CL1-D 2 1	oradev1	oradev1	-	-
HORCM_DEV #dev_group dev_name port# TargetID LU# MU# Oradb oradev1 CL1-D 2 1 Oradb1 oradev11 CL1-D 2 1 1 Oradb2 oradev21 CL1-D 2 1 2	oradev1	oradev1	oradev11 oradev21	-
HORCM_DEV #dev_group dev_name port# TargetID LU# MU# Oradb oradev1 CL1-D 2 1 Oradb1 oradev11 CL1-D 2 1 0 Oradb2 oradev21 CL1-D 2 1 1 Oradb3 oradev31 CL1-D 2 1 2	oradev1	oradev11	oradev21 oradev31	-
HORCM_DEV #dev_group dev_name port# TargetID LU# MU# Oradb oradev1 CL1-D 2 1 0	-	oradev1	-	-
HORCM_DEV #dev_group dev_name port# TargetID LU# MU# Oradb oradev1 CL1-D 2 1 0 Oradb1 oradev11 CL1-D 2 1 1 Oradb2 oradev21 CL1-D 2 1 2	-	oradev1	oradev11 oradev21	-
HORCM_DEV #dev_group dev_name port# TargetID LU# MU# Oradb oradev1 CL1-D 2 1 Oradb1 oradev11 CL1-D 2 1 0 Oradb2 oradev21 CL1-D 2 1 h1 Oradb3 oradev31 CL1-D 2 1 h2 Oradb4 oradev41 CL1-D 2 1 h3	oradev1	oradev11	-	oradev21 oradev31 oradev41

Cascading connection and configuration files

A volume of the cascading connection describes entity in a configuration definition file on the same instance, and classifies connection of volume through the mirror descriptor. In case of TrueCopy/ShadowImage cascading connection, too, the volume entity describes to a configuration definition file on the same instance. The following figure shows an example of this.

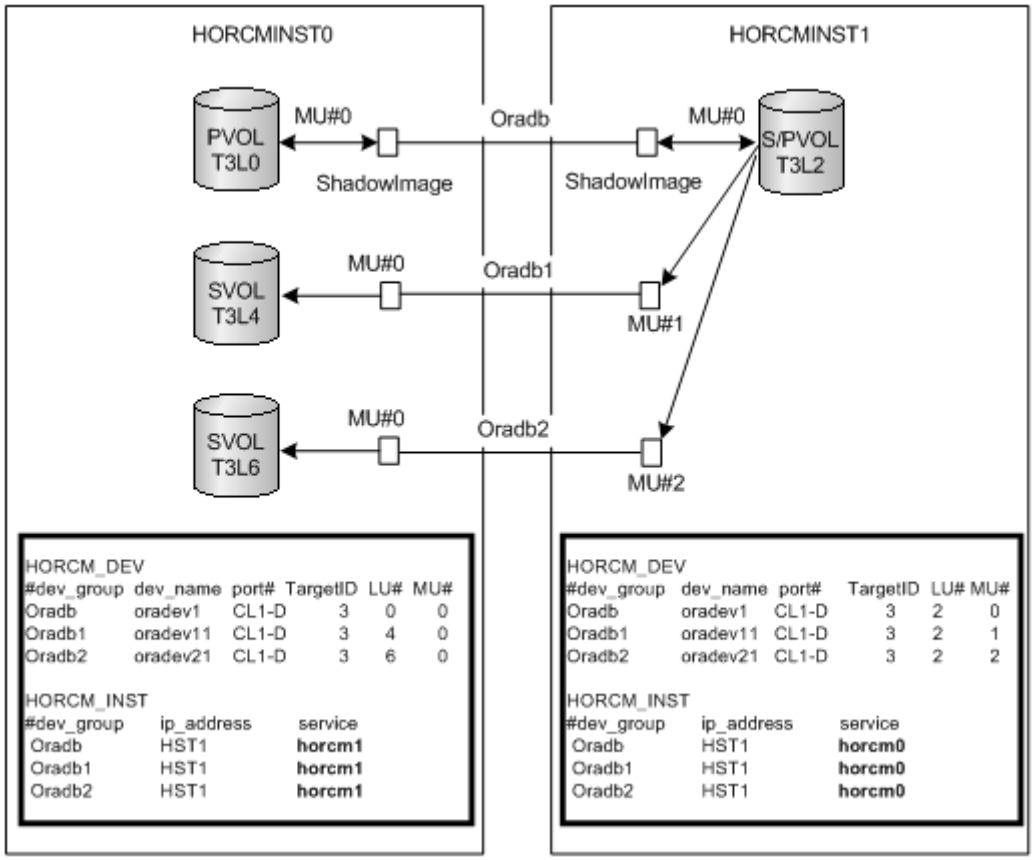
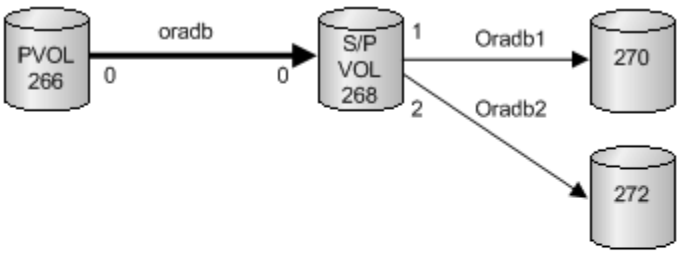


Figure 2-15 ShadowImage cascade connection and configuration file

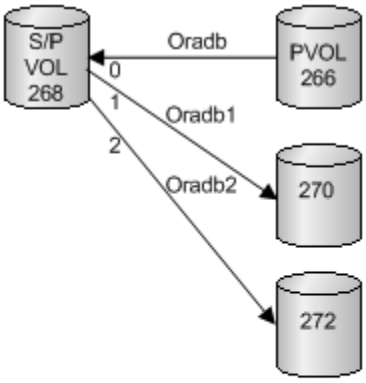
ShadowImage

Since ShadowImage is a mirrored configuration within one storage system, it can be described as a volume of the cascading connection according to two configuration definition files. For a ShadowImage-only cascading connection, the specified group is assigned to the mirror descriptor (MU#) of ShadowImage, specifically defining "0" as the MU# for ShadowImage. Figure 2-16 Pairdisplay on HORCMINST0 on page 2-28 - Figure 2-18 Pairdisplay on HORCMINST0 on page 2-28 show ShadowImage cascading configurations and the pairdisplay information for each configuration.



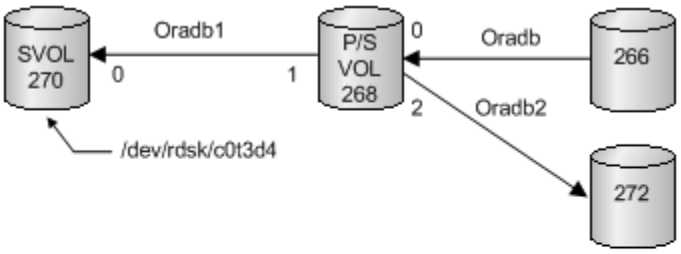

```
# pairdisplay -g oradb -m cas
Group   PairVol(L/R) (Port#,TID,LU-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb   oradev1(L)  (CL1-D , 3,  0-0) 30053  266..P-VOL PAIR,30053    268  -
oradb   oradev1(R)  (CL1-D , 3,  2-0) 30053  268..S-VOL PAIR,-----     266  -
oradb1  oradev11(R) (CL1-D , 3,  2-1) 30053  268..P-VOL PAIR,30053    270  -
oradb2  oradev21(R) (CL1-D , 3,  2-2) 30053  268..P-VOL PAIR,30053    272  -
```

Figure 2-16 Pairdisplay on HORCMINST0




```
# pairdisplay -g oradb -m cas
Group   PairVol(L/R) (Port#,TID,LU-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb   oradev1(L)   (CL1-D , 3,  2-0)30053   268..S-VOL PAIR,-----     266  -
oradb1  oradev11(L) (CL1-D , 3,  2-1)30053   268..P-VOL PAIR,30053    270  -
oradb2  oradev21(L) (CL1-D , 3,  2-2)30053   268..P-VOL PAIR,30053    272  -
oradb   oradev1(R)   (CL1-D , 3,  0-0)30053   266..P-VOL PAIR,30053    268  -
```

Figure 2-17 Pairdisplay on HORCMINST1

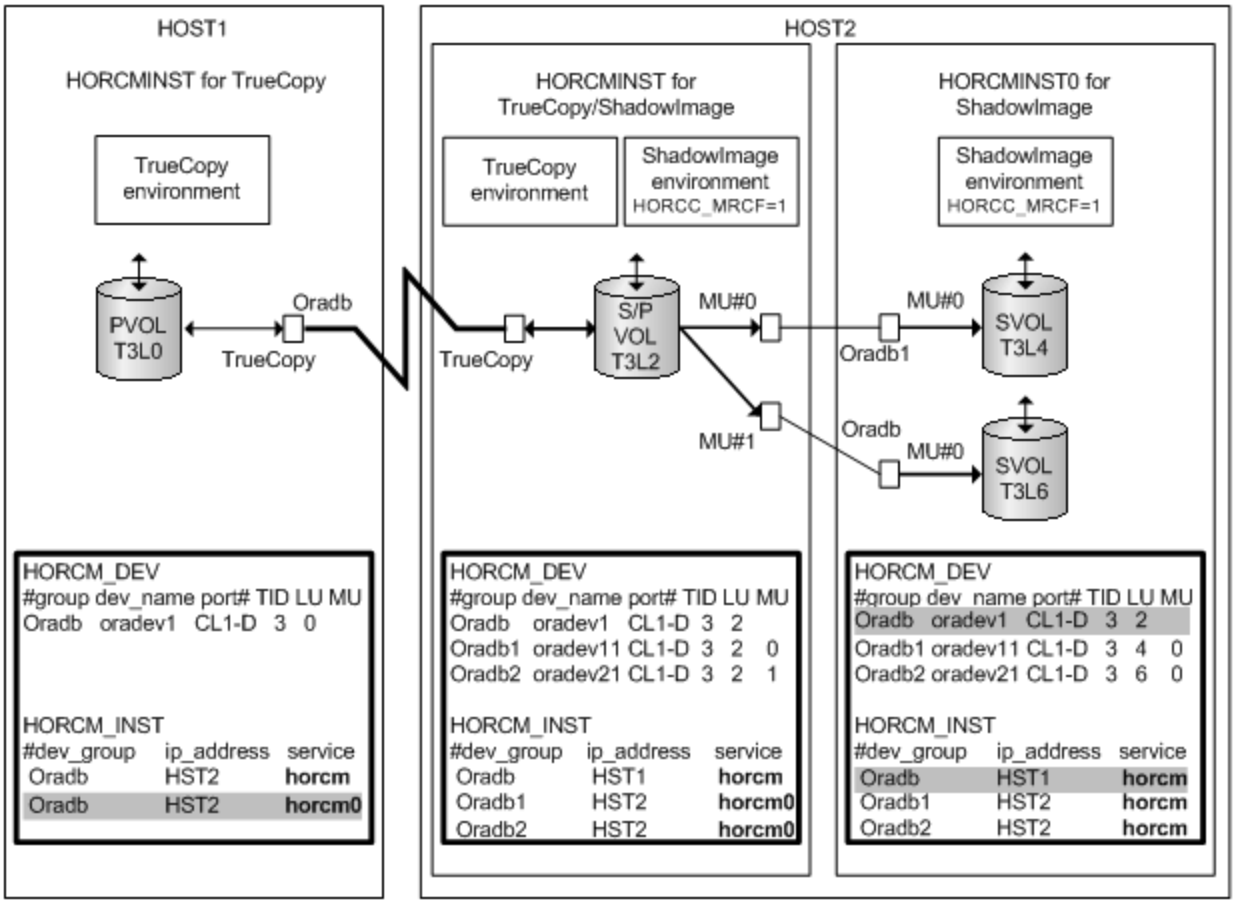



```
# pairdisplay -d /dev/rdsk/c0t3d4 -m cas
Group   PairVol(L/R) (Port#,TID,LU-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb1  oradev11(L) (CL1-D , 3,  4-0)30053  270..S-VOL PAIR,-----     268  -
oradb1  oradev11(R) (CL1-D , 3,  2-1)30053  268..P-VOL  PAIR,30053    270  -
oradb   oradev1(R)  (CL1-D , 3,  2-0)30053  268..S-VOL  PAIR,-----     266  -
oradb2  oradev21(R) (CL1-D , 3,  2-2)30053  268..P-VOL  PAIR,30053    272  -
```

Figure 2-18 Pairdisplay on HORCMINST0

Cascading connections for TrueCopy and ShadowImage

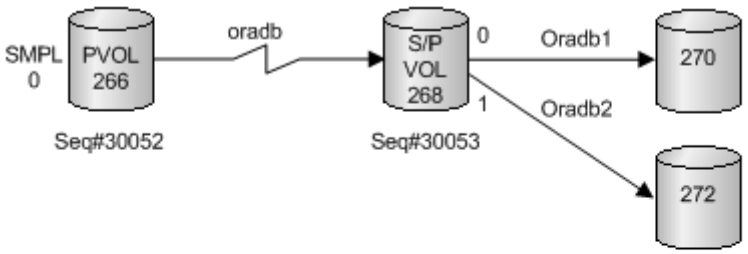
The cascading connections for TrueCopy/ShadowImage can be set up by using three configuration definition files that describe the cascading volume entity in a configuration definition file on the same instance. The mirror descriptor of ShadowImage and TrueCopy definitely describe "0" as MU#, and the mirror descriptor of TrueCopy does not describe "0" as MU#.



Note: Shaded portions: If HORCMINST0 needs to manage Hitachi TrueCopy's paired volume, and then "oradb" must describe that there is a connection to HST1 via HORCMINST0.

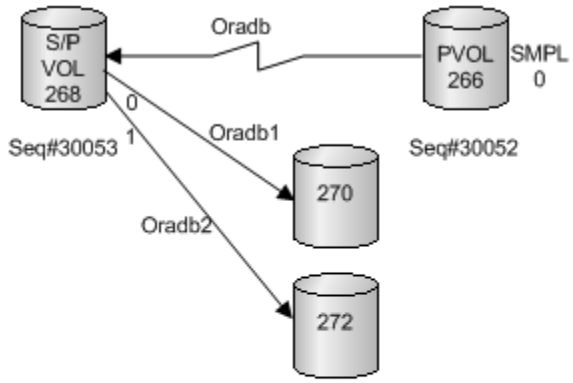
Figure 2-19 TrueCopy/ShadowImage cascading connection and configuration file

Figure 2-20 Pairdisplay for TrueCopy on HOST1 on page 2-30 through Figure 2-23 Pairdisplay for ShadowImage on HOST2 (HORCMINST0) on page 2-31 show TrueCopy/ShadowImage cascading configurations and the pairdisplay information for each configuration.



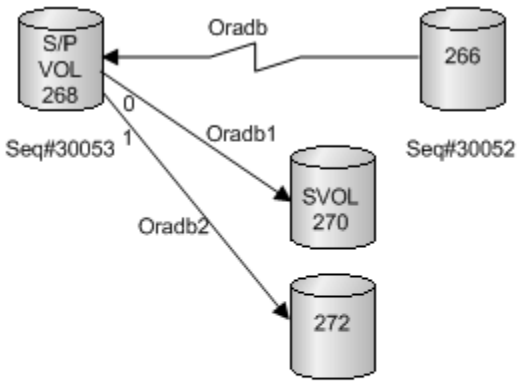

```
# pairdisplay -g oradb -m cas
Group   PairVol(L/R) (Port#,TID,LU-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb   oradev1(L)  (CL1-D , 3,  0-0) 30052  266..SMPL  ----,-----      ----  -
oradb    oradev1(L)  (CL1-D , 3,  0)   30052  266..P-VOL COPY,30053  268   -
oradb1  oradev11(R) (CL1-D , 3,  2-0) 30053  268..P-VOL COPY,30053  270   -
oradb2  oradev21(R) (CL1-D , 3,  2-1) 30053  268..P-VOL PSUS,30053  272   W
oradb   oradev1(R)  (CL1-D , 3,  2)   30053  268..S-VOL COPY,-----    266   -
```

Figure 2-20 Pairdisplay for TrueCopy on HOST1



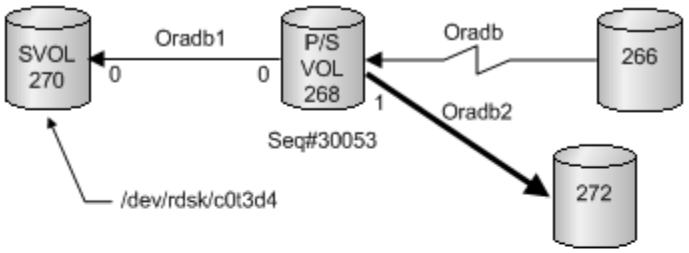

```
# pairdisplay -g oradb -m cas
Group   PairVol(L/R) (Port#,TID,LU-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb1  oradev11(L)  (CL1-D , 3,  2-0) 30053  268..P-VOL PAIR,30053   270  -
oradb2  oradev21(L)  (CL1-D , 3,  2-1) 30053  268..P-VOL PSUS,30053  272  W
oradb   oradev1(L)   (CL1-D , 3,  2)   30053  268..S-VOL PAIR, -----  266  -
oradb   oradev1(R)   (CL1-D ,  3,  0-0) 30052  266..SMPL  ----,   -----    ----  -
oradb   oradev1(R)   (CL1-D ,  3,  0)   30052  266..P-VOL PAIR, 30053   268  -
```

Figure 2-21 Pairdisplay for TrueCopy on HOST2 (HORCMINST)




```
# pairdisplay -g oradb1 -m cas
Group   PairVol(L/R) (Port#,TID,LU-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb1  oradev11(L) (CL1-D , 3,  2-0) 30053  268..P-VOL PAIR,30053   270   -
oradb2  oradev21(L) (CL1-D , 3,  2-1) 30053  268..P-VOL PSUS,30053  272   W
oradb   oradev1(L)  (CL1-D , 3,  2)   30053  268..S-VOL PAIR, -----   266   -
oradb   oradev11(R)  (CL1-D , 3,  4-0) 30053  270..S-VOL PAIR, -----   268   -
```

Figure 2-22 Pairdisplay for ShadowImage on HOST2 (HORCMINST)




```
# pairdisplay -g oradb1 -m cas
Group   PairVol(L/R) (Port#,TID,LU-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb1  oradev11(L) (CL1-D , 3,  4-0) 30053  270..S-VOL PAIR,-----   268   -
oradb2  oradev11(R) (CL1-D , 3,  2-0) 30053  268..P-VOL PAIR, 30053  270   -
oradb2  oradev21(R) (CL1-D , 3,  2-1) 30053  268..P-VOL PSUS,30053  272   W
oradb   oradev1  (R) (CL1-D , 3,  2)   30053  268..S-VOL PAIR, -----   266   -

# pairdisplay -d /dev/rdsk/c0t3d4 -m cas
Group   PairVol(L/R) (Port#,TID,LU-M),Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M
oradb1  oradev11(L) (CL1-D , 3,  4-0) 30053  270..S-VOL PAIR,-----   268   -
oradb2  oradev11(R) (CL1-D , 3,  2-0) 30053  268..P-VOL PAIR, 30053  270   -
oradb2  oradev21(R) (CL1-D , 3,  2-1) 30053  268..P-VOL PSUS,30053  272   W
oradb   oradev1  (R) (CL1-D , 3,  2)   30053  268..S-VOL PAIR, -----   266   -
```

Figure 2-23 Pairdisplay for ShadowImage on HOST2 (HORCMINST0)

CCI software files

The CCI software consists of files supplied with the software, log files created internally, and files created by the user. These files are stored on the local disk in the server machine.

- CCI files supplied with the software on page 2-32
- CCI log and trace files on page 2-35
- User environment variable on page 2-44

CCI files supplied with the software

CCI files for UNIX-based systems

Title	File name	Command name	Mode	User*1	Group
HORCM	/etc/horcmgr	horcmd	0544	root	sys
HORCM_CONF	/HORCM/etc/horcm.conf	-	0444	root	sys
Takeover	/usr/bin/horctakeover	horctakeover	0544	root	sys
Accessibility check	/usr/bin/paircurchk	paircurchk	0544	root	sys
Pair generation	/usr/bin/paircreate	paircreate	0544	root	sys
Pair splitting	/usr/bin/pairsplit	pairsplit	0544	root	sys
Pair resynchronization	/usr/bin/pairresync	pairresync	0544	root	sys
Event waiting	/usr/bin/pairevtwait	pairevtwait	0544	root	sys
Error notification	/usr/bin/pairmon	pairmon	0544	root	sys
Volume check	/usr/bin/pairvolchk	pairvolchk	0544	root	sys
Pair configuration confirmation	/usr/bin/pairdisplay	pairdisplay	0544	root	sys
RAID scanning	/usr/bin/raidscan	raidscan	0544	root	sys
RAID activity reporting	/usr/bin/raidar	raidar	0544	root	sys
Connection confirming	/usr/bin/raidqry	raidqry	0544	root	sys
Trace control	/usr/bin/horcctl	horcctl	0544	root	sys
HORCM activation script	/usr/bin/horcmstart.sh	horcmstart.sh	0544	root	sys
HORCM shutdown script	/usr/bin/horcmshutdown.sh	horcmshutdown.sh	0544	root	sys
Connection confirming	/HORCM/usr/bin/inqraid	--	0544	root	sys
Synchronous waiting	/usr/bin/pairsyncwait	pairsyncwait	0544	root	sys
Configuration setting and confirming command	/HORCM/usr/bin/raidcfg	raidcfg	0544	root	sys
Text filtering	/HORCM/usr/bin/rmawk	rmawk	0544	root	sys
DB Validator setting	/usr/bin/raidvchkset	raidvchkset	0544	root	sys
DB Validator confirmation	/usr/bin/raidvchkdsp	raidvchkdsp	0544	root	sys
DB Validator confirmation	/usr/bin/raidvchkscan	raidvchkscan	0544	root	sys

Title	File name	Command name	Mode	User*1	Group
Storage Replication Adapter	/HORCM/usr/bin/rmsra	rmsra	0544	root	sys
Configuration setting command	HORCM/usr/bin/raidcom	raidcom	0544	root	sys
A file for management	HORCM/etc/ Raidcom_Dic_Raid_RM_Patch.txt	-	0644	root	sys
A file for management	HORCM/etc/ Raidcom_Help_Raid_RM.txt	-	0644	root	sys
A file for management	HORCM/etc/ Raidcom_Dic_Raid_RM.txt	-	0644	root	sys

For information and instructions on changing the UNIX user for the CCI software, please see the *Command Control Interface Installation and Configuration Guide*.

CCI files for Windows-based systems

Title	File name	Command name
HORCM	\HORCM\etc\horcmgr.exe	horcmd
HORCM_CONF	\HORCM\etc\horcm.conf	-
Takeover	\HORCM\etc\horctakeover.exe	horctakeover
Accessibility check	\HORCM\etc\paircurchk.exe	paircurchk
Pair generation	\HORCM\etc\paircreate.exe	paircreate
Pair split	\HORCM\etc\pairsplit.exe	pairsplit
Pair re-synchronization	\HORCM\etc\pairresync.exe	pairresync
Event waiting	\HORCM\etc\pairevtwait.exe	pairevtwait
Error notification	\HORCM\etc\pairmon.exe	pairmon
Volume checking	\HORCM\etc\pairvolchk.exe	pairvolchk
Pair configuration confirmation	\HORCM\etc\pairdisplay.exe	pairdisplay
RAID scanning	\HORCM\etc\raidscan.exe	raidscan
RAID activity reporting	\HORCM\etc\raidar.exe	raidar
Connection confirmation	\HORCM\etc\raidqry.exe	raidqry
Trace control	\HORCM\etc\horcctl.exe	horcctl
HORCM activation script	\HORCM\etc\horcmstart.exe	horcmstart
HORCM shutdown script	\HORCM\etc\horcmshutdown.exe	horcmshutdown
Synchronous waiting	\HORCM\etc\pairsyncwait.exe	pairsyncwait
Connection confirmation	\HORCM\etc\inqraid.exe	inqraid
Configuration setting and confirming command	\HORCM\Tool\mkconf.exe	mkconf
Text filtering	\HORCM\Tool\rmawk.exe	rmawk
Oracle Validation setting	\HORCM\etc\raidvchkset.exe	raidvchkset
Oracle Validation confirmation	\HORCM\etc\raidvchkdsp.exe	raidvchkdsp

Title	File name	Command name
Oracle Validation confirmation	\HORCM\etc\raidvchkscan.exe	raidvchkscan
Configuration setting command	\HORCM\etc\raidcom.exe	raidcom
A file for management	\HORCM\etc\Raidcom_Dic_Raid_RM_Patch.txt	-
A file for management	\HORCM\etc\Raidcom_Help_Raid_RM.txt	-
A file for management	\HORCM\etc\Raidcom_Dic_Raid_RM.txt	-
Tool	\HORCM\Tool\chgacl.exe	chgacl
Tool	\HORCM\Tool\svcexe.exe	svcexe
Sample script for svcexe	\HORCM\Tool\HORCM0_run.txt	-
Tool	\HORCM\Tool\TRCLOG.bat	TRCLOG
Storage Replication Adapter	\HORCM\etc\rmsra.exe	rmsra
Takeover	\HORCM\usr\bin\horctakeover.exe	horctakeover
Accessibility check	\HORCM\usr\bin\paircurchk.exe	paircurchk
Pair generation	\HORCM\usr\bin\paircreate.exe	paircreate
Pair split	\HORCM\usr\bin\pairsplit.exe	pairsplit
Pair re-synchronization	\HORCM\usr\bin\pairresync.exe	pairresync
Event waiting	\HORCM\usr\bin\pairevtwait.exe	pairevtwait
Volume check	\HORCM\usr\bin\pairvolchk.exe	pairvolchk
Synchronous waiting	\HORCM\usr\bin\pairsyncwait.exe	pairsyncwait
Pair configuration confirmation	\HORCM\usr\bin\pairdisplay.exe	pairdisplay
RAID scanning	\HORCM\usr\bin\raidscan.exe	raidscan
Connection confirmation	\HORCM\usr\bin\raidqry.exe	raidqry
Oracle Validation setting	\HORCM\usr\bin\raidvchkset.exe	raidvchkset
Oracle Validation confirmation	\HORCM\usr\bin\raidvchkdsp.exe	raidvchkdsp
Oracle Validation confirmation	\HORCM\usr\bin\raidvchkscan.exe	raidvchkscan
Configuration setting and confirming command	\HORCM\usr\bin\raidcfg.exe	raidcfg

Note:

- The \HORCM\etc\ commands are used from the console window. If these commands are executed without an argument, the interactive mode will start up.
- The \HORCM\usr\bin commands have no console window, and can therefore be used from the application.
- The \HORCM\usr\bin commands do not support the directory mounted volumes in subcommands.
- \HORCM\Tool\TRCLOG.bat is a troubleshooting tool. This tool is not usually used.
- \HORCM\etc\rmsra.exe is the binary data used for cooperation with VMware. This is used directly by VMware, not usually used by users.

CCI files for OpenVMS-based systems

Title	File name	Command name	User
HORCM	$ROOT:[HORCM.etc]horcmgr.exe	horcmd	sys
HORCM_CONF	$ROOT:[HORCM.etc]horcm.conf	-	sys
Takeover	$ROOT:[HORCM.usr.bin]horctakeover.exe	horctakeover	sys
Volume accessibility check	$ROOT:[HORCM.usr.bin]paircurchk.exe	paircurchk	sys
Pair generation	$ROOT:[HORCM.usr.bin]paircreate.exe	paircreate	sys
Pair splitting	$ROOT:[HORCM.usr.bin]pairsplit.exe	pairsplit	sys
Pair re-synchronization	$ROOT:[HORCM.usr.bin]pairresync.exe	pairresync	sys
Event waiting	$ROOT:[HORCM.usr.bin]pairevtwait.exe	pairevtwait	sys
Error notification	$ROOT:[HORCM.usr.bin]pairmon.exe	pairmon	sys
Volume checking	$ROOT:[HORCM.usr.bin]pairvolchk.exe	pairvolchk	sys
Pair config. confirmation	$ROOT:[HORCM.usr.bin]pairdisplay.exe	pairdisplay	sys
RAID scan	$ROOT:[HORCM.usr.bin]raidscan.exe	raidscan	sys
RAID activity report	$ROOT:[HORCM.usr.bin]raidar.exe	raidar	sys
Connection confirmation	$ROOT:[HORCM.usr.bin]raidqry.exe	raidqry	sys
Trace control	$ROOT:[HORCM.usr.bin]horcctl.exe	horcctl	sys
HORCM activation script	$ROOT:[HORCM.usr.bin]horcmstart.exe	horcmstart.sh	sys
HORCM shutdown script	$ROOT:[HORCM.usr.bin]horcmshutdown.exe	horcmshutdown.sh	sys
Connection confirmation	$ROOT:[HORCM.usr.bin]inqraid.exe	-	sys
Synchronous waiting	$ROOT:[HORCM.usr.bin]pairsyncwait.exe	pairsyncwait	sys
Configuration file making	$ROOT:[HORCM.usr.bin]mkconf.exe	-	sys
Text filtering	$ROOT:[HORCM.usr.bin]rmawk.exe	-	sys
Database Validator setting	$ROOT:[HORCM.usr.bin]raidvchkset.exe	raidvchkset	sys
DB Validator confirmation	$ROOT:[HORCM.usr.bin]raidvchkdsp.exe	raidvchkdsp	sys
DB Validator confirmation	$ROOT:[HORCM.usr.bin]raidvchkscan.exe	raidvchkscan	sys
Storage Replication Adapter	$ROOT:[HORCM.usr.bin]rmsra.exe	rmsra	sys
Sample file for horcmstart	$ROOT:[HORCM]loginhorcm*.com	-	sys
Sample file for horcmstart	$ROOT:[HORCM]runhorcm*.com	-	sys

Note:

- $ROOT is defined as SYS$POSIX_ROOT. $POSIX_ROOT is necessary when using C RTL.
- The user name for OpenVMS is "System".

CCI log and trace files

The CCI software (HORCM) maintains internal startup log files, execution log files, and trace files that can be used to identify the causes of errors and to keep records of the status transition history of the paired volumes.

- CCI log files on page 2-36
- CCI trace files on page 2-38

- CCI trace control command on page 2-38
- Command logging for audit on page 2-39

CCI log files

HORCM logs are classified into startup logs and execution logs.

- The startup logs contain data on errors that occur before HORCM becomes ready to provide services. Thus, if HORCM fails to start up due to improper environment setting, refer to the startup logs to resolve the problem.
- The HORCM execution logs (error log, trace, and core files) contain data on errors that are caused by software or hardware problems. These logs contain internal error data that does not apply to any user settings, therefore, you do not need to refer to the HORCM execution logs.
- When an error occurs in execution of a command, data on the error is collected in the command log file. Users may refer to the command log file if a command execution error occurs.

The following figure shows a graphical representation of the CCI log and trace files within the CCI configuration environment.

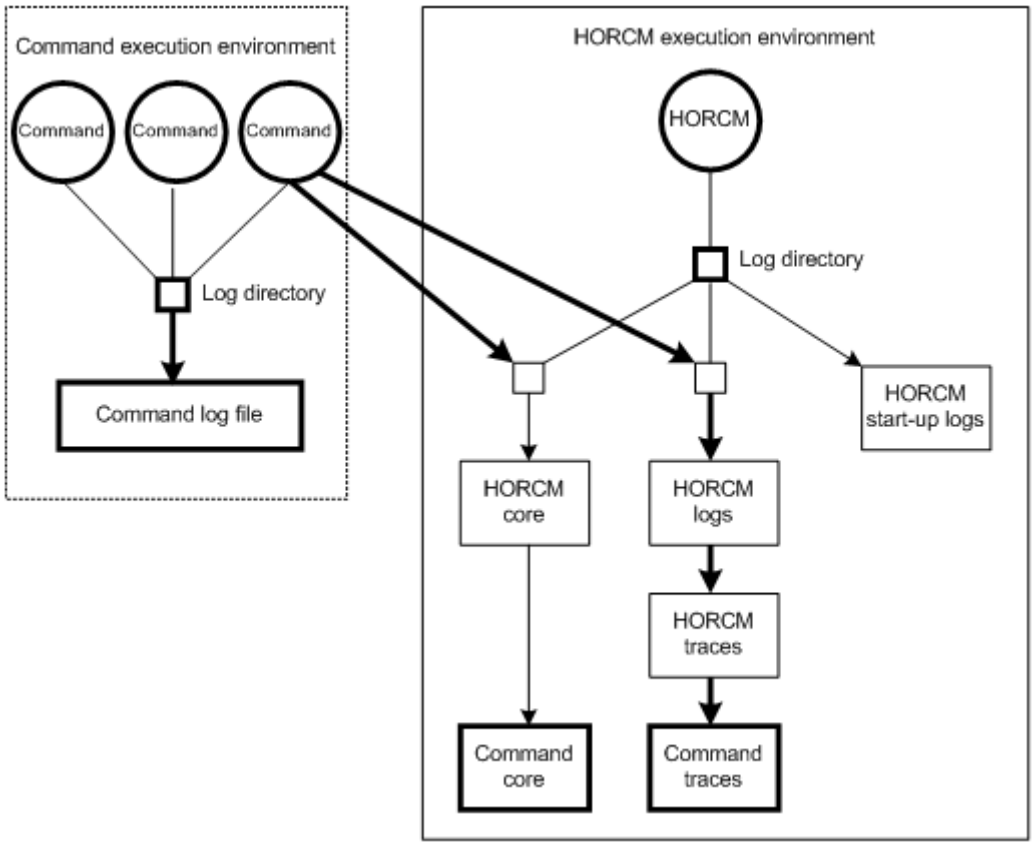


Figure 2-24 Logs and traces

The startup log, error log, trace, and core files are stored as shown in Table 2-4 Log file names and locations on page 2-37. Specify the directories for the HORCM and command log files using the HORCM_LOG and HORCC_LOG environment variables as shown in Table 2-5 Environment variables for log

directories on page 2-38. If it is not possible to create the log files, or if an error occurs before the log files are created, the error logs are output in the system log file. If the HORCM activation fails, the system administrator should check the system log file and activation log, identify the error cause, and take the proper action. The system log file for UNIX-based systems is the syslog file. The system log file for Windows-based systems is the event log file.

Table 2-4 Log file names and locations

File	UNIX-based systems	Windows-based systems
Startup log	HORCM startup log: $HORCM_LOG/horcm_HOST.log Command log: $HORCC_LOG/horcc_HOST.log $HORCC_LOG/horcc_HOST.oldlog	HORCM startup log: $HORCM_LOG\horcm_HOST_log.txt Command log: $HORCC_LOG\horcc_HOST_log.txt $HORCC_LOG\horcc_HOST_oldlog.txt
Error log	HORCM error log: $HORCM_LOG/horcmlog_HOST/horcm.log	HORCM error log: $HORCM_LOG\horcmlog_HOST\horcm_log.txt
Trace	HORCM trace: $HORCM_LOG/horcmlog_HOST/horcm_PID.trc Command trace: $HORCM_LOG/horcmlog_HOST/horcc_PID.trc	HORCM trace: $HORCM_LOG\horcmlog_HOST\horcm_PID_trc.txt Command trace: $HORCM_LOG\horcmlog_HOST\horcc_PID_trc.txt
Core	HORCM core: $HORCM_LOG/core_HOST_PID/core Command core: $HORCM_LOG/core_HOST_PID/core	HORCM core: $HORCM_LOG\core_HOST_PID\core Command core: $HORCM_LOG\core_HOST_PID\core

Note: HOST denotes the host name of the corresponding machine. PID denotes the process ID of that machine.

The location of the directory containing the log file depends on your command execution environment and the HORCM execution environment. The command trace file and core file reside together under the directory specified in the HORCM execution environment. A directory specified using the environment variable HORCM_LOG is used as the log directory in the HORCM execution environment. If no directory is specified, the directory /tmp is used. A directory specified using the environment variable HORCC_LOG is used as the log directory in the command execution environment. If no directory is specified, the directory /HORCM/log* is used (* = instance number). A nonexistent directory may be specified as a log directory using the environment variable.

Table 2-5 Environment variables for log directories

Directory name	Definition
$HORCM_LOG	A directory specified using the environment variable HORCM_LOG. The HORCM log file, trace file, and core file as well as the command trace file and core file are stored in this directory. If no environment variable is specified, "/HORCM/log/curlog" is used.
$HORCC_LOG	A directory specified using the environment variable HORCC_LOG. The command log file is stored in this directory. If no environment variable is specified, the directory "/HORCM/log*" is used (* is the instance number). While the HORCM is running, the log files are stored in the $HORCM_LOG directory shown in (a). When the HORCM starts up, the log files created in the operation are stored automatically in the $HORCM_LOGS directory shown in (b). a. HORCM log file directory in operation $HORCM_LOG = /HORCM/log*/curlog (* is instance number) b. HORCM log file directory for automatic storing $HORCM_LOGS = /HORCM/log*/tmplog (* is instance number)

CCI trace files

The command trace file is used for maintenance aiming at troubleshooting. It is not created normally. If a cause of an error cannot be identified using the log file, the environment variables or trace control commands with trace control parameters are issued to start tracing and the trace file is created. The trace control parameters include trace level, file size, mode, etc. More detailed tracing is enabled by increasing the trace level. Tracing is made in wraparound within the range of the file size. HORCM makes the trace file according to the trace level specified in the HORCM startup shell script set to activate the HORCM.

CCI trace control command

The trace control command (one of the HORCM control commands) sets or changes the trace control parameters. This command is used for troubleshooting and maintenance. If no trace control parameters can be specified using the environment variables in your command execution environment, it is possible to change the trace control parameters into the global parameters using this command. Table 2-6 Trace command parameters on page 2-38 lists and describes the parameters of the trace control command.

Table 2-6 Trace command parameters

Parameter	Function
Trace level parameter	Specifies the trace level, range = 0 to 15.
Trace size parameter	Specifies the trace file size in KB.
Trace mode parameter	Specifies the buffer mode or non-buffer mode for writing data in the trace file.
Trace type parameter	Specifies the trace type defined internally.
Trace change instruction	Specifies the command or CCI instance for which the trace control parameters are changed.

Command logging for audit

Logging other than raidcom command

This section explains the logging other than the raidcom command described in Logging raidcom command on page 2-41.

CCI supports command logging, this logging function cannot be used for auditing the script issuing the command. Thus, CCI supports the function logging the result of the command executions by expanding the current logging.

This function has the following control parameters.

- **$HORCC_LOGSZ** variable

  This variable is used to specify a maximum size (in units of KB) and normal logging for the current command. /HORCM/log*/horcc_HOST.log file is moved to /HORCM/log*/horcc_HOST.**old**log file when reaching in the specified maximum size. If this variable is not specified or specified as 0, it is same as the current logging for only command error.

  This variable is able to define to the environment variable and/or horcc_HOST.conf as discussed below.

  For example setting 2MB size: **HORCC_LOGSZ=2048 Export HORCC_LOGSZ**

- **/HORCM/log*/horcc_HOST.conf** file

  This file is used to describe HORCC_LOGSZ variable and the masking variable for logging. If the HORCC_LOGSZ as the environment variable is not specified, then HORCC_LOGSZ variable of this file is used. If both variable is not specified, then it is same as the current logging for only command error.

- **HORCC_LOGSZ** variable

  This variable must be described as follows: HORCC_LOGSZ=2048

- **The masking variable**

  This variable is used to mask (disable) the logging by specifying a condition of the command and returned value (except inqraid or EX_xxx error code). This variable is valid for NORMAL exit.

  If executing the **`pairvolchk`** command repeatedly at every interval (30 seconds), logging of this command may not be wanted. Therefore, you can mask it by specifying HORCC_LOGSZ=0 as shown below, and you may need to change your scripts if tracing is ON.

  Example of masking pairvolchk on a script:

  Export HORCC_LOGSZ=0 Pairvolchk -g xxx -s Unset HORCC_LOGSZ

  The masking feature is to enable the tracing without changing their scripts. And this feature is available for all CCI commands (except **`inqraid`** or **`EX_xxx error code`**).

For example, if you want to mask pairvolchk (returns 22) and raidqry, specify the following:

pairvolchk=22 raidqry=0

You can track script performance, and then decide to mask by auditing the command logging file, as needed.

- **Relationship between an environment variable and horcc_HOST.conf**

  Logging depends on the $HORCC_LOGSZ environment variable and/or the HORCC_HOST.conf file as shown below.

$HORCC_LOGSZ	HORCC_HOST.conf	Performing
=value	Any (does not matter)	Tracing within this APP
=0		NO tracing within this APP
Unspecified	HORCC_LOGSZ=value	Global tracing within this CCI instance
	HORCC_LOGSZ=0	NO global tracing within this CCI instance
	Unspecified or nonexistent	Use the default value (0) The same as the current logging for only command error

- **Examples for execution**

  /HORCM/log* directory

```
[root@raidmanager log9]#  ls  l
total 16
drwxr-xr-x  3 root root    4096 Oct 27 17:33 curlog
-rw-r--r--  1 root root    3936 Oct 27 17:36
horcc_raidmanager.log
-rw-r--r--  1 root root 2097452 Oct 27 17:29
horcc_raidmanager.oldlog
-rw-r--r--  1 root root      46 Oct 27 17:19
horcc_raidmanager.conf
drwxr-xr-x  3 root root    4096 Oct 27 17:19 tmplog
```

  /HORCM/log*/horcc_HOST.log file

```
COMMAND NORMAL : EUserId for HORC : root (0)  Tue Nov  1
12:21:53 2005
CMDLINE : pairvolchk  ss  g URA
12:21:54-2d27f-10090- [pairvolchk][exit(32)]
COMMAND NORMAL : EUserId for HORC : root (0)  Thu Oct 27
17:36:32 2005
CMDLINE : raidqry  l
17:36:32-3d83c-17539- [raidqry][exit(0)]
COMMAND ERROR  : EUserId for HORC : root (0)  Thu Oct 27
17:31:28 2005
CMDLINE : pairdisplay  g UR
17:31:28-9a206-17514- ERROR:cm_sndrcv[rc < 0 from HORCM]
17:31:28-9b0a3-17514- [pairdisplay][exit(239)]
[EX_ENOGRP] No such group
[Cause ]:The group name which was designated or the device name
doesn't exist in the configuration file, or the network address
for remote communication doesn't exist.
[Action]:Please confirm if the group name exists in the
configuration file of the local and remote host
```

  /HORCM/log*/horcc_HOST.conf file

```
# For Example
HORCC_LOGSZ=2048
#The masking variable
#This variable is used to disable the logging by the command
and exit code.
#For masking below log pairvolchk returned '32'(status is
SVOL_COPY)
#COMMAND NORMAL : EUserId for HORC : root (0)  Tue Nov  1
12:21:53 2005
#CMDLINE : pairvolchk  ss  g URA
#12:21:54-2d27f-10090- [pairvolchk][exit(32)]
pairvolchk=32
pairvolchk=22
```

Logging raidcom command

The history of performing raidcom command can be stored in syslog server by outputting it to the syslog file. Since the information of what command was performed by who and when are recorded on the syslog file, this is available to use for audit log.

Output the syslog file by using syslog service on the host OS. For details, refer to the host OS manual.

Caution:

- The packet loss occurs on the syslog because the syslog uses UDP communication. The log is also lost when the server to be received the syslog is down because the server does not have a function to store the data until it recovered. If you want to record the same log at the client side by considering the lost of syslog at the syslog server, refer to the output setting of the syslog file.
- This syslog files are not deleted automatically. Delete unnecessary files accordingly, or make run the log rotation by installing such as the logrotate service separately.

The conditions to support the output of syslog file

The conditions to support this function are explained in the following:

Supported OS

This function is supported only when the OS of the host is one of the following (Windows is out of support):

- Solaris 2.5
- Solaris 10/x86
- HP-UX 10.20/11.0/11.2x
- AIX 4.3
- Red Hat Linux 6.0, 7.0, 8.0 AS/ES 2.1, 3.0, 4.0, 5.0
- AS/ES 2.1, 3.0 Update2, 4.0, 5.0 on EM64T / IA641

Target command

The following shows the raidcom command that is target to be output on the syslog file.

- Setting commands
- raidcom get command status
- Authentication commands (performing the authentication command at the prompt also becomes the target.)

However, if the command is not issued to the DKC by detecting the raidcom command execution error beforehand, the command becomes out of target even if it falls under the above items.

Output setting for the syslog file

A syslog file is output when "1" is set on the RAIDCOM_SYSLOG of environment variables. The syslog file is not output at the stage of initial setting.

How to set the syslog.conf

The contents that can be set on the syslog.conf for the environment setting may vary in each OS. However, set basically according to the syslog.conf described in the following:

Setting example (It may vary by the host OS)

- Client side (extracts)

```
user.info                                   /var/log/
raidcomuser.err                                    /var/log/
raidcom.erruser.info
@host1234user.err                                    @host1234
```

- Server side (extracts)

```
user.info                                   /var/log/
raidcomuser.err                                    /var/log/
raidcom.err
```

You can record the same log at the client side by considering the lost of syslog at the syslog server. In this case, add the following settings.

- facility:user
- level:info/err ("info" for the normal command operation; "err" for the abnormal command operation.)

Syslog file display information

Three kinds of information for one raidcom command are output on the syslog file.

- Title row (first row)
- Command row (second row)
- Result rows (3 - 132 rows): the number of rows changes depending on the issuing command.

Table 2-7 Display information of the title row

Item	Output example
Syslog fixed output part (Including the host name)	Jun 27 10:15:13 rmsolx86 raidcom: [ID 702911 user.info] *It varies depending on the host OS.
Process ID	PID:1234
Command status	COMMAND NORMAL or COMMAND ERROR
Separation	:
User name Title	EUserId for HORC :
User name of the host	root
(user ID)	(0)
Time that performed raidcom	Wed Jun 27 10:15:13 2012

Table 2-8 Display information of the command row

Item	Output example
Syslog fixed output part (Including the host name)	Jun 27 10:15:13 rmsolx86 raidcom: [ID 702911 user.info] *It varies depending on the host OS.
Process ID	PID:1234
Title for performed command	CMDLINE:
Performed command	raidcom modify ldev -ldev_id 1234 -status nml

Table 2-9 Display information of the result rows

Item	Output example
Syslog fixed output part (Including the host name)	Jun 27 10:15:13 rmsolx86 raidcom: [ID 702911 user.info] *It varies depending on the host OS.
Process ID	PID:1234
[raidcom]	[raidcom]
Rows for the error information	[EX_CMDRJE] An order to the control/command device was rejected It was rejected due to SKEY=0x05, ASC=0x26, ASCQ=0x00, SSB=0x2E11,0x2205 on Serial#(64568)
Result of get_command_status	HANDLE SSB1 SSB2 ERR_CNT Serial# Description 00c4 - - 0 200414 -
Rows for the returned values of a command	[exit(0)]

Display example (It may vary depending on the host OS.)

- Logs when the normal operation

```
Aug 24 12:24:37 raidmanager raidcom: PID:06864 COMMAND NORMAL :
EUserID for HORC : root(0) Fri Aug 24 12:24:36 2012
Aug 24 12:24:37 raidmanager raidcom: PID:06864 CMDLINE :
raidcom get command_status -ldev_id 0001
Aug 24 12:24:37 raidmanager raidcom: PID:06864 [raidcom] HANDLE
```

```
SSB1    SSB2    ERR_CNT        Serial#     Description
Aug 24 12:24:37 raidmanager raidcom: PID:06864 [raidcom] 00c3
-       -           0          64568     -
Aug 24 12:24:37 raidmanager raidcom: PID:06864 [raidcom]
[exit(0)]
```

- Logs when the abnormal operation

```
Aug 24 12:24:27 raidmanager raidcom: PID:06857 COMMAND ERROR :
EUserID for HORC : root(0) Fri Aug 24 12:24:19 2012
Aug 24 12:24:27 raidmanager raidcom: PID:06857 CMDLINE :
raidcom get command_status
Aug 24 12:24:27 raidmanager raidcom: PID:06857 [raidcom] User
for Serial#[64568] : user1234
Aug 24 12:24:27 raidmanager raidcom: PID:06857 [raidcom] User
authentication has failed on Serial#(64568).
Aug 24 12:24:27 raidmanager raidcom: PID:06857 [raidcom]
[EX_ENAUTH] Authentication failed with User
Aug 24 12:24:27 raidmanager raidcom: PID:06857 [raidcom]
[exit(202)]
```

User-created files

CCI supports scripting to provide automated and unattended copy operations. A CCI script contains a list of CCI commands that describes a series of TrueCopy and/or ShadowImage operations. The scripted commands for UNIX-based platforms are defined in a shell script file. The scripted commands for Windows-based platforms are defined in a text file. The host reads the script file and sends the commands to the command device to execute the TrueCopy/ShadowImage operations automatically.

The CCI scripts are:

- **HORCM startup script (horcmstart.sh, horcmstart.exe).** A script that starts HORCM (/etc/horcmgr), sets environment variables as needed (for example, HORCM_CONF, HORCM_LOG, HORCM_LOGS), and starts HORCM.
- **HORCM shutdown script. (horcmshutdown.sh, horcmshutdown.exe):** A script for stopping the HORCM (/etc/horcmgr).
- **HA control script.** A script for executing takeover processing automatically when the cluster manager (CM) detects a server error.

When constructing the HORCM environment, the system administrator should make a copy of the **`horcm.conf`** file. The copied file should be set according to the system environment and registered as the following file (* is the instance number):

UNIX systems: **/etc/horcm.conf** or **/etc/horcm*.conf**

Windows systems:**%windir%\horcm.conf** or **%windir%\horcm*.conf**

User environment variable

When HORCM or command is invoked, environment variable can be specified.

3

CCI functions

This chapter describes the CCI functions.

Command execution using in-band and out-of-band methods

The methods of executing commands provided by CCI can be classified into the in-band and out-of-band methods.

- **In-band method.** This method transfers a command from the client or the server to the command device of the storage system via fibre and executes a CCI operation instruction.
- **Out-of-band method.** This method transfers a command from the client or the server to the virtual command device in the SVP via LAN, assigning a CCI operation instruction to the storage system, and executes it.

  If many commands are issued in a short period of time, for example issuing commands in the configuration in cooperation with VMware Site Recovery Manager (SRM), or from pre-existing scripts, the command response may slow. In this case, issuing commands using the In-Band method is recommended.

  Out-of-band operations are supported on the Virtual Storage Platform and later storage systems.

When executing a command using the in-band and out-of-band methods, a command device or a virtual command device is set in a configuration definition file as shown in the following figure. For the out-of-band method, the IP address of the SVP is specified in the configuration definition file.

The following figure shows a system configuration example and a setting example of a command device and a virtual command device using the in-band and out-of-band methods.

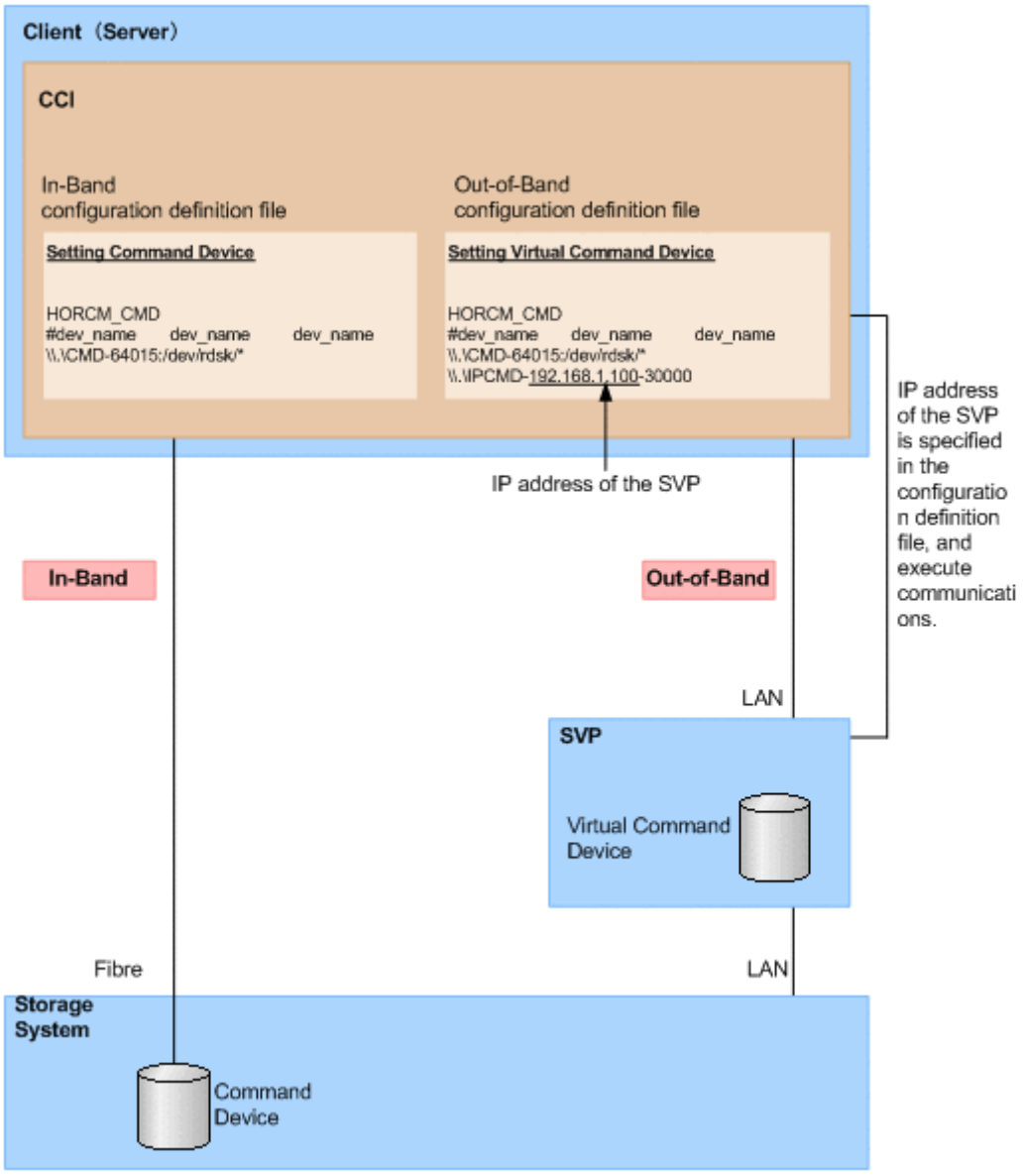


Figure 3-1 System configuration example and setting example of command device and virtual command device by in-band and out-of-band methods

To set these two methods, a command device or a virtual command device must be set to HORCM_CMD of a configuration definition file.

Connecting to CCI server already connected by In-Band method using Out-of-Band method

In Out-of-Band method, CCI server port can also be specified as a virtual command device. For this reason, CCI server which connected to a storage system in In-Band method can be connected in Out-of-Band method. If a CCI server is specified as a virtual command device, it provides a better performance than Out-of-Band method specified SVP as a virtual command device.

Hardware requirements

CCI uses SCSI path through driver to issue I/O for command device. To use CCI server port as virtual command device, the virtual command device interface needs to be converted to the actual SCSI path through interface. Following is the environment for using CCI server port as a virtual command device.

- CCI server which can set virtual command devices

  CCI support platform except Tru64UNIX and the environment can be used SCSI path through driver

- Client PC which can issue commands to virtual command devices

  It must be CCI support platform. Windows client such a Windows XP can be used as well.

- Initiator port

  Initiator port is required. Following is the default port number.

  If not specified the instance number: 34000

  If specified instance number (X): 34000 + X + 1

  If you change the default port number, use following environment variables.

  $HORCM_IPSCPORT=<services>*

  * <services>: port number or service name

For details about supported platforms, see the *Command Control Interface Installation and Configuration Guide*.

I/O Traffic Control

Synchronized I/O is issued from a virtual command device. The queueing time may occur because of the heavy I/O traffic because the virtual command device has to relay the command to the next virtual command device in the cascade configuration using the virtual command device. To improve the response in this environment, define the configuration so that asynchronous I/O is issued using the following environment variables..

```
$HORCM_IPSCPAIO=1
```

Security setting

Following security can be set.

- Specifying security of IP address and port number

  By defining IP address and port number of the client PC that issues command to virtual command device to HORCM_ALLOW_INST in the configuration definition file, users who can use virtual command device can be restricted. For the details about the settings to HORCM_ALLOW_INST, please refer to "Configuration definition file".

- Security setting for virtual command device

By using the following environment variable, security can be set to virtual command device.

```
$HORCM_IPCMDSEC=<value>
```

Specify the number (from 0 to 7) to <value> depending on the contents of the security which you want, in reference with the following table.

Table 3-1 Security setting for virtual command device

Value specifying to <value>	Command device setting			
	Security setting	User authentication	Device group definition	Security to be set (see Notes)
0	0	0	0	No security
1	0	0	1	Only HORCM_DEV allowed
2	0	1	0	User authentication required
3	0	1	1	User authentication required Only HORCM_DEV allowed
4	1	0	0	CMD security
5	1	0	1	CMD security Only HORCM_DEV allowed
6	1	1	0	CMD security User authentication required
7	1	1	1	CMD security User authentication required Only HORCM_DEV allowed

Notes:

- Only HORCM_DEV allowed: the operation can be performed only for paired logical volumes described in HORCM_DEV.
- User authentication required: only commands issued by authorized users can be executed.
- CMD security: only devices recognizable from the host can be operated. For details about CMD security, see Data Protection facility on page 7-5.

User authentication

CCI allows user authentication by using the user information managed by Storage Navigator and the SVP.

User authentication is arbitrary in the Replication operation in the in-band method while the operation by user authentication is mandatory in the configuration information operation and in the out-of-band method.

To enable the user authentication function, the user authentication mode of the command device accessed by CCI must be enabled.

The user authentication function inputs a login command from the client (server) and, to authenticate the user ID and password sent from CCI and the same types of information maintained by the storage system, issues an authentication request to the authentication module (SVP).

If the user ID and password sent from CCI are authenticated, CCI, for the once authenticated user (the user on the client starting up CCI), stores the user ID and password. This saves the necessity of inputting the user ID and password each time a command is executed. If the user logs out, the user ID and password stored by CCI are deleted.

If the user ID and password are different, the command is rejected and CCI automatically performs the logout processing for it, and requires the user authentication processing (user ID and password input) again.

Note:

- The only function that can be used if the user authentication function is disabled is the Replication function (replication command). If the user authentication function is disabled, the Provisioning function (configuration setting command) cannot be used.
- If specific user information or authority information is changed, delete the user ID and password maintained by the storage system from the SVP. Therefore, perform the user authentication processing on CCI again.
- If the communication with the SVP in the out-band method cannot be performed, the new authentication cannot be performed.

Command operation authority and user authentication

When CCI is used with the user authentication function enabled, commands are executed complying with the operation authority managed by Storage Navigator and the SVP.

Controlling User Role

CCI verifies whether or not the user executing the command on the host was already authenticated by checking the command device being in the authentication mode. After that, CCI obtains the execution authority of the command that is configured on the user role, and then compares the relevant command and the execution authority.

Checking the execution authority

If the configuring commands authenticated are compared with the execution authorities of commands configured on the user role and they do not correspond, CCI rejects the command with an error code "EX_EPPERM".

Normally, the user role needs to be the consistent and integrated authority among the large storage systems. In case of HORCM instances that are configured by the multiple large storage systems, the execution authorities are obtained by the serial number of the storage systems. If the user role is for the multiple storage systems and is not consistent among these storage systems, CCI makes the integrated authority by performing the logical AND of the execution authorities among the storage systems.

The target commands

CCI checks execution authorities on the following commands that use command devices.

- horctakeover, horctakeoff
- paircreate, pairsplit, pairresync
- raidvchkset

Controlling user resources

CCI verifies the user who executes the command has been authenticated already. After that, CCI obtains the access authority of the resource groups that are configured on the user roles, and then compares the access authority of the user and the specified resources.

Checking resource authorities

If the access is not permitted by comparing the access authorities of the resource groups configured on the user roles and the specified resource, CCI rejects the command with an error code "EX_EGPERM". If the resource groups are defined among the large storage systems, the specified resource is compared with the resource specified by obtaining the access authority configured to each large storage system.

Target commands

CCI checks resource authorities on the following commands that use command devices.

- raidcom commands (commands for setting configurations)
- horctakeover, horctakeoff, paircurchk, paircreate, pairsplit, pairresync, pairvolchk, pairevtwait, pairsyncwait, pairmon
- raidscan (-find verify, -find inst, -find sync except for [d]), pairdisplay, raidar, raidqry (except for -l and -r)
- raidvchkset, raidvchkscan (except for -v jnl), raidvchkdsp

Relation between user authentication and resource groups

In user authentication mode, CCI verifies the access authority of the relevant resource based on the user authentication and the role of it. Also, on the user authentication unnecessary mode and the undefined resource groups, CCI checks the access authorities shown in the following table.

Table 3-2 Relations between resource groups and command devices

Resources	Commands			
	pairXX[1]		raidcom	
	Not authenticated user[2]	Authenticated user	Not authenticated user[2]	Authenticated user
Undefined resource[3]	Permitted	Permitted by the authority of resource ID 0	EX_EPPERM[4]	Permitted by the authority of resource ID 0
Defined resource	EX_EGPERM[4]	Permitted by the authority of the relevant resource ID	EX_EGPERM[4] EX_EPPERM	Permitted by the authority of the relevant resource ID

Notes:

1. Above-described commands except for the raidcom command
2. User who uses the mode without the command authentication
3. Undefined as the resource group
4. Command execution is rejected by the relevant error

Target resources

The following objects are arbitrarily defined as the resource groups by each user.

- LDEV
- Physical port
- Host group
- RAID group
- External connection group

Commands executed depending on operation authorities

The commands and operation authority managed by Storage Navigator and SVP are listed in the following table.

For information about creating the Storage Navigator user accounts, registering user accounts to user groups, and user group authorities, see the *Hitachi Storage Navigator User Guide*.

Table 3-3 Commands and operation authority managed by Storage Navigator and SVP

Operation	Operation target	Authority	Executable command	Operation authority (Role)
Setting	MP blade	MP blade setting authority	raidcom modify ldev raidcom modify journal raidcom modify external_grp	Storage Administrator (System Resource Management)
Resource creation, deletion	LDEV	LDEV creation authority raidcom add ldev	raidcom add ldev	Storage Administrator (Provisioning)
		LDEV deletion authority	raidcom delete ldev	Storage Administrator (Provisioning)
	External volume (Universal Volume Manager)	External volume creation authority	raidcom add external_grp raidcom discover external_storage raidcom discover lun	Storage Administrator (Provisioning)
		External path operation authority	raidcom check_ext_storage path raidcom disconnect path	Storage Administrator (Provisioning)
		External volume disconnection authority External volume connection check and resumption authority	raidcom check_ext_storage external_grp raidcom disconnect external_grp	Storage Administrator (Provisioning)
		External volume mapping release authority	raidcom delete external_grp	Storage Administrator (Provisioning)
	Pool	Pool creation and capacity change authority	raidcom add dp_pool raidcom add snap_pool	Storage Administrator (Provisioning)
		Pool deletion authority	raidcom delete pool	Storage Administrator (Provisioning)
	Dynamic Provisioning virtual volume	Dynamic Provisioning virtual volume creation authority	raidcom add ldev -pool	Storage Administrator (Provisioning)
		Dynamic Provisioning virtual volume deletion authority	raidcom delete ldev	Storage Administrator (Provisioning)

Operation	Operation target	Authority	Executable command	Operation authority (Role)
	Copy-on-Write Snapshot virtual volume	Copy-on-Write Snapshot virtual volume creation authority	raidcom add ldev -pool	Storage Administrator (Provisioning)
		Copy-on-Write Snapshot virtual volume deletion authority	raidcom delete ldev	Storage Administrator (Provisioning)
	Port	LUN security setting authority	raidcom modify port -security_switch	Storage Administrator (System Resource Management) Storage Administrator (Provisioning)
	Host group	Host group creation authority	raidcom add host_grp	Storage Administrator (Provisioning)
		Host group deletion authority	raidcom delete host_grp	Storage Administrator (Provisioning)
	LUN	LU path creation authority	raidcom add lun	Storage Administrator (Provisioning)
		LU path deletion authority	raidcom delete lun	Storage Administrator (Provisioning)
	WWN	WWN addition authority	raidcom add hba_wwn	Storage Administrator (Provisioning)
		WWN deletion authority	raidcom delete hba_wwn	Storage Administrator (Provisioning)
	LDEV group	Device group and Copy group creation authority	raidcom add device_grp raidcom add copy_grp	Storage Administrator (Provisioning)
		Device group and Copy group deletion authority	raidcom delete device_grp raidcom delete copy_grp	Storage Administrator (Provisioning)
	Local copy	Pair creation authority	paircreate	Storage Administrator (Local Copy)
		Pair deletion authority	pairsplit -S	Storage Administrator (Local Copy)
		Volume Migration pair creation authority	paircreate	Storage Administrator (Provisioning)
		Volume Migration pair deletion authority	pairsplit -S	Storage Administrator (Provisioning)
	Remote copy	Pair creation authority	paircreate	Storage Administrator (Remote Copy)
		Pair deletion authority	pairsplit -S	Storage Administrator (Remote Copy)

Operation	Operation target	Authority	Executable command	Operation authority (Role)
Attribute change	External volume	External path setting authority	raidcom add path	Storage Administrator (Provisioning)
	Pool	Pool setting authority	raidcom modify pool	Storage Administrator (Provisioning)
	Port	Port attribute setting authority	raidcom modify port -port_attribute	Storage Administrator (System Resource Management)
		Port setting authority	raidcom modify port -loop_id raidcom modify port -topology raidcom modify port -port_speed	Storage Administrator (Provisioning)
	Host group	Host group setting authority	raidcom add host_grp	Storage Administrator (Provisioning)
	WWN	WWN setting authority	raidcom set hba_wwn raidcom reset hba_wwn	Storage Administrator (Provisioning)
	LDEV nickname	LDEV nickname setting authority	raidcom modify ldev -ldev_name	Storage Administrator (Provisioning)
	Local copy	Pairsplit and resync authority	pairresync	Storage Administrator (Local Copy)
	Remote copy	Environment construction authority	raidcom add rcu raidcom delete rcu raidcom modify rcu raidcom add rcu_path raidcom delete rcu_path raidcom add journal raidcom delete journal raidcom modify journal	Storage Administrator (Remote Copy)
		Pairsplit and resync authority	pairresync	Storage Administrator (Remote Copy)

Relation between resource groups and command operations

The operation for using resource groups are different by the command devices (the In-Band method) or the Out-of-Band method that are used when you start CCI.

You can create resource groups for each resource. And you can share them with multiple users. When user 10 and user 20 share the port like the following figure, the relation between the command devices and resource groups that user can use is like Table 3-4 Relation between resource groups and command devices on page 3-12.

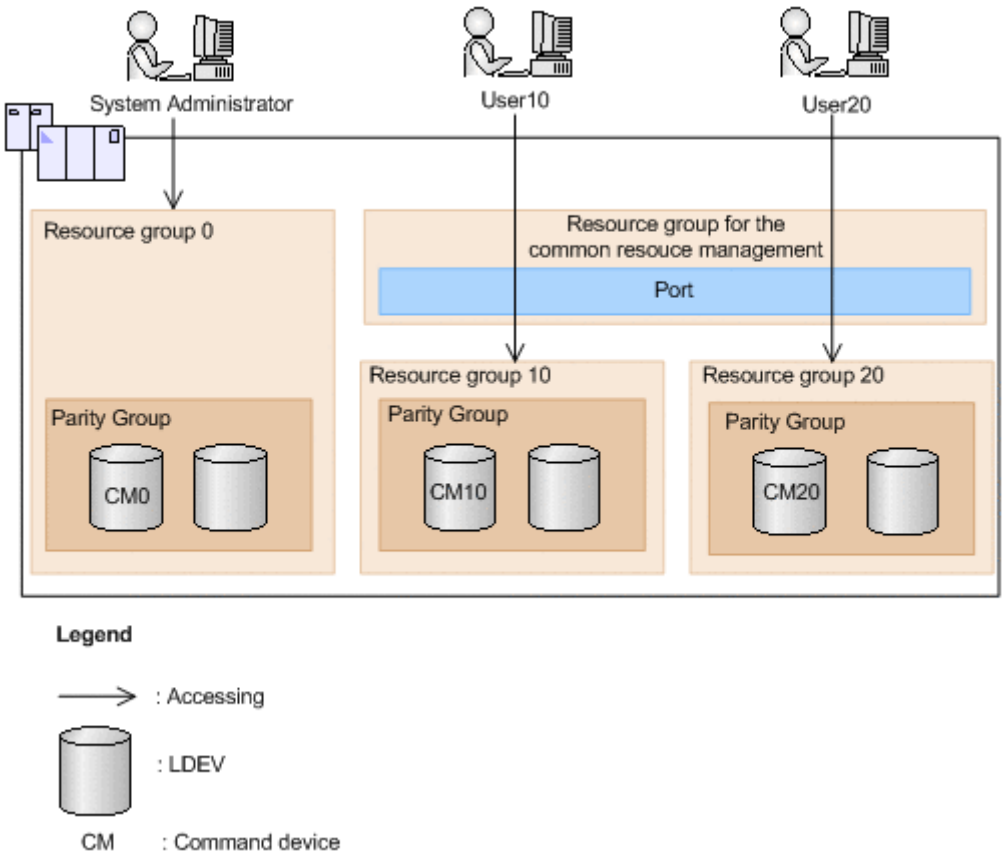


Figure 3-2 Relation among user, command devices, and resource groups

Table 3-4 Relation between resource groups and command devices

Login user	Command device	Operating range	Reference	Configuration change	Out-of-band operation
System administrator	CM0	OK: Can operate all resource groups.	OK	OK	OK
	CM10	OK: Can operate only in the range of resource group 10.	OK	OK	-
	CM20	OK: Can operate only in the range of resource group 20.	OK	OK	-

Login user	Command device	Operating range	Reference	Configuration change	Out-of-band operation
User 10	CM0	OK: Can operate in the range of resource group 10 and shared ports.	OK	OK	OK
	CM10	OK: Can operate only in the range of resource group 10.	OK	OK	-
	CM20	NG: Nothing is displayed or the operation authority error.		Operation authority error	-
User 20	CM0	OK: Can operate in the range of resource group 20 and shared ports.	OK	OK	OK
	CM10	NG: Nothing is displayed or the operation authority error.		Operation authority error	-
	CM20	OK: Can operate only in the range of resource group 20.	OK	OK	-
Legend: OK: Operable NG: Inoperable					

As shown in the table above, the relation among users, command devices and operations of resource groups are the following.

- The range that can be operated by command device 0 (CM0) or Out-of-Band is the shared range (AND) of resource groups that are allocated to each user and all resource groups.
- The range that can be operated by command device 10 (CM10) is the shared range (AND) of resource groups that are allocated to each user and resource group 10 that the command devices are allocated.

  Therefore, in the range of resource group 10 can be operated.

The following shows the example of the case that the execution results of the commands change by the case of having or not having the authority of the operated resources, specifies only the objects or specifies to the parameters.

When user has the authority using CL1-A, CL3-A and CL5-A ports, and CL1-A, CL2-A, CL3-A, CL4-A and CL5-A ports are implemented in the system, executes the following command.

When only the objects are specified:

```
# raidcom get port
```

The execution results of CL1-A, CL3-A and CL5-A are displayed. The execution results of CL2-A and CL4-A (the user does not have the authority of the resource) are not displayed (filtered).

When parameters are also specified:

```
# raidcom get port -port CL1-A
```

The execution result of CL1-A is only displayed.

```
# raidcom get port -port CL2-A
```

The error is displayed because the user does not have the execution authority.

The following shows the output example when -cnt that is used in get ldev is used.

The following command is executed when the user has the authorities of LDEV number 10 and 12.

```
# raidcom get ldev -ldev_id 10 -cnt 3
```

Execution results of LDEV number 10 and 12 are displayed. LDEV number 11 is not displayed because the user does not have the authority of the resource.

Resource lock function

When the configuration changes from multiple CCI, SVP, or Storage Navigator are done to the same resource, unexpected change is executed on each other and it might not be configure the expected configuration.

To prevent from the changing configuration for the same resource by each of the users, the resource lock command is provided. When this command is used, the resource group can be locked for the other users that they cannot be used the specified resource group. And even if the lock is not performed, each configuration change command can be performed. However, the competition with the other application might cause an error.

The commands for performing the exclusive control and exclusive control release (lock and unlock) of resource groups are as follows.

- raidcom lock resource -resource_name <resource group name > [-time <time(sec)>] (Locking a specified resource group)
- raidcom unlock resource -resource_name <resource group name > (Unlocking a specified resource group)

If multiple users (IDs) operate the same resource, by confirming by the raidcom lock resource command that no other user is using the resource, the operation competition for the relevant resource can be prevented.

After the configuration change is completed, release the lock status by the raidcom unlock resource command.

Command execution modes

Overview

Provisioning operations are performed using a configuration setting command. For details about the configuration setting command, see Overview of the configuration setting command on page 5-2 or Command Control Interface Command Reference.

Two modes can be used for executing the configuration setting command:

- Line-by-line mode.

  This mode executes commands input from the command line one at a time.

- Transaction mode.

  Executes a script file specified by the -zt option.

When executing the configuration setting command, the following checks can be done depending on the above two mode types.

- Syntax check

  This function checks if there is no syntax error in the specified command. This is executed every time at the both line-by-line mode and transaction mode.

- Context check

  This function checks the consistency of one specified line in the script and the preceding lines in the order from the top. This function is available only at the Transaction mode. For details about context checking, see Context check on page 3-16.

- Configuration check

  Acquire the current configuration information to a configuration file, and then this function checks whether the resources specified in the script (LDEVs, ports, or host groups) are configured in the storage system or not. This function is available only at the transaction mode. For details about context checking, see Configuration check on page 3-24.

The configuration setting command also has a execution option described in the following.

- Precheck

  Specify the checkmode precheck option. It operates checking only (it does not execute processing even if no error is detected.) This can be specified at the both line-by-line mode and transaction mode.

The following table shows the overview of execution modes and options of the configuration setting command.

Table 3-5 Execution modes and options of the configuration setting command (line-by-line mode)

Command syntax	Syntax check	Context check	Configura-tion check	Command execution with no error	Remarks
raidcom <action>	Executed	Not executed	Not executed	Executed	Default
raidcom <action> -checkmode precheck	Executed	Not executed	Not executed	Not executed	Check only

Table 3-6 Execution modes and options of the configuration setting command (transaction mode)

Command syntax	Syntax check	Context check	Configura-tion check	Command execution with no error	Remarks
raidcom -zt <script file>	Executed	Executed	Not executed	Executed	Default
raidcom -zt <script file> -load <work file>	Executed	Executed	Executed	Executed	With configuration check
raidcom -zt <script file> -checkmode precheck	Executed	Executed	Not executed	Not executed	Check only
raidcom -zt <script file> -load < work file> -checkmode precheck	Executed	Executed	Executed	Not executed	With configuration check Check only

Detailed description are provided in the following.

Caution: Observe the following cautions:

- For <script file>, specify an executable file name.
- For <script file>, either specify a full path name or store under the c:\HORCM\etc folder.
- For <work file>, either specify a full path name or store in the current directory.

Context check

This check can be performed to ensure consistent content of the created script file. For example, it can check if the script refers to an ldev_id that is already deleted in the preceding lines.

The script is executed only when no error is detected by the checking of whole script contents.

The following resources can be the target of the check:

- LDEV
- Port
- Host group

Checking the contents before executing the script helps reduce debugging after running the script.

How to check

The script is performed by specifying it as follows.

```
raidcom -zt <created script file name>
```

```
raidcom -zt <created script file name> -load <configuration file>
```

```
raidcom -zt <created script file name> -checkmode precheck
```

```
raidcom -zt <created script file name> -load <configuration file> -checkmode precheck
```

Details of check contents

Details of Context check is described below. checking contents before issuing a script can reduce load for the debug operation in a way of executing script.

LDEV check

The check is performed from the following perspective. Note that checking for the object information that is related to the LDEV such as pool or device group, or an attribute of LDEV is not executed.

Check with the additional operation

It is checked to ensure no same LDEV as the already existing LDEV is added. If the same LDEV is attempted to be added, an error is detected.

If it is not clear whether the LDEV to be added exists or not (if the target LDEV information does not exist in the configuration definition file), the error is not detected. Therefore, the script is executed and the LDEV is added.

The command as the target of the check is shown below.

```
raidcom add ldev {-parity_grp_id <gno-sgno>| -external_grp_id
   <gno-sgno> | -pool {<pool ID#> | <pool naming> | snap}}
   {-ldev_id <ldev#> | -tse_ldev_id <ldev#>} {-capacity <size>
   | -offset_capacity <size> | -cylinder <size>} [-emulation
   <emulation type>][-location <lba>][-mp_blade_id <mp#>]
   [-clpr <clpr#>]
```

Check with the attribute setting

It is checked whether the operation is performed for the existing LDEV or not. If the operation is attempted to be performed for an LDEV that does not exist, an error is detected.

If it is not clear whether the LDEV as the target of the operation exists in the configuration definition file (if the target LDEV information does not exist in the configuration definition file), the error is not detected.

The commands as the target of the check are shown below.

- raidcom modify host_grp -port <port#> [<host group name>] -host_mode <host mode> [-host_mode_opt <host mode option> …]
- raidcom add hba_wwn -port <port#> [<host group name>] -hba_wwn <WWN strings>
- raidcom delete hba_wwn -port <port#> [<host group name>] -hba_wwn <WWN strings>
- raidcom set hba_wwn -port <port#>[<host group name>] -hba_wwn <WWN strings> -wwn_nickname <WWN Nickname>
- raidcom reset hba_wwn -port <port#>[<host group name>] -hba_wwn <WWN strings>
- raidcom add lun -port <port#> [<host group name>] {-ldev_id <ldev#> [-lun_id<lun#>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}
- raidcom delete lun -port <port#> [<host group name>] {-lun_id <lun#> | -ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}

Check with the deletion operation

It is checked to ensure that the operation is not intended to be performed for the LDEV that is already deleted. If it is, an error is detected.

If it is not clear whether the LDEV as the target of the operation exists in the configuration definition file or not (if the target LDEV information does not exist in the configuration definition file), the error is not detected.

The command as the target of the check is shown below.

- `raidcom delete ldev {-ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name>  [<device name>]}`

The example of the script where the same LDEV is attempted to be added to the already created LDEV and the execution result of the Context check is shown below.

- Example of script

```
raidcom add ldev -parity_grp_id 01-01 -ldev_id 1 -capacity 100M
raidcom add ldev -parity_grp_id 01-01 -ldev_id 2 -capacity 100M
raidcom add ldev -parity_grp_id 01-01 -ldev_id 3 -capacity 100M
```

- Execution result

```
C:\HORCM\etc>raidcom get ldev -ldev_id 1 -cnt 65280 -store ldevconf_65 >
ldevconf_65.txt
C:\HORCM\etc>raidcom -zt 3_defined_ldev.bat -load ldevconf_65.dat  -
checkmode precheck
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 1 -capacity
100M
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 2 -capacity
100M
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 3 -capacity
100M
```

- Example of script (the text in bold indicates the part of incorrect configuration definition.)

```
raidcom add ldev -parity_grp_id 01-01 -ldev_id 1 -capacity 100M
raidcom add ldev -parity_grp_id 01-01 -ldev_id 2 -capacity 100M
raidcom add ldev -parity_grp_id 01-01 -ldev_id 3 -capacity 100M
raidcom add ldev -parity_grp_id 01-01 -ldev_id 1 -capacity 100M
raidcom add ldev -parity_grp_id 01-01 -ldev_id 2 -capacity 100M
raidcom add ldev -parity_grp_id 01-01 -ldev_id 3 -capacity 100M
for /l %%i in (1,1,3) do (
 raidcom add ldev -parity_grp_id 01-01 -ldev_id %%i -capacity 100M
)
for /l %%i in (1,1,3) do (
 raidcom add ldev -parity_grp_id 01-01 -ldev_id %%i -capacity 100M
)
```

- Execution result (the text in bold indicates the contents of the error accompanying the invalid configuration definition in the script.)

```
C:\HORCM\etc>raidcom get ldev -ldev_id 1 -cnt 65280 -store ldevconf_65 >
ldevconf_65.txt
C:\HORCM\etc>raidcom -zt 3_defined_ldev.bat -load ldevconf_65.dat  -
checkmode precheck
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 1 -capacity
100M
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 2 -capacity
100M
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 3 -capacity
100M
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 1 -capacity
100M
raidcom: LDEV(1) is already existing as status is [1] on UnitID# 0.
raidcom_#5 : [EX_CTXCHK] Context Check error
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 2 -capacity
100M
raidcom: LDEV(2) is already existing as status is [1] on UnitID# 0.
raidcom_#6 : [EX_CTXCHK] Context Check error
C:\HORCM\etc>raidcom add ldev -parity_grp_id 01-01 -ldev_id 3 -capacity
100M
raidcom: LDEV(3) is already existing as status is [1] on UnitID# 0.
raidcom_#7 : [EX_CTXCHK] Context Check error
```

The number in raidcom # of raidcom_#7: [EX_CTXCHK] Context Check error is the number of times of performing the raidcom command by using <work file>. The number of times is incremented each time the raidcom command is executed.

Port check

The check is performed from the following perspective. Note that checking for object information related to the port, such as external volume group or RCU, or an attribute of port, is not executed.

Checking for attribute setting

It is checked whether the operation is performed for the existing port. If the port does not exist, an error is detected.

If it is not clear whether the port as the target of the operation exists in the configuration definition file or not (if the target port information does not exist in the configuration definition file), the error is not detected.

The commands as the target of the check are shown below.

- raidcom modify port -port <port#>{[-port_speed <value>] [-loop_id <value>][-topology <topology>] [-security_switch < y|n >] | -port_attribute <port attribute>}
- raidcom add external_grp -path_grp <path group#> -external_grp_id <gnosgno> -port <port#> -external_wwn <wwn strings> -lun_id <lun#> [-emulation <emulation type>] [-clpr <clpr#>]

- raidcom add path -path_grp <path group#> -port <port#> -external_wwn <wwn strings>
- raidcom delete path -path_grp <path group#> -port <port#> -external_wwn <wwn strings>
- raidcom check_ext_storage path -path_grp <path group#> -port <port#> -external_wwn <wwn strings>
- raidcom disconnect path -path_grp <path group#> -port <port#> -external_wwn <wwn strings>
- raidcom add rcu {-rcu <serial#> <mcu#> <rcu#> <id> -ssid <ssid>| -cu_free <serial#> <id> <pid>} -mcu_port <port#> -rcu_port <port#>

For example, if a path is attempted to be added to a port that does not exist, an error is detected. An example of the script where the error is detected and the execution result of the actual Context check are shown below.

- Example of script (the text in bold indicates the part of incorrect configuration definition.)

```
raidcom add path -path_grp 1 -port CL1-C -external_wwn
50060e80,06fc4180
raidcom add path -path_grp 1 -port CL1-D -external_wwn
50060e80,06fc4190
raidcom add path -path_grp 1 -port CL1-E -external_wwn 50060e80,06fc41a0
```

- Execution result (the text in bold indicates the contents of the error accompanying the invalid configuration definition in the script.)

```
C:\HORCM\etc>raidcom get port -store portcnf_27.dat
PORT   TYPE  ATTR   SPD  LPID  FAB  CONN  SSW   SL   Serial#  WWN
CL1-A  FIBRE TAR    AUT   EF  N    FCAL  N     0    64539  06fc1b000000fc1b
CL1-B  FIBRE TAR    AUT   EF  N    FCAL  N     0    64539  50060e8006fc1b01
CL2-A  FIBRE TAR    AUT   EF  N    FCAL  N     0    64539  50060e8006fc1b10
CL2-B  FIBRE TAR    AUT   EF  N    FCAL  N     0    64539  50060e8006fc1b11
CL3-A  FIBRE TAR    AUT   E8  N    FCAL  N     0    64539  50060e8006fc1b20
CL3-B  FIBRE TAR    AUT   E0  N    FCAL  N     0    64539  50060e8006fc1b21
CL4-A  FIBRE TAR    AUT   D6  N    FCAL  N     0    64539  50060e8006fc1b30
CL4-B  FIBRE TAR    AUT   D2  N    FCAL  N     0    64539  50060e8006fc1b31
CL5-A  FIBRE TAR    AUT   E4  N    FCAL  N     0    64539  50060e8006fc1b40
CL5-B  FIBRE TAR    AUT   DC  N    FCAL  N     0    64539  50060e8006fc1b41
CL6-A  FIBRE TAR    AUT   D5  N    FCAL  N     0    64539  50060e8006fc1b50
CL6-B  FIBRE TAR    AUT   D1  N    FCAL  N     0    64539  50060e8006fc1b51
CL7-A  FIBRE ELUN   AUT   E2  N    FCAL  N     0    64539  50060e8006fc1b60
CL7-B  FIBRE ELUN   AUT   DA  N    FCAL  N     0    64539  50060e8006fc1b61
CL8-A  FIBRE TAR    AUT   D4  N    FCAL  N     0    64539  50060e8006fc1b70
CL8-B  FIBRE TAR    AUT   CE  N    FCAL  N     0    64539  50060e8006fc1b71
C:\HORCM\etc>raidcom -zt 4_no_port.bat -load portcnf_27.dat -checkmode precheck
C:\HORCM\etc>raidcom add path -path_grp 1 -port CL1-C -external_wwn
50060e80,06fc4180
raidcom: PORT(2) does not exist as status is [2] on UnitID# 0.
raidcom_#2  : [EX_CTXCHK] Context Check error
C:\HORCM\etc>raidcom add path -path_grp 1 -port CL1-D -external_wwn
50060e80,06fc4190
raidcom: PORT(3) does not exist as status is [2] on UnitID# 0.
raidcom_#3  : [EX_CTXCHK] Context Check error
C:\HORCM\etc>raidcom add path -path_grp 1 -port CL1-E -external_wwn
50060e80,06fc41a0
raidcom: PORT(4) does not exist as status is [2] on UnitID# 0.
raidcom_#4  : [EX_CTXCHK] Context Check error
```

Host group check

The check is performed from the following perspective. Note that checking for an attribute of host group, or for a name of host group is not executed.

Check with the attribute setting

Checks whether the operation is performed for an existing host group. If the host group does not exist, an error is detected.

If it is not clear whether the target port or host group exists (if the target port or host group information does not exist in the configuration definition file), the error is not detected.

The commands as the target of the check are shown below.

- raidcom modify host_grp -port <port#> [<host group name>] -host_mode <host mode> [-host_mode_opt <host mode option> …]
- raidcom add hba_wwn -port <port#> [<host group name>] -hba_wwn <WWN strings>
- raidcom delete hba_wwn -port <port#> [<host group name>] -hba_wwn <WWN strings>
- raidcom set hba_wwn -port <port#>[<host group name>] -hba_wwn <WWN strings> -wwn_nickname <WWN Nickname>
- raidcom reset hba_wwn -port <port#>[<host group name>] -hba_wwn <WWN strings>
- raidcom add lun -port <port#> [<host group name>] {-ldev_id <ldev#> [-lun_id<lun#>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}
- raidcom delete lun -port <port#> [<host group name>] {-lun_id <lun#> | -ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}

Check with deletion operation

It is checked to ensure that the operation is not intended to be performed for the host group that is already deleted. If the host group is already deleted, an error is detected.

If it is not clear whether the target port or host group exists or not (if the target port or host group information does not exist in the configuration definition file), the error is not detected.

The command as the target of the check is shown below.

- `raidcom delete host_grp -port <port> [<host group name>]`

For example, if the host group that does not exist is attempted to be deleted, an error is detected. An example of the script where the error is detected and the execution result of the actual context check are shown below.

- Example of script (the text in bold indicates the part of incorrect configuration definition.)

```
raidcom delete host_grp -port CL1-A-0
raidcom delete host_grp -port CL1-A-1
raidcom delete host_grp -port CL1-A-2
```

- Execution result (the text in bold indicates the contents of the error accompanying the invalid configuration definition in the script.)

```
C:\HORCM\etc>raidcom get host_grp -port CL1-A -store hostgrpcnf_27_cl1-a.dat
PORT   GID  GROUP_NAME               Serial# HMD        HMO_BITs
CL1-A    0    1A-G00                   64539 LINUX/IRIX
C:\HORCM\etc>raidcom -zt 6_no_hstgrp.bat -load hostgrpcnf_27_cl1-a.dat
-checkmode precheck
C:\HORCM\etc>raidcom delete host_grp -port CL1-A-0
C:\HORCM\etc>raidcom delete host_grp -port CL1-A-1
raidcom: PORT-HGRP(0-1) does not exist as status is [2] on UnitID# 0.
raidcom_#3: [EX_CTXCHK] Context Check error
C:\HORCM\etc>raidcom delete host_grp -port CL1-A-2
raidcom: PORT-HGRP(0-2) does not exist as status is [2] on UnitID# 0.
raidcom_#4 : [EX_CTXCHK] Context Check error
```

Configuration check

The contents of a script file can be checked whether the operation is performed for the existing resource or not.

Before performing the configuration check, execute the following command, acquire the current configuration information, and store it in the work file specified by the -store option.

Check the operation for LDEV

```
raidcom get ldev {-ldev_id <ldev#> … [-cnt <count>] | -grp_opt     <group
option> -device_grp_name <device group name> [<device name>]}      -store
<work file>
```

Check the operation for Port

```
raidcom get port -port -store <work file>
```

Check the operation for Host group

```
raidcom get host_grp -port <port> -store <work file>
```

After acquiring the configuration information, execute the script by specifying the configuration file.

```
raidcom -zt <created script file name> -load <work file>
```

Resource location and parameter

MP blade location and parameter

To specify MP blade IDs by the raidcom add ldev command, specify the following IDs.

Table 3-7 MP blade names and parameters for VSP G1000

MP blade name	MP blade number	MP blade ID
MPB-1MA	0	0
MPB-1MB	1	1
MPB-1PE	2	2
MPB-1PF	3	3
MPB-2MA	4	4
MPB-2MB	5	5
MPB-2PE	6	6
MPB-2PF	7	7
MPB-1MC	8	8
MPB-1MD	9	9
MPB-1PL	10	10
MPB-1PM	11	11
MPB-2MC	12	12
MPB-2MD	13	13
MPB-2PL	14	14
MPB-2PM	15	15

Table 3-8 MP blade names and parameters for VSP

MP blade name	MP blade number	MP blade ID
MPB-1MA	0	0
MPB-1MB	1	1
MPB-2MC	2	2
MPB-2MD	3	3
MPB-1ME	4	4
MPB-1MF	5	5
MPB-2MG	6	6
MPB-2MH	7	7

Table 3-9 MP unit names and parameters for HUS VM

MP unit name	MP blade number	MP blade ID
MPU-10	0	0
MPU-11	1	1
MPU-20	2	2
MPU-21	3	3

LDEV grouping function

The LDEV grouping function enables you to create a group of multiple LDEVs (device group function and copy group function).

Overview

CCI can be used to create a group of multiple LDEVs by defining copy groups, which are a group of copy pairs. This is accomplished in both the primary and secondary configuration definition files by defining the group names of the combined LDEVs (dev_name of HORCM_DEV or HORCM_LDEV).

To change copy group information, modify the primary and secondary configuration definition files. For example, to change the LDEV configuration of copy group dbA (see following figure), change the LDEV information in configuration definition files A and B.

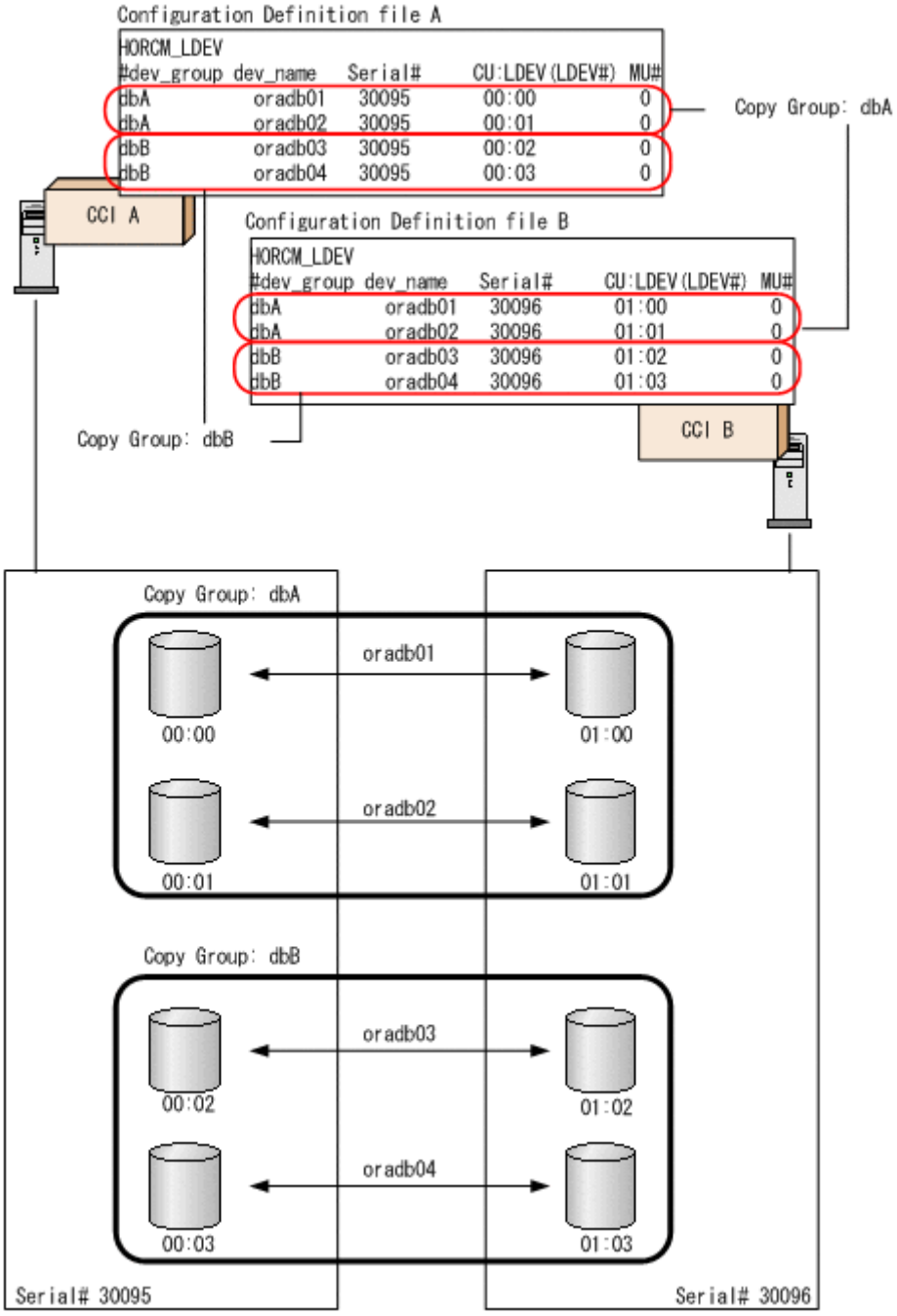


Figure 3-3 LDEV grouping for USP V/VM and earlier

For Virtual Storage Platform and later, CCI can be used to create a group of multiple LDEVs by defining device groups. This is accomplished by defining device groups in either the primary or secondary configuration definition file, but not both. By defining a device group, LDEV information can be changed or defined in one operation. It is not required to modify LDEV information in both configuration definition files. For example, referencing LDEVs or creating pools can be executed at the same time, because all LDEVs in the device group are subjected to the operation.

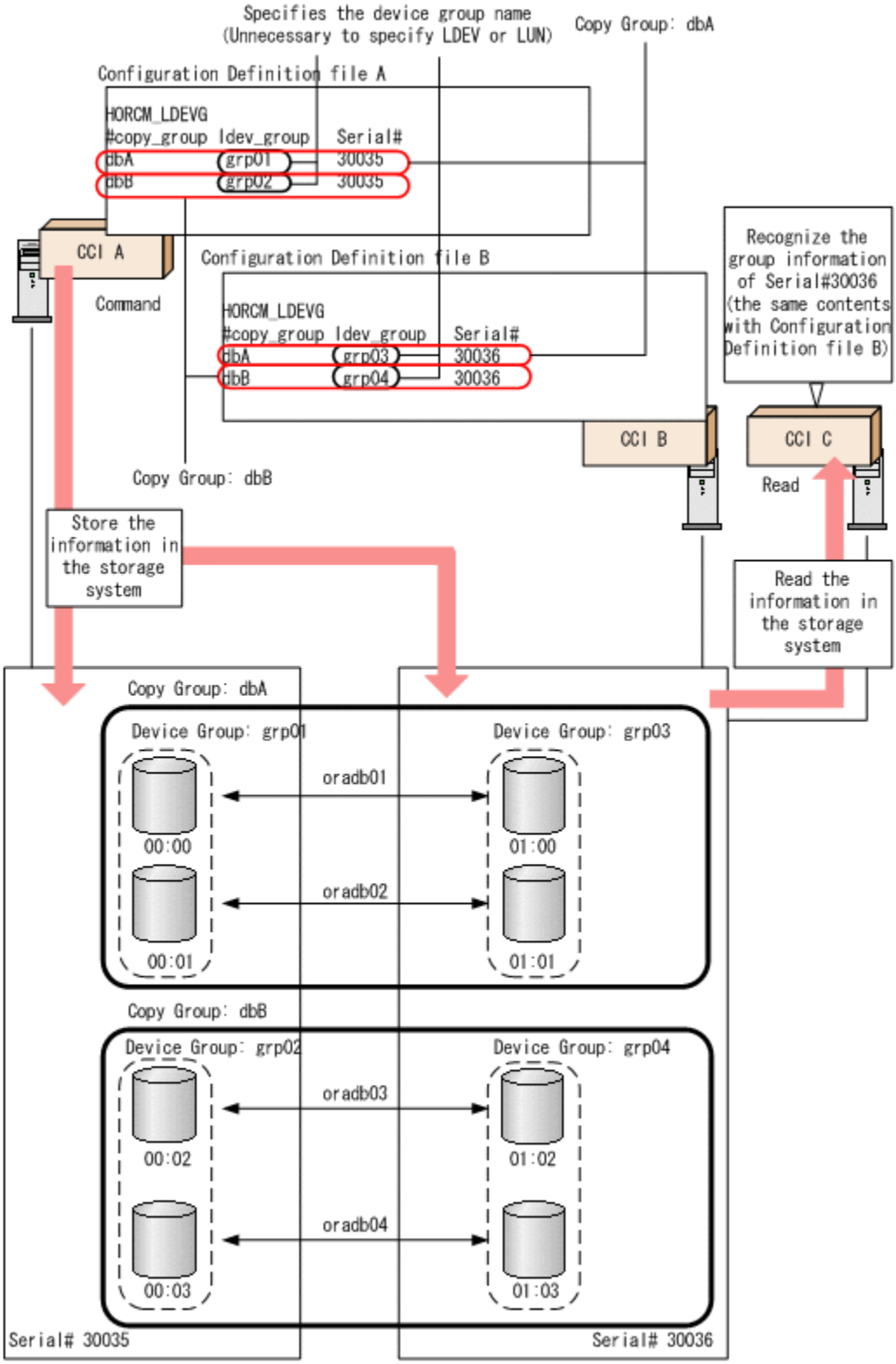


Figure 3-4 LDEV grouping for VSP and later (device group and copy group)

However, for executing replication function commands in CCI, two device groups must be combined and defined as a copy group.

When defining a device group or copy group by a command, the command can be issued from multiple CCI instances because the group information is defined in the storage system.

Device group definition methods

To define a device group or copy group in the CCI that supports Virtual Storage Platform or later, use one or both of following methods.

- **Execute a command**

  Create a device group with the raidcom add device_grp command, and execute the raidcom add copy_grp command specifying the name of the device group to define a copy group. When the command is executed, a description corresponding to HORCM_LDEV of CCI is defined in the storage system. Then, define HORCM LDEVG in the configuration file to incorporate it into the CCI instance. This can be executed at CCI that supports Virtual Storage Platform or later.

- **Define a configuration definition file**

  Define HORCM_LDEV or HORCM_DEV of the configuration definition files of the primary and secondary volumes. For definition details, see Configuration definition file on page 2-12.

A device name is a name given to an LDEV in each device group.This is equivalent to the dev_name definition of HORCM_DEV. A device name is not required, but it is convenient to use to specify device group or device name instead of LDEV number. However, to create a pool or a journal, specifying LDEV number is required.

The LDEVs that have the same device name are recognized as a pair in the primary and secondary device group. Therefore, make match the device name for the LDEV to be a pair. Also, the number of LDEVs in the device group must be the same at the primary and secondary sides. Pairs are operated in the ascending sequence of the LDEV numbers. If there is no corresponding device name of LDEV in the device group to be paired, an error might be occurred on the pair operation.

Read operations and command device settings

When grouping LDEVs, if HORCM_LDEVG on the primary side and secondary side is not defined, the read operation of CCI is different depending on the command device settings. The following table shows the details.

Table 3-10 Reading of command device setting and group information

HORCM_LDEVG	Command device setting			Reading of device group or copy group information	Security to be set
	Security	User authentication	Group information acquisition		
Not defined	OFF	OFF	OFF	Do not read	No security
			ON	Do not read	Only HORCM_DEV allowed
	OFF	ON	OFF	Read[1]	User authentication required
			ON	Do not read	User authentication required Only HORCM_DEV allowed
	ON	OFF	OFF	Read[1]	CMD security
			ON	Do not read	CMD security Only HORCM_DEV allowed
	ON	ON	OFF	Read[1]	CMD security User authentication required
			ON	Do not read	CMD security User authentication required Only HORCM_DEV allowed
Defined	-	-	-	Read[2]	-

Notes:

1. Read the entire group information in the storage system.
2. Read the information of device group and copy group from the contents of the configuration definition file regardless of the setting of the command device.

Define device group

A device group is created by specifying a device name and a device group name. Once a device group is created, the device group name, the LDEV number, and the information if there is copy group definition or not are stored in the storage system as configuration information.

The maximum number of device groups is 1,024 in one storage system. The maximum 65,279 LDEVs can be placed under the device group. And one LDEV can be placed in multiple device groups.

Notes when specifying a device name

- Multiple device names can be defined in one LDEV (Max: 1,024 names).
- The length of a device name must be up to 32 characters.

- In the device group that does not become an element of copy a group, the same device name can be used in the same device group.
- In the device group that becomes an element of a copy group, a device group name must be unique in the device group. It is because a pair is created between LDEVs that have same device names in respective primary and secondary volumes at the group operation of a replication series command.

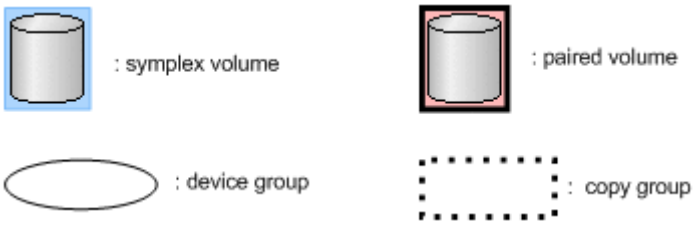
Notes when specifying a device group name

- The length of a device group name must be up to 32 characters.
- A device group name must be unique within the storage system. The device group name cannot be duplicated in one storage system.
- When a device group name is specified by the raidcom command option and an LDEV to operate is specified by the device name, all devices that have the same name with the beginning of the specified name will be operated.

The contents of the following operations that can be executed for a device group are expressed hereafter with its use cases.

1. Device group creation
2. LDEV addition to device group
3. LDEV deletion from device group
4. Device group deletion

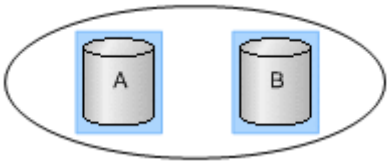
Note: The following symbols are used in the use cases described hereafter.



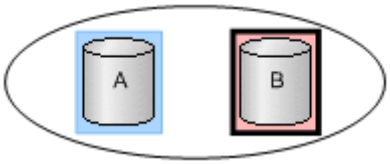
Device group creation

Creating a device group by specifying a subject of multiple LDEV IDs and device group names of the device groups to be created.

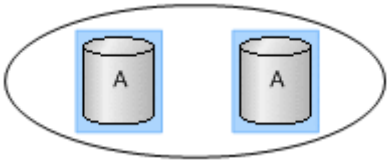
- Use cases. The following examples show use cases for creating a device group.
  - Creating a device group configured of simplex volumes with different device names.



  - Creating a device group configured of a simplex volume and a paired volume with different device names.



- Creating a device group configured of simplex volumes with same device names.



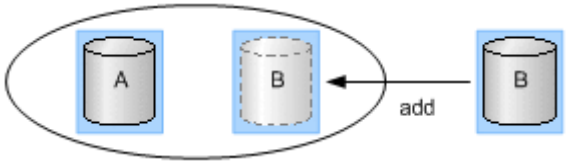
LDEV addition to device group

Adding an LDEV to the device group by specifying a created device group name and the LDEV ID of the LDEV to be added.

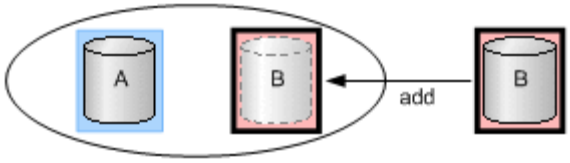
- Use Cases

  The following shows use cases that can be added an LDEV to a device group.

  - Adding an LDEV (simplex volume) with a different device name to a device group.

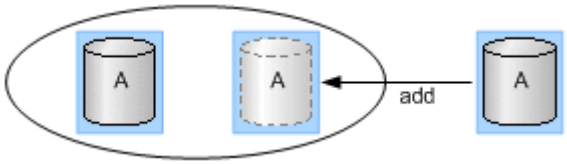


  - Adding an LDEV (paired volume) with a different device name to a device group.



  - Adding an LDEV to a device group already including the same device name.

    The device name can be duplicated in the case of not creating the copy group by specifying a device group.



LDEV deletion from device group

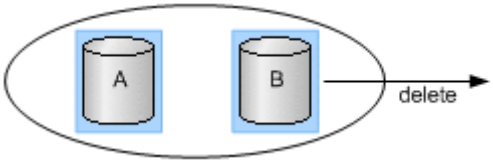
Deleting an LDEV from the device group by specifying a created device group name and an LDEV ID of the LDEV to be deleted.

LDEV can be deleted from the device group associating a copy group. The pair status does not change even if the LDEV is deleted from the device group.

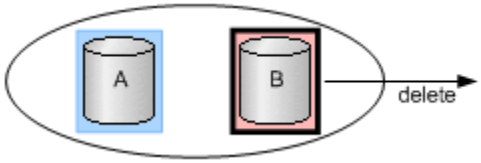
- Use Cases

  The following shows use cases that can be deleted an LDEV from a device group.

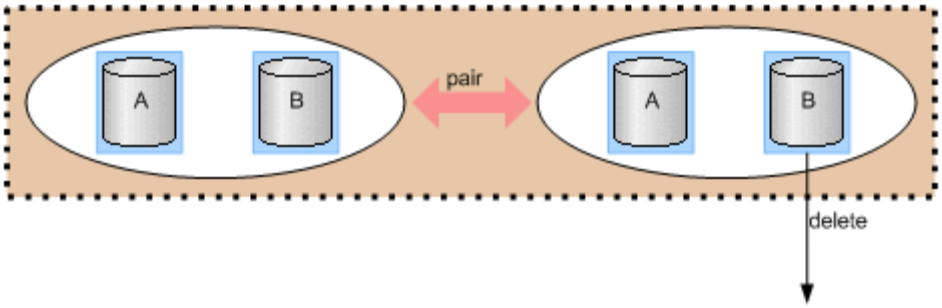
  - Deleting an LDEV (simplex volume) not associated with a copy group from a device group.



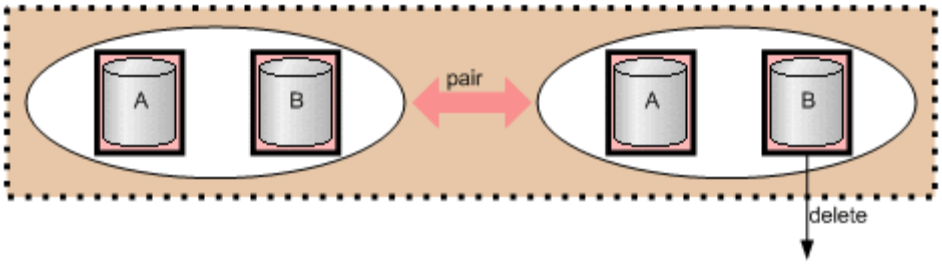
- Deleting an LDEV (paired volume) not associated with a copy group from a device group.



- Deleting an LDEV (simplex volume) associated with a copy group from a device group.



- Deleting an LDEV (paired volume) associated with a copy group from a device group.



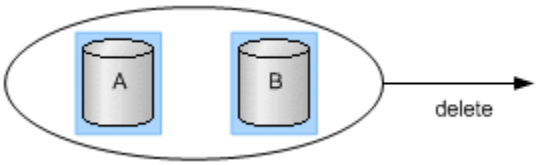
Device group deletion

Deleting an LDEV that configuring a device group by specifying a created device group name and an LDEV ID of the LDEV to be deleted. If all the LDEVs configuring the device group are deleted from the device, the relevant device group is deleted. And, even if a device group is deleted, the pair status of the pair in the device group does not change.

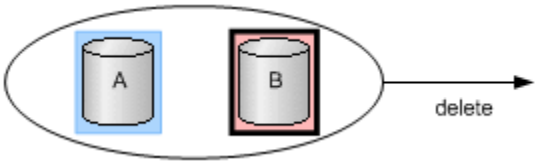
- Use Cases

  The following shows use cases that can be deleted an LDEV from a device group.

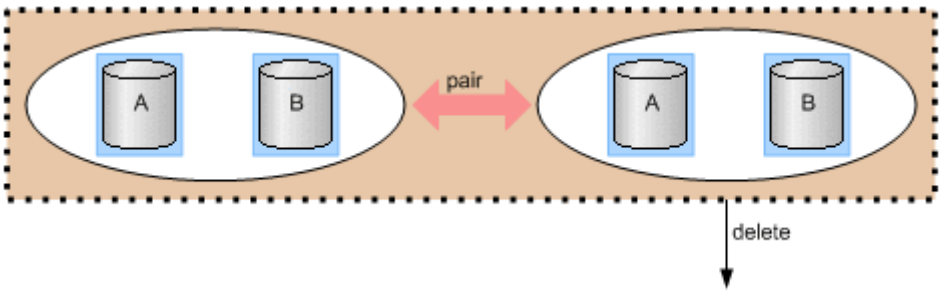
  - Deleting a device group configured of simplex volumes and not associated with a copy group.



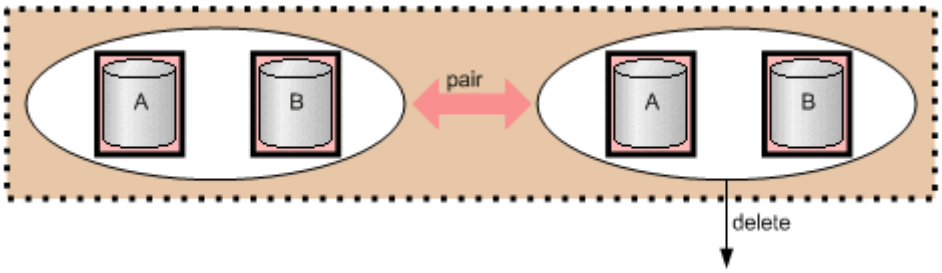
- Deleting a device group configured of a simplex volume and a paired volume and not associated with a copy group.



- Deleting a device group configured of simplex volumes and associated with a copy group.



- Deleting a device group configured of paired volumes and associated with a copy group.



Copy group function

Defining a copy group by specifying two device groups: one device group from primary side and one device group from secondary side, whether they are inside or outside the storage system. A copy group cannot be defined by specifying more than one device group from just one side of primary or secondary.

When a copy group is created, which device group is primary and which is secondary cannot be specified. Therefore, it is specified at the time of actual pair creation. As configuration information, a copy group name, a device group name (primary and secondary), and an MU# are maintained in the storage system.

The notes when operating copy groups are shown below.

When creating a copy group

- In case of creating a copy group by executing a command, a copy group cannot be created through direct specification of multiple LDEVs. Create a copy group by specifying a device group.
- In one device group associated as a copy group, the same device name cannot be defined.
- Copy groups with the same name cannot be defined within the same storage system.
- One device group cannot be defined to multiple copy groups.
- The maximum number of copy groups per storage system is 16,384.
- At the time of consistency group creation (pair creation) and consistency group deletion (pair deletion), the collaboration with the group operations (device group creation/deletion, copy group creation/deletion) is not performed.

When deleting a copy group

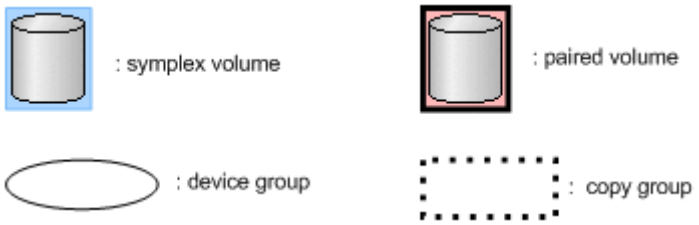
- If a copy group is deleted, the association of two device groups is deleted. However, the actual pair status, the consistency group ID and others are not changed (not affected). Even if the pair status in the copy group is not single and the copy group is deleted, the copy group deletion processing is performed.
- If an LDEV is deleted from a device group associated as a copy group, the relevant LDEVs are deleted from all the associated copy groups.
- A copy group defines the relationship of device groups. Therefore, it is not possible to specify an LDEV and remove it from the copy group.
- Regardless of the pair status (copy status), it is possible to exclude LDEVs from device groups associated as a copy group.

The contents of the following operations that can be executed for a copy group are expressed hereafter with its use cases.

1. Copy group creation
2. LDEV addition to copy group

3. LDEV deletion from copy group
4. Copy group deletion
5. Pair operation by specifying a copy group

Note: The following symbols are used in the use cases described hereafter.



Copy group creation

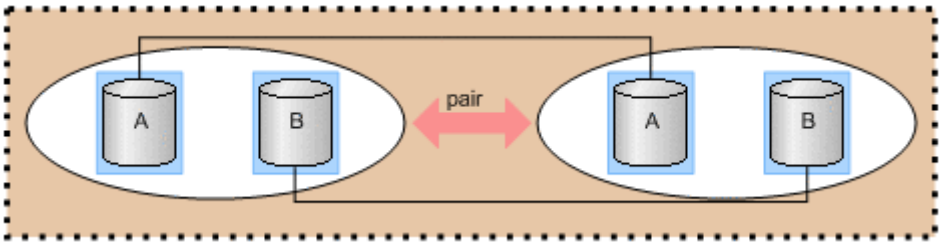
Specifying two device groups and creating a copy group. The same device name must not be defined for any LDEVs in a specified device group. A copy group can be created whether the LDEV in the device group is paired status or not.

- Use cases

  The following shows use cases that can be created a copy group.

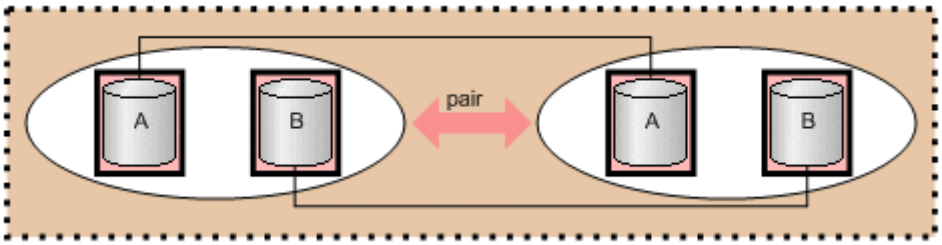
  - Creating a copy group in cases where two device groups are configured of simplex volumes and the device names and the LDEV numbers in the respective device groups are the same.

    In the following example, when a copy group is created, the LDEVs within the device names of A to A and B to B become a subject of pair operation.



  - Creating a copy group in cases where two device groups are configured of paired volumes and the device names and the LDEV numbers in the respective device groups are the same.

    In the following example, although pairs have been created on the device names of A to A and B to B, a copy group can be created.



LDEV addition to a copy group

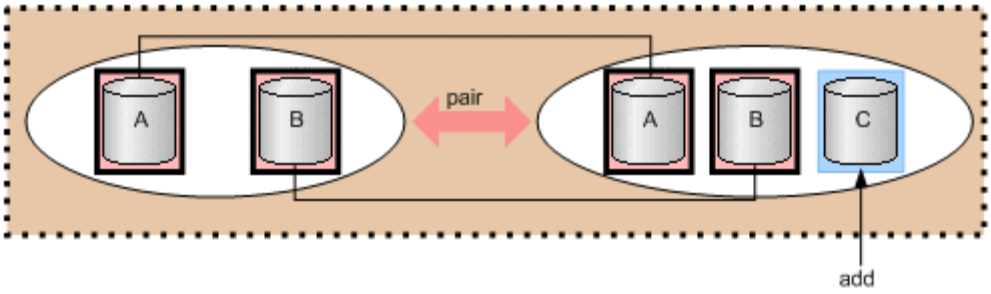
Adding an LDEV to a device group by specifying a device group name forming a copy group. It is not possible to add LDEVs directly to the copy group.

With the same device name, the operation for the device group associated with a copy group cannot be performed.

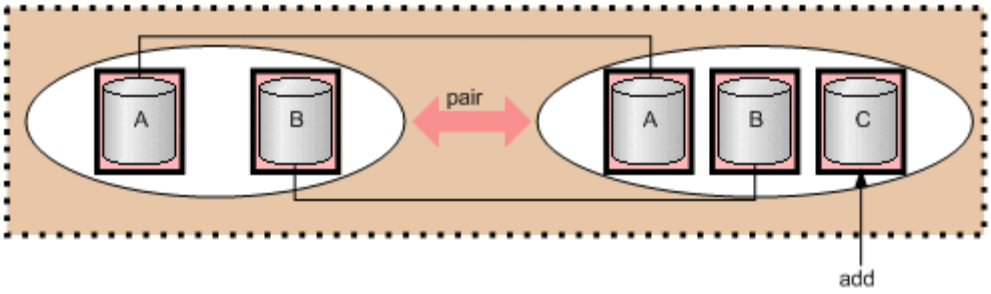
- Use cases

  The following shows use cases that can be added an LDEV to the device group associating a copy group.

  - Adding an LDEV with a different device name (simplex volume) to a device group forming a copy group.



  - Adding an LDEV with a different device name (paired volume) to a device group forming a copy group.



LDEV deletion from copy group

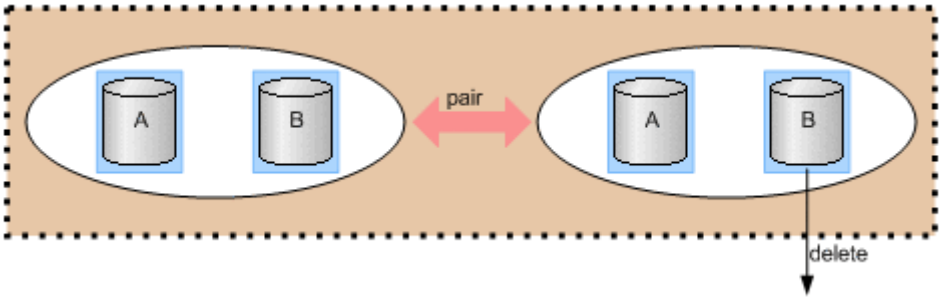
Deleting an LDEV from a device group forming a copy group. It can be deleted both the simplex volume or paired volume LDEVs.

It is not possible to delete LDEVs directly from the copy group.

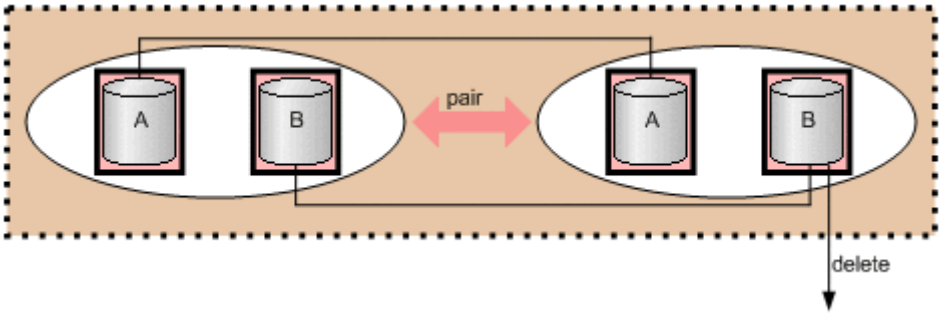
- Use cases

  The following shows use cases that can be deleted LDEVs from the device group forming a copy group.

  - Deleting an LDEV (simplex volume) from a device group forming a copy group.



- Deleting an LDEV (paired volume) from a device group forming a copy group.



Copy group deletion

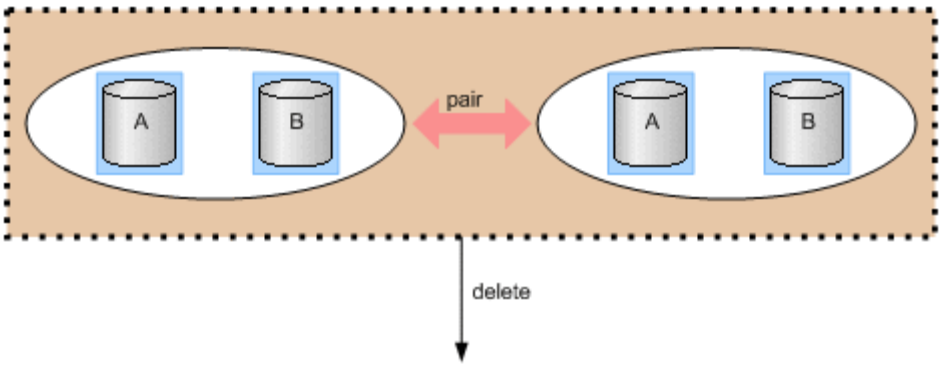
Deleting a copy group by specifying a defined copy group.

- Use cases

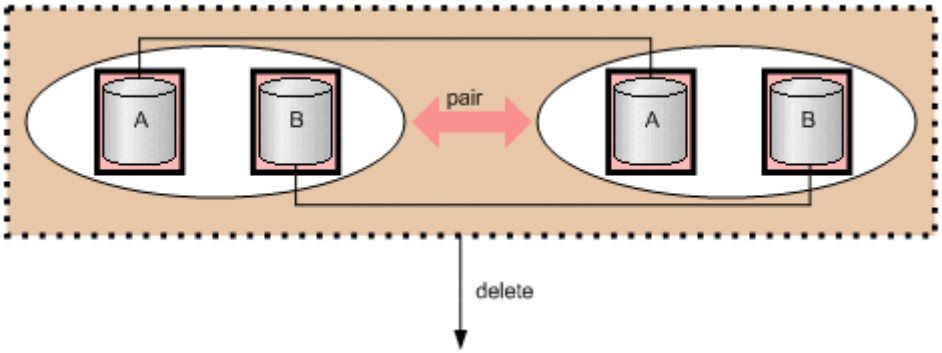
  A copy group can be deleted even if it is configured of simplex volumes or paired volumes.

  The following shows use cases that can be deleted a copy group.

  - Deleting a copy group configured of simplex volumes.



  - Deleting a copy group configured of paired volumes.



Pair operation by specifying a copy group

Specifying a copy group and creating a pair. Pairs are created for which the same device names of LDEV defined in respective device groups of the LDEVs. Therefore, it is required to give a same device name for the item to be operated as a pair.

If a consistency group attribute is valid and no consistency group ID is specified, automatically assign a consistency group ID (1 copy group=1 consistency group). If the automatic consistency group assignment is specified and the other pairs in a copy group already have consistency group IDs, assign the same consistency group ID.

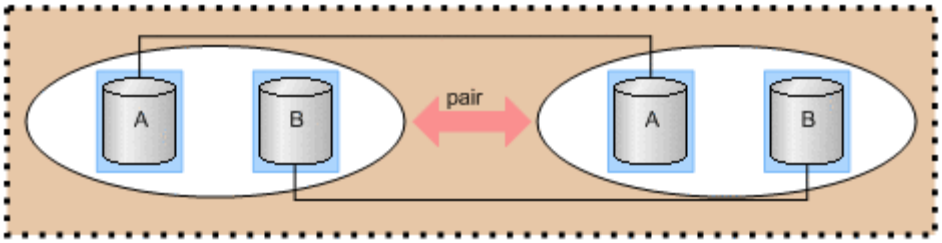
If there is no target LDEV to be a pair in the copy group, the process is terminated by detecting an error.

- Use cases

  As an example of pair operation, the following shows use cases that can be created a pair by specifying a copy group.

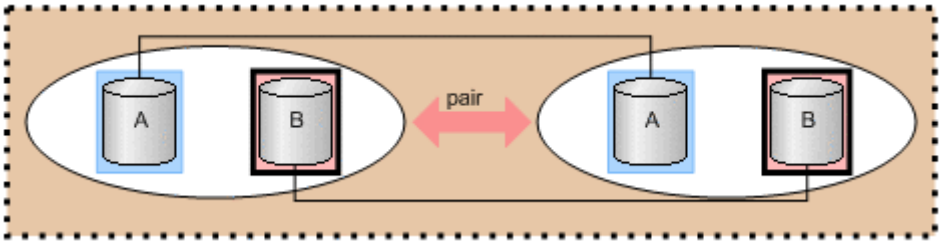
  - Creating a pair in cases where the device names and the numbers of LDEVs in two device groups in a copy group configured of simplex volumes are the same.

    In the following example, pairs are created with LDEVs that have the same device name, A to A and B to B.



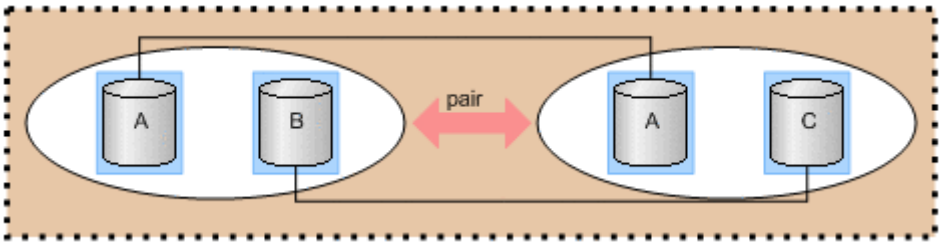
  - Creating a pair in cases where the device names and the numbers of LDEVs in two device groups in a copy group configured of simplex volumes and paired volumes are the same.

    In the following example, a pair is created with LDEVs for the device name A. And no operation is performed for the volumes of device name B that are already formed into copy pairs.



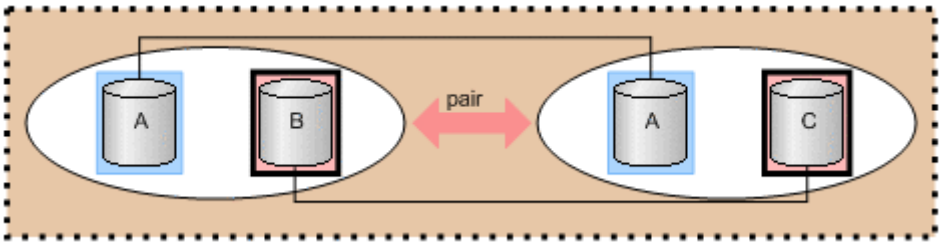
- Creating a pair in cases where different device names exist in two device groups in a copy group configured of simplex volumes.

  In the following example, a pair for device name A can be created, but not for device name B and C because they have different names.



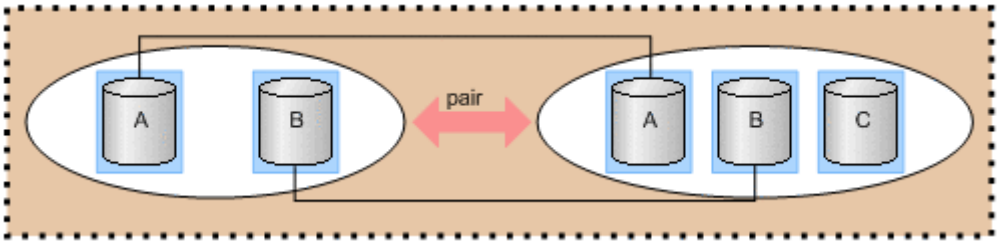
- Creating a pair in cases where the device names in two device groups in a copy group configured of simplex volumes and paired volumes are different.

  In the following example, a pair for device name A to A can be created. For the device name B and C, although it does not change the paired status, but an error occurs because they have different device names.



- Creating a pair in cases where the numbers of LDEVs in two device groups in a copy group configured of simplex volumes are different.

  In the following example, pairs are created for the device name A to A and B to B.

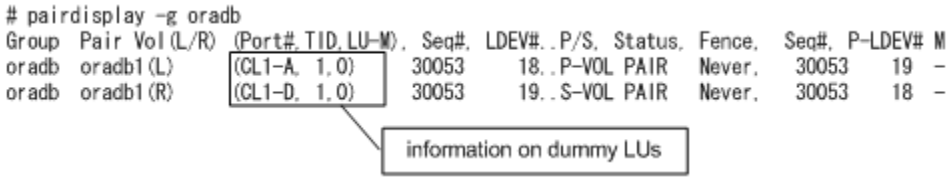


Pair operations with mainframe volumes

You can create a pair with mainframe LDEVs using CCI. However, some of the replication functions are not available in CCI. For more detailed information, see the user manual for the replication function: Hitachi TrueCopy® for Mainframe User Guide, Hitachi Universal Replicator for Mainframe User Guide, or Hitachi ShadowImage® for Mainframe User Guide.

Using "dummy" LUs for mainframe LDEVs

Pseudo-LUs called "dummy" LUs are used to access mainframe LDEVs in CCI. The dummy LUs are unconditionally defined for all mainframe device emulation types. Since the dummy LUs are used only by CCI, other user interfaces such as Storage Navigator and host servers do not display the dummy LUs. Two dummy LUs are assigned to each mainframe LDEV. The port IDs of the mainframe PCBs are assigned as the port IDs for the dummy LUs. Host modes cannot be defined for dummy LUs.



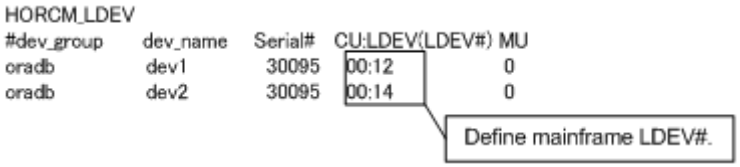
To determine the port number for dummy LUs, use the following formula:

```
Port#:Installed Port#(*1) (LDEV# / 0x4000)x32
      Installed Port#(*1) (LDEV# / 0x4000)x32+1
```

*1: The lowest port number of the installed mainframe ports.

```
TID:                          (LDEV# & 03xFCO)/64
LU-M:                         (LDEV# &0x3F)
```

To perform pair operations on mainframe volumes just like on open-system volumes, include the mainframe LDEV# in the HORCM_LDEV section of the configuration definition file. If you have mainframe pairs that already exist, you can verify their MU # using the **raidscan** command.



Pair status and access permission for mainframe LDEVs

The pair status of mainframe LDEVs is displayed in the same way as for open-system LDEVs. However, access permissions to mainframe P-VOLs and S-VOLs are different from those of open volumes. The following tables show the pair status and access permissions for mainframe LDEVs. For more information about displayed pair status of open LDEVs, see TrueCopy/ ShadowImage/Universal Replicator pair status on page 6-19.

Table 3-11 Pair status and access permission for TrueCopy/TrueCopy for Mainframe

Pair status in Storage Navigator		Pair status in CCI		Access to mainframe P-VOL	Access to mainframe S-VOL	Notes
Open	**Mainframe**	**Open**	**Mainframe**			
SMPL	Simplex	SMPL	SMPL	Read/write enabled	Read/write enabled	not in pair
COPY	Pending	COPY	COPY	Read/write enabled	Reject	copying
PAIR	Duplex	PAIR	PAIR	Read/write enabled	Reject	pair
PSUS (pair suspended split)	Suspended	PSUS	PSUS	Read/write enabled	Reject[1]	suspend
PSUE (pair suspended error)	Suspended	PSUE	PSUE	Read/write enabled	Reject[1]	suspend by failure
PDUB	-	PDUB	-[2]	-	-	inconsistency in LUSE status
SSWS	SSWS	SSWS	SSWS	-	Read/write enabled	HAM only/ horctakeover only

Notes:

1. When the system option mode 20 is on, this is a read only volume.
2. PDUB (inconsistency in LUSE status) does not exist in the mainframe system.

Table 3-12 Pair status and access permission for Universal Replicator/Universal Replicator for Mainframe

Pair status in Storage Navigator		Pair status in CCI		Access to mainframe P-VOL	Access to mainframe S-VOL	Notes
Open	**Mainframe**	**Open**	**Mainframe**			
SMPL	Simplex	SMPL	SMPL	Read/write enabled	Read/write enabled	not in pair
COPY	Pending	COPY	COPY	Read/write enabled	Reject	copying
PAIR	Duplex	PAIR	PAIR	Read/write enabled	Reject	pair
PSUS (pair suspended split)	Suspend	PSUS	PSUS	Read/write enabled	Reject*	suspend
PSUE (pair suspended error)	Suspend	PSUE	PSUE	Read/write enabled	Reject*	suspend
Suspending	Suspending	PAIR	PAIR	Read/write enabled	Reject	pair
Deleting	Deleting	PAIR / COPY	PAIR / COPY	Read/write enabled	Reject	pair/copying

Pair status in Storage Navigator		Pair status in CCI		Access to mainframe P-VOL	Access to mainframe S-VOL	Notes
Open	Mainframe	Open	Mainframe			
HOLD	Hold	PSUS	PSUS	Read/write enabled	Reject*	suspend
HOLDING	Holding	PSUS	PSUS	Read/write enabled	-	suspend
PSUS (HLDE)	Hlde	PSUE	PSUE	Read/write enabled	Reject	suspend
PFUL	Suspend	PFUL	PFUL	Read/write enabled	Reject	suspend
PFUS	Suspend	PFUS	PFUS	Read/write enabled	Reject	suspend
SSWS	Suspend	SSWS	SSWS	-	Read/write enabled	suspend
*When system option mode 20 is on, this is a read-only volume.						

Table 3-13 Pair status and access permission for ShadowImage/ShadowImage for Mainframe

Pair status in Storage Navigator		Pair status in CCI		Access to mainframe P-VOL	Access to mainframe S-VOL	Notes
Open	Mainframe	Open	Mainframe			
SMPL	Simplex	SMPL	SMPL	Read/write enabled	Read/write enabled	simplex
COPY(PD)	Pending	COPY	COPY	Read/write enabled	Reject	copying
PAIR	Duplex	PAIR	PAIR	Read/write enabled	Reject	pair
COPY (SP)	SP-Pend	COPY	COPY	Read/write enabled	Reject	suspend (in COPY(SP) COPY-COPY)
PSUS (SP)	V-split	PSUS	PSUS	Read/write enabled	Read/write enabled	suspend (in Quick Split PSUS-COPY)
PSUS (pair suspended split)	Split	PSUS	PSUS	Read/write enabled	Read/write enabled	suspend
PSUE (pair suspended error)	Suspend	PSUE	PSUE	Read/write enabled	Reject	suspend by failure
COPY (RS)	Resync	COPY	COPY	Read/write enabled	Reject	resynchronizing
COPY (RS-R)	Resync-R	RCPY	RCPY	Reject	Reject	restoring

Operational differences for multiplatform volumes

The following table shows the operational differences for TrueCopy, Universal Replicator, and ShadowImage multiplatform volumes.

Table 3-14 Operational differences for multiplatform volumes

LU path definition	LU path information reported to CCI	ShadowImage operations	TrueCopy operations	Universal Replicator operations
LU path is defined.	Actual LU path information is reported.	ShadowImage for Mainframe operations	Commands are rejected.	Commands are rejected.
LU path is not defined.	Dummy LU number is reported.	ShadowImage for Mainframe operations	Commands are rejected.	Commands are rejected.

Operational differences for replication commands

The following table shows the differences between open volumes and mainframe volumes in replication commands. For details on the differences, see the manual for each program product.

Table 3-15 Differences in replication commands

Command	Option	Description	Operation in open systems	Operation in mainframe systems	Notes
paircreate*	-c <size>	Specifies track size when copying.	TrueCopy: You can specify 1 to 15 tracks.	TrueCopy for Mainframe: 3 or 15 tracks When you specify the number 1 to 3, the copy speed is 3 tracks. When you specify the number 4 to 15, the copy speed is 15 tracks.	This option is not supported in Universal Replicator or Universal Replicator for Mainframe. There is no difference between ShadowImage and ShadowImage for Mainframe.
	-m grp [CTGID]	If CTGID is not specified, CTGID is automatically assigned and a pair is registered to the CT group.If CTGID is specified, a pair is registered to the CTGID in use.	You can specify this option.	You can specify this option.	ShadowImage pairs and ShadowImage for Mainframe pairs cannot be registered to the same CTG ID.If both ShadowImage pairs and ShadowImage for Mainframe pairs are registered to one group, the command ends abnormally.

Command	Option	Description	Operation in open systems	Operation in mainframe systems	Notes
pairsplit	-r -rw	Specifies access mode to S-VOL after splitting a pair.	-r: Read only -rw: Read/ write enabled	The volume cannot be read regardless of specified options.	This option is only for TrueCopy, TrueCopy for Mainframe, Universal Replicator, and Universal Replicator for Mainframe. You cannot specify this option in ShadowImage or ShadowImage for Mainframe.

*If the capacity of the S-VOL is larger than that of the P-VOL, you cannot create a pair with CCI. To create a TrueCopy for Mainframe pair with volumes that differ in capacity, use Business Continuity Manager or Storage Navigator.

Notes:

- A mainframe primary volume may also be called a source volume or a main volume.
- A mainframe secondary volume may also be called a target volume or a remote volume.

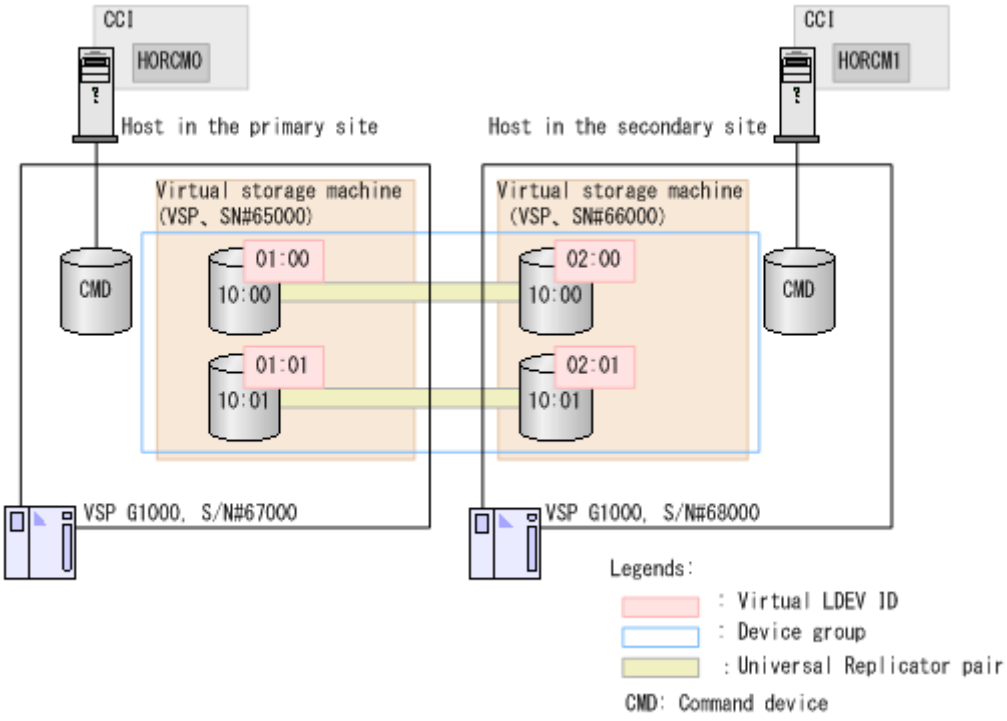
Global virtualization function (VSP G1000 only)

The global virtualization function enables you to minimize rewrites of configuration definition files (horcm*.conf) when you operate volumes migrated from other storage system models to the VSP G1000. For details on the global virtualization function, see the *Provisioning Guide for Open Systems*.

System configuration example with the global virtualization function

This topic shows a system configuration with the global virtualization function. In this configuration, a virtual storage machine is created in two VSP G1000 storage systems respectively. Volumes in the virtual storage machine are given virtual LDEV IDs.

- Primary site
  - Storage system: VSP G1000 (S/N: 67000)
  - Virtual storage machine: VSP (S/N: 65000)
  - LDEV ID of VSP G1000: 10:00 and 10:01
  - Virtual LDEV ID: 01:00 and 01:01
- Secondary site
  - Storage system: VSP G1000 (S/N: 68000)
  - Virtual storage machine: VSP (S/N: 66000)
  - LDEV ID of VSP G1000: 10:00 and 10:01
  - Virtual LDEV ID: 02:00 and 02:01



Using CCI in a system configuration with the global virtualization function

To use CCI with the system configuration using the global virtualization function, the following two methods can be used.

- Specifying a virtual storage machine to HORCM_VCMD in configuration definition files
- Specifying a virtual storage machine to command options (that is, -s <seq#> or -u <unit id>)

If you specify the virtual storage machine to HORCM_VCMD of the configuration file, the shell scripts can be used continuously, because you do not need to modify their scripts. However, if you define HORCM_VCMD, you cannot operate the virtual storage machine whose the serial number is not specified by HORC_VCMD. If you specify the virtual storage machine to the command options (that is, -s <seq#> or -u <unit id>) instead of specifying with HORCM_VCMD, you can also operate the virtual storage machine of the serial number not specifying to HORCM_VCMD.

After you change the virtual storage machine configuration with the raidcom add resource command or the raidcom delete resource command, restart HORCM.

Specifying a virtual storage machine by HORCM_VCMD

Configuration definition file settings when specifying a virtual storage machine by HORCM_VCMD

This topic shows configuration definition file settings with the global virtualization function when specifying a virtual storage machine by HORCM_VCMD. For details on other parameters, see Configuration definition file on page 2-12.

- HORCM_CMD

  Specify a volume belonging to meta_resource in VSP G1000 as the command device. CCI obtains the virtual storage machine information defined in VSP G1000 via the specified command device, and configure the virtual storage machine components. When you specify a volume in the virtual storage machine as the command device in the system configuration with the global virtualization function, you cannot start CCI.

- HORCM_VCMD

  In the beginning of HORCM_VCMD, specify a serial number of the virtual storage machine to be operated by this instance. If you specify the serial number of the virtual storage machine to HORCM_VCMD, even if you do not specify the command option (that is, -s <seq#> or -u <unit ID>), the virtual storage machine of the serial number defined with the beginning of HORCM_VCMD is operated.

  If you define HORCM_VCMD, you cannot operate the virtual storage machines whose serial numbers are not specified by HORCM_VCMD. When you specify a virtual storage machine that is not specified with HORCM_VCMD by command options (that is, -s <seq#> or -u <unit id>), error occurs. To operate more than one virtual storage machine from a instance, specify serial numbers of the virtual storage machines with HORCM_VCMD. To operate the virtual storage machine specified in the second or later of HORCM_VCMD, use the command options (that is, -s <seq#> or -u <unit id>).

- HORCM_LDEV

  Specify volumes to be copied. Serial numbers of the virtual storage machine and virtual LDEV IDs must be specified. You cannot specify the volumes with HORCM_DEV in the system configuration with the global virtualization function. Specify the volumes with HORCM_LDEV.

- HORCM_INST

  Specify an IP address and a service name of the remote host as it is for not using the global virtualization function.

Example of the configuration definition files when specifying a virtual storage machine by HORCM_VCMD

Example of the configuration definition files (HORCM0)

The underlined parts indicate the information that needs to modify from the file of the old model.

```
#/******** HORCM0 on PHOST *****/
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
NONE        horcm0       1000    3000

#/********** For HORCM_CMD ****************/
HORCM_CMD #dev_name \\.\CMD-367000:/dev/rdsk HORCM_VCMD # redefine
Virtual DKC Serial# as unitIDs 365000

HORCM_LDEV
Ora         dev1       365000  02:00  h1
Ora         dev2       365000  02:01  h1

#/********** For HORCM_INST ****************/
HORCM_INST
#dev_group    ip_address     service
Ora           RHOST       horcm1
```

Example of the configuration definition files (HORCM1)

The underlined parts indicate the information that needs to modify from the file of the old model.

```
#/******** HORCM1 on RHOST *****/
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
NONE        horcm1       1000    3000

#/********** For HORCM_CMD ****************/
HORCM_CMD #dev_name \\.\CMD-368000:/dev/rdsk HORCM_VCMD # redefine
Virtual DKC Serial# as unitIDs 366000

HORCM_LDEV
Ora         dev1       366000  02:00  h1
Ora         dev2       366000  02:01  h1

#/********** For HORCM_INST ****************/
HORCM_INST
#dev_group    ip_address     service
Ora           PHOST      horcm0
```

The raidqry command display example

```
# raidqry -l
No Group  Hostname    HORCM_ver   Uid Serial# Micro_ver
Cache(MB)
1  ---    raidmanager 01-31-03/00 0   66000   80-01-00/00 81920
```

Specifying a virtual storage machine by command options

Configuration definition file settings when specifying a virtual storage machine by command options

This topic shows configuration definition file settings with the global virtualization function when specifying a virtual storage machine by command options. For details on other parameters, see Configuration definition file on page 2-12.

- HORCM_CMD

Specify a volume belonging to meta_resource in VSP G1000 as the command device. CCI obtains the virtual storage machine information defined in VSP G1000 via the specified command device, and configure the virtual storage machine components. When you specify a volume in the virtual storage machine as the command device in the system configuration with the global virtualization function, you cannot start CCI.

- HORCM_LDEV

  Specify volumes to be copied. Serial numbers of the virtual storage machine and virtual LDEV IDs must be specified. You cannot specify the volumes with HORCM_DEV in the system configuration with the global virtualization function. Specify the volumes with HORCM_LDEV.

- HORCM_INST

  Specify an IP address and a service name of the remote host as it is for not using the global virtualization function.

Example of the configuration definition files when specifying a virtual storage machine by command options

Example of the configuration definition files (HORCM0)

The underlined parts indicate the information that needs to modify from the file of the old model.

```
#/******** HORCM0 on PHOST *****/
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
NONE        horcm0       1000    3000

#/********** For HORCM_CMD ****************/
HORCM_CMD #dev_name \\.\CMD-367000:/dev/rdsk

HORCM_LDEV
Ora         dev1       365000  01:00  h1
Ora         dev2       365000  01:01  h1

#/********** For HORCM_INST ****************/
HORCM_INST
#dev_group   ip_address     service
Ora          RHOST       horcm1
```

Example of the configuration definition files (HORCM1)

The underlined parts indicate the information that needs to modify from the file of the old model.

```
#/******** HORCM1 on RHOST *****/
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
NONE        horcm1       1000    3000

#/********** For HORCM_CMD ****************/
HORCM_CMD #dev_name \\.\CMD-368000:/dev/rdsk

HORCM_LDEV
Ora         dev1       366000  02:00  h1
Ora         dev2       366000  02:01  h1
```

```
#/********** For HORCM_INST ****************/
HORCM_INST
#dev_group    ip_address      service
Ora           PHOST       horcm0
```

Commands to the virtual storage machine

When HORCM starts, CCI obtains the virtual storage machine information from multiple storage systems, and configure each virtual storage machine component. CCI regards commands as the command to the virtual storage machine by the descriptions of the configuration definition file or the command options (that is, -s <seq#> or -u <unit id>), and use their information. The following table shows how to issue the command to the virtual storage machine for each command.

Commands	How to issue the command to the virtual storage machine	Remarks
paircreate	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
pairsplit	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
pairresync	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
pairevtwait	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
pairvolchk	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
pairdisplay	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
paircurchk	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
horctakeover	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
raidvchkset	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
raidvchkdsp	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
pairsyncwait	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---

Commands	How to issue the command to the virtual storage machine	Remarks
pairmon	Describe the virtual storage machine information in HORCM_LDEV in the configuration definition file.	---
raidscan	Specify the virtual storage machine by the -s <seq#> option. The virtual storage machine can be specified regardless of the description contents of the configuration definition file.	You cannot specify a virtual storage machine by the -u <unit ID> option of the raidscan command. Use the -s <seq#> option.
raidar	Specify the virtual storage machine by a unit ID by the command option (-p <port>).	The raidar command has no option to specify a serial number nor a unit ID. Use the -p <port> option as "CL1-An" (specify a unit ID in n).
raidqry	---	The information of both VSP G1000 and the virtual storage machine is displayed.
raidvchkscan	Specify the virtual storage machine by the command option (-s <seq#> or -u <unit ID>). The virtual storage machine can be specified regardless of the description contents of the configuration definition file.	---
horcctl	Specify VSP G1000 information.	If you specify the virtual storage machine information, error (No such control device) occurs.
raidcom	Specify the virtual storage machine by the command option (-s <seq#> or -u <unit ID>). The virtual storage machine can be specified regardless of the description contents of the configuration definition file.	Some commands only (see Operation target when you specify the virtual storage machine by the raidcom command on page 3-51).

Operation target when you specify the virtual storage machine by the raidcom command

This topic shows operational objects when you specify the virtual storage machine by the raidcom command option (-s <seq#> or -u <unit ID>). If the operation target of the command is VSP G1000 when you specify the virtual storage machine, even if you specify the virtual storage machine for the command option (that is, -s <seq#> or -u <unit ID>), the option is ignored. When you do not specify the option (that is, -s <seq#> or -u <unit ID>), operational objects of all the raidcom command is VSP G1000s.

Operation type	Commands	Operation target when you specify the virtual storage machine
Copy group	raidcom get copy_grp	VSP G1000
	raidcom add copy_grp	VSP G1000
	raidcom delete copy_grp	VSP G1000

Operation type	Commands	Operation target when you specify the virtual storage machine
Device group	raidcom get device_grp	VSP G1000
	raidcom add device_grp	VSP G1000
	raidcom delete device_grp	VSP G1000
External volume group	raidcom get external_grp	VSP G1000
	raidcom add external_grp	VSP G1000
	raidcom delete external_grp	VSP G1000
	raidcom modify external_grp	VSP G1000
	raidcom disconnect external_grp	VSP G1000
Host group	raidcom get host_grp	VSP G1000
	raidcom add host_grp	VSP G1000
	raidcom delete host_grp	VSP G1000
	raidcom modify host_grp	VSP G1000
WWN	raidcom get hba_wwn	VSP G1000
	raidcom add hba_wwn	VSP G1000
	raidcom set hba_wwn	VSP G1000
	raidcom reset hba_wwn	VSP G1000
Journal	raidcom get journal	VSP G1000
	raidcom add journal	VSP G1000
	raidcom delete journal	VSP G1000
	raidcom modify journal	VSP G1000
LDEV	raidcom get ldev	Virtual storage machine
	raidcom add ldev	VSP G1000
	raidcom delete ldev	VSP G1000
	raidcom modify ldev	VSP G1000
	raidcom extend ldev	VSP G1000
	raidcom initialize ldev	VSP G1000
LUN	raidcom get lun	Virtual storage machine
	raidcom add lun	Virtual storage machine
	raidcom delete lun	Virtual storage machine
External path	raidcom get path	VSP G1000
	raidcom add path	VSP G1000
	raidcom delete path	VSP G1000
	raidcom disconnect path	VSP G1000
	raidcom check_ext_storage path	VSP G1000
	raidcom check_ext_storage external_grp	VSP G1000
	raidcom discover external_storage	VSP G1000
	raidcom discover lun	VSP G1000

Operation type	Commands	Operation target when you specify the virtual storage machine
Pool	raidcom get pool	VSP G1000
	raidcom get dp_pool	VSP G1000
	raidcom get snap_pool	VSP G1000
	raidcom add dp_pool	VSP G1000
	raidcom add snap_pool	VSP G1000
	raidcom delete pool	VSP G1000
	raidcom modify pool	VSP G1000
	raidcom reallocate pool	VSP G1000
	raidcom monitor pool	VSP G1000
Port	raidcom get port	VSP G1000
	raidcom modify port	VSP G1000
RCU	raidcom get rcu	VSP G1000
	raidcom add rcu	VSP G1000
	raidcom delete rcu	VSP G1000
Logical path to RCU	raidcom add rcu_path	VSP G1000
	raidcom delete rcu_path	VSP G1000
Parity group	raidcom get parity_grp	VSP G1000
SSID	raidcom get ssid	VSP G1000
	raidcom add ssid	VSP G1000
	raidcom delete ssid	VSP G1000
Resource group	raidcom get resource	VSP G1000
	raidcom add resource	VSP G1000
	raidcom delete resource	VSP G1000
	raidcom lock resource	VSP G1000
	raidcom unlock resource	VSP G1000
	raidcom map resource	VSP G1000
	raidcom unmap resource	VSP G1000
CLPR	raidcom get clpr	VSP G1000
	raidcom modify clpr	VSP G1000
Thin Image	raidcom get snapshot	Virtual storage machine
	raidcom add snapshot	Virtual storage machine
	raidcom delete snapshot	Virtual storage machine
	raidcom modify snapshot	Virtual storage machine

Operation type	Commands	Operation target when you specify the virtual storage machine
Server Priority Manager	raidcom get spm_wwn	VSP G1000
	raidcom get spm_group	VSP G1000
	raidcom add spm_wwn	VSP G1000
	raidcom add spm_group	VSP G1000
	raidcom delete spm_wwn	VSP G1000
	raidcom delete spm_group	VSP G1000
	raidcom monitor spm_wwn	VSP G1000
	raidcom monitor spm_group	VSP G1000
Others	raidcom get command_status	VSP G1000
	raidcom reset command_status	VSP G1000
	raidcom get error_message	VSP G1000

4

Starting up CCI

You can begin using the CCI software after you have installed the CCI software, set the command device, created the configuration definition file(s), and (for OpenVMS only) followed the porting requirements and restrictions. One or two instances of CCI can be used simultaneously in UNIX, Windows, and OpenVMS operating system environments.

- ☐ Starting up on UNIX systems
- ☐ Starting up on Windows systems
- ☐ Starting up on OpenVMS systems
- ☐ Starting CCI as a service (Windows systems)

Starting up on UNIX systems

One instance

To start up one instance of CCI on a UNIX system:

1. Modify **/etc/services** to register the port name/number (service) of each configuration definition file. Make the port name/number the same on all servers:

   horcm *xxxxx*/udp

   xxxxx = the port name/number for horcm.conf
2. If you want CCI to start automatically each time the system starts up, add **/etc/horcmstart.sh** to the system automatic startup file (for example, **/sbin/rc**).
3. Execute the **horcmstart.sh** script manually to start the CCI instances: **# horcmstart.sh**
4. Set the log directory (**HORCC_LOG**) in the command execution environment as needed.
5. If you want to perform TrueCopy operations, do not set the **HORCC_MRCF** environment variable. If you want to perform ShadowImage operations, set the **HORCC_MRCF** environment variable for the CCI execution environment.

   For B shell:

   # HORCC_MRCF=1 # export HORCC_MRCF

   For C shell:

   # setenv HORCC_MRCF 1 # pairdisplay -g *xxxx* *xxxx* = group name

Two instances

To start up two instances of CCI on a UNIX system:

1. Modify **/etc/services** to register the port name/number (service) of each configuration definition file. The port name/number must be different for each CCI instance.

   horcm0 *xxxxx*/udp

   xxxxx = the port name/number for horcm0.conf

   horcm1 *yyyyy*/udp

   yyyyy = the port name/number for horcm1.conf
2. If you want CCI to start automatically each time the system starts up, add **/etc/horcmstart.sh 0 1** to the system automatic startup file (for example, **/sbin/rc**).
3. Execute the **horcmstart.sh** script manually to start the CCI instances: **# horcmstart.sh 0 1**
4. Set an instance number to the command execution environment:

   For B shell:

 # HORCMINST=*X* # export HORCMINST

X = instance number = 0 or 1

For C shell:

 # setenv HORCMINST *X*

5. Set the log directory (**HORCC_LOG**) in the command execution environment as needed.
6. If you want to perform TrueCopy operations, do not set the **HORCC_MRCF** environment variable. If you want to perform ShadowImage operations, set the **HORCC_MRCF** environment variable for the CCI execution environment.

   For B shell:

   # HORCC_MRCF=1 # export HORCC_MRCF

   For C shell:

   # setenv HORCC_MRCF 1 # pairdisplay -g *xxxx*

   xxxx = group name

Starting up on Windows systems

One instance

To start up one instance of CCI on a Windows system:

1. Modify **%windir%\system32\drivers\etc\services** to register the port name/number (service) of the configuration definition file. Make the port name/number the same on all servers:

   horcm *xxxxx*/udp *xxxxx* = the port name/number of horcm.conf
2. If you want CCI to start automatically each time the system starts up, add **\HORCM\etc\horcmstart** to the system automatic startup file (for example, **\autoexec.bat**).
3. Execute the **horcmstart** script manually to start CCI:
   D:\HORCM\etc> horcmstart
4. Set the log directory (**HORCC_LOG**) in the command execution environment as needed.
5. If you want to perform TrueCopy operations, do not set the **HORCC_MRCF** environment variable. If you want to perform ShadowImage operations, set the **HORCC_MRCF** environment variable for the CCI execution environment:

   D:\HORCM\etc> set HORCC_MRCF=1 D:\HORCM\etc> pairdisplay -g *xxxx*

   xxxx = group name

Two instances

To start up two instances of CCI on a Windows system:

1. Modify **%windir%\system32\drivers\etc\services** to register the port name/number (service) of the configuration definition files. Make sure that the port name/number is different for each instance:

   horcm0 *xxxxx*/udp

   xxxxx = the port name/number of horcm0.conf

   horcm1 *xxxxx*/udp

   xxxxx = the port name/number of horcm1.conf

2. If you want CCI to start automatically each time the system starts up, add **\HORCM\etc\horcmstart 0 1** to the system automatic startup file (for example, **\autoexec.bat**).
3. Execute the **horcmstart** script manually to start CCI:
   D:\HORCM\etc> horcmstart 0 1
4. Set an instance number to the command execution environment:
   D:\HORCM\etc> set HORCMINST=*X*

   X = instance number = 0 or 1

5. Set the log directory (**HORCC_LOG**) in the command execution environment as needed.
6. If you want to perform TrueCopy operations, do not set the **HORCC_MRCF** environment variable. If you want to perform ShadowImage operations, set the **HORCC_MRCF** environment variable for the CCI execution environment:

   D:\HORCM\etc> set HORCC_MRCF=1 D:\HORCM\etc> pairdisplay -g *xxxx*

   xxxx = group name

Starting up on OpenVMS systems

One instance

To start up one instance of CCI on an OpenVMS system:

1. Create the configuration definition file.

   For a new installation, use the configuration definition sample file that is supplied (SYS$POSIX_ROOT:[HORCM.etc]horcm.conf). Make a copy of the file: **$ COPY SYS$POSIX_ROOT:[HORCM.etc]horcm.conf SYS$POSIX_ROOT:[etc]**

   Edit this file according to your system configuration using a text editor (for example, eve).

   Register the port name (service) of the configuration definition file in "SYS$SYSROOT:[000000.TCPIP$ETC]SERVICES.DAT ".

   horcm *xxxxx*/udp *xxxxx* = port number

   Use the same port number in all servers. The port number can be directly specified without registering it in "SYS$SYSROOT:[000000.TCPIP$ETC]SERVICES.DAT".

2. Manually execute the HORCM startup command.

$ spawn /nowait /process=horcm horcmstart

Note: The subprocess (HORCM) created by SPAWN is terminated when the terminal is LOGOFF or the session is terminated. If you want an independent process to the terminal LOGOFF, use the "RUN / DETACHED" command.

3. Confirm the configuration.

   Set the log directory (HORCC_LOG) in the command execution environment as required.

Note: If the log directory under SYS$POSIX_ROOT is shared with other nodes, the log directory of Horc Manager must be set for each node. The log directory of Horc Manager can be changed by setting the parameter of horcmstart. See the *Command Control Interface Command Reference* for information about horcmstart parameters.

If you want to perform ShadowImage operations, set the environment variable (HORCC_MRCF). **$ HORCC_MRCF:=1 $ pairdisplay -g *xxxx*** *xxxx* = group name

Note: If a system configuration change or a RAID configuration change causes this file to change, (for example, cache size change or microcode change), these changes will not take effect until you stop HORCM (horcmshutdown) and restart HORCM (horcmstart). Use the "-c" option of the pairdisplay command to verify that there are no configuration errors.

Two instances

To start up two instances of CCI on an OpenVMS system:

1. Create the configuration definition files.

   For a new installation, use the configuration definition sample file that is supplied (SYS$POSIX_ROOT:[HORCM.etc]horcm.conf). Copy the file twice, once for each instance.

   $ COPY SYS$POSIX_ROOT:[HORCM.etc]horcm.conf SYS$POSIX_ROOT:[etc] horcm0.conf

   $ COPY SYS$POSIX_ROOT:[HORCM.etc]horcm.conf SYS$POSIX_ROOT:[etc] horcm1.conf

   Edit these two files according to your system configuration using a text editor (for example, eve).

   Register the port name (service) of the configuration definition file in "SYS$SYSROOT:[000000.TCPIP$ETC]SERVICES.DAT".

   horcm0 *xxxxx*/udp *xxxxx* = port number **horcm1 *yyyyy*/udp** *yyyyy* = port number

   Each instance should have a unique port number.

   The port number can be directly specified without registering it in "SYS$SYSROOT:[000000.TCPIP$ETC]SERVICES.DAT".

2. Execute the HORCM startup command.

$ spawn /nowait /process=horcm0 horcmstart 0 $ spawn /nowait /process=horcm1 horcmstart 1

Note: The subprocess (HORCM) created by SPAWN is terminated when the terminal is LOGOFF or the session is terminated. If you want an independent process to the terminal LOGOFF, use "RUN /DETACHED" command.

3. Set the HORCM instance numbers in the environment in which the command is to be executed: **$ HORCMINST:=*X*** *X* = instance number (0 or 1)
4. Confirm the configuration using a CCI command.

   Set the log directory (**HORCC_LOG**) in the command execution environment as required.

Note: If the log directory under SYS$POSIX_ROOT is shared with other nodes, the log directory of Horc Manager must be set for each node. The log directory of Horc Manager can be changed by setting the parameter of horcmstart. See the *Command Control Interface Command Reference* for information about horcmstart parameters.

If you want to perform ShadowImage operations, set the environment variable (**HORCC_MRCF**). **$ HORCC_MRCF:=1 $ pairdisplay -g *xxxx*** *xxxx* denotes a group name.

Note: If a system configuration change or a RAID configuration change causes this file to change (for example, cache size change, microcode change), these changes will not take effect until you stop HORCM (horcmshutdown 0 1) and restart HORCM (horcmstart 0 and horcmstart 1). Use the "-c" option of the pairdisplay command to verify that there are no configuration errors.

Starting CCI as a service (Windows systems)

Usually, CCI (HORCM) is started by executing the startup script from the Windows services. However, in the VSS environment, there is no interface to automatically start CCI. CCI provides the **svcexe.exe** command and a sample script file (HORCM0_run.txt) so that CCI can be started automatically as a service.

C:\HORCM\tool\>svcexe

- Usage for adding [HORCM_START_SVC]: **svcexe /A=command_path**
  - for deleting [HORCM_START_SVC]: **svcexe /D**
  - for specifying a service: **svcexe /S=service_name**
  - for dependent services: **svcexe /C=service_name,service_name**

This command example uses HORCM0 for registering the service name for HORCM instance#0:

- Example for adding [HORCM0]: **svcexe /S=HORCM0 "/A=C:\HORCM\tool\svcexe.exe"**
  - for deleting [HORCM0]: **svcexe /S=HORCM0 /D**

- for starting [HORCM0]:

:[1] make a C:\HORCM\tool\HORCM0_run.txt file.

:[2] set a user account to this service.

:[3] confirm to start using horcmstart 0.

:[4] confirm to stop using horcmshutdown 0.

:[5] start as a service by net start HORCM0.

Performing Additional Configuration Tasks

1. **Registering the CCI (HORCM) instance as a service.** The system administrator must add the CCI instance using the following command:

   C:\HORCM\tool\>svcexe /S=HORCM0 "/ A=C:\HORCM\tool\svcexe.exe"

2. **Customizing a sample script file.** The system administrator must customize the sample script file (HORCM0_run.txt) according to the CCI instance. For details, see the descriptions in the HORCM0_run.txt file.

3. **Setting the user account.** The system administrator must set the user account for the CCI administrator as needed.

   When using the GUI, use "Administrative Tools - Services - Select HORCM0 - Logon".

   When using the CUI, use "sc config" command as follows:

   ```
   C:\HORCM\tool\>sc config HORCM0 obj= AccountName password= password
   ```

   If the system administrator uses the default account (LocalSystem), add "HORCM_EVERYCLI=1":

   ```
   #  ****  For INSTANCE# X, change to HORCMINST=X as needed  ****
   START:
    set HORCM_EVERYCLI=1
    set HORCMINST=0
    set HORCC_LOG=STDERROUT
    C:\HORCM\etc\horcmstart.exe
    exit 0
   ```

4. Starting the CCI instance from the service. After you have confirmed starting and stopping using "horcmstart 0" and "horcmshutdown 0", you must verify that HORCM0 starts from the service and that HORCM0 started automatically from REBOOT, using the following command:

   C:\HORCM\tool\>net start HORCM0

5. Stopping CCI instance as a service. Instead of using the "horcmshutdown 0" command, you must use the following command to stop HORCM0:

   C:\HORCM\tool\>net stop HORCM0

   (By using the "horcmshutdown 0" command, the script written into HORCM0_run.txt will automatically restart HORCM0).

5

Provisioning operations with CCI

This chapter describes storage provisioning operations with CCI.

About provisioning operations

Provisioning operations can be performed using CCI.

For details about provisioning, see the Provisioning Guide for the storage system.

Note: The operation of refreshing window on Hitachi Storage Navigator or SVP might be delayed while executing provisioning operation on CCI. During maintenance work on the storage system (SVP in modify mode), the command is rejected (2E10, 8000).

Overview of the configuration setting command

CCI functions enable provisioning operations such as host setting, LDEV creation, and device group creation. These operations are required for performing the data replication operations. The is done by using the configuration setting command.

The configuration setting command is specified using the following syntax:

```
raidcom <action> <resource> <parameter>
```

The content of operation such as add or delete is specified in the action, and a resource object such as LDEV or path is specified in the resource. The necessary value to operate the resource object is specified in the parameter. For the details about contents of specification for the configuration setting command, see *Command Control Interface Command Reference*.

Some provisioning operations take much processing time. Therefore CCI provides two ways to execute the configuration setting command: synchronously and asynchronously.

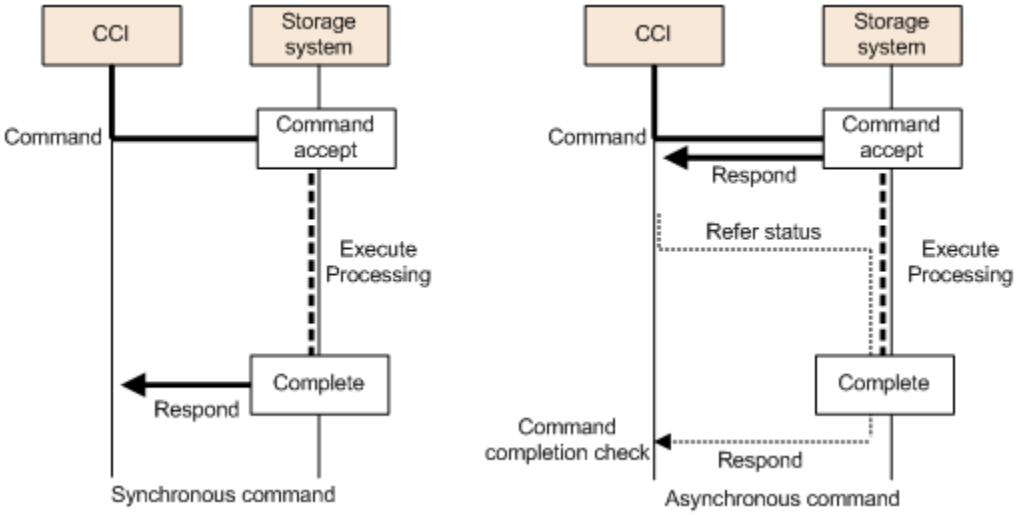


Figure 5-1 Synchronous and asynchronous command processing

The processing difference between these two command types are described in Synchronous command processing on page 5-3 and Asynchronous command processing on page 5-3.

Synchronous command processing

In addition to the replication commands, the process is executed by synchronizing with a command execution, and then returning a response after the processing is completed. When an error occurs, the error is returned to CCI at each occurrence.

Asynchronous command processing

When an asynchronous command is executed, the command is received at the storage system, and a response is returned before the processing is executed. The actual processing is executed asynchronously with command input.

The completion of the asynchronous command processing can be checked with the raidcom get command_status command. Executing raidcom get command_status command after executing an asynchronous command, the raidcom get command_status command is terminated after completing all the asynchronous command processing.

When an error occurs by executing asynchronous command, the error information, such as the total number of errors or error code (SSB1 and SSB2), is provided. After executing the asynchronous command, execute raidcom get command_status command to check the error information if the asynchronous command processing completed normally.

Error codes SSB1 and SSB2 are stored only at the first error occurrence. For the second and subsequent occurrences, only the number of the error occurrence is stored with no error code. Therefore, before executing an asynchronous command, reset the error information in the storage system using the raidcom reset command_status command. You can check the information in SSB1 and SSB2 by using the raidcom get error_message command.

In a part of asynchronous command processing, the multiple commands received by the host are executed at a time. Therefore, the total number of errors may not correspond with the unexecuted commands. If the error occurred in asynchronous commands, verify the system configuration by the reference commands. For details about the reference commands, see Available provisioning operations on page 5-5.

When executing an asynchronous command, execute a command or a script with the following procedures.

1. Execute a raidcom reset command_status command.

   Resets the error information of asynchronous command in the storage system.

2. Execute an asynchronous command.

   Executes the asynchronous command.

3. Execute a raidcom get command_status command.

   Checks if all the asynchronous command processing are done or if no error is occurred.

Asynchronous commands

The asynchronous commands associated with the configuration setting command provide provisioning functions. The table lists the functions performed by asynchronous commands and describes the required syntax.

Table 5-1 Asynchronous commands of the configuration setting command

Function	Command syntax
Blocking an LDEV	raidcom modify ldev -ldev_id <ldev#> -status blk
Adding an LDEV	raidcom add ldev {-parity_grp_id <gno-sgno>| - external_grp_id <gno-sgno> | -pool {<pool ID#> | <pool naming> | snap}} -ldev_id <ldev#> { -capacity <size> | -offset_capacity <size> | -cylinder <size>} [-emulation <emulation type>][-location <lba>][-mp_blade_id <mp#>]
Deleting an LDEV	raidcom delete ldev {-ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}
LDEV Quick Format	raidcom initialize ldev {-ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]} -operation qfmt
Restoring an LDEV	raidcom modify ldev -ldev_id <ldev#> -status nml
Creating virtual volume for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, or Copy-on-Write Snapshot	raidcom add ldev -pool {<pool ID#> | <pool naming>| snap} -ldev_id <ldev#> -capacity <size>
Deleting virtual volume for Dynamic Provisioning, Dynamic Tiering, or Copy-on-Write Snapshot	raidcom delete ldev {-ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name>[<device name>]}
Creating a pool /adding a pool volume for Dynamic Provisioning or Dynamic Provisioning for Mainframe	raidcom add dp_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>} {-ldev_id <ldev#> …[-cnt<count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}[-user_threshold <threshold_1> [<threshold_2>]]
Creating a pool /adding a pool volume for Snapshot	raidcom add snap_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>}} {-ldev_id <ldev#> …[-cnt<count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}[-user_threshold <%>]
Deleting or shrinking a pool	raidcom delete pool -pool {<pool ID#> | <pool naming>}[-ldev <ldev#>]
Releasing a blocked pool	raidcom modify pool -pool {<pool ID#> | <pool naming>} -status nml
RCU registration	raidcom add rcu -cu_free <serial#> <id> <pid> -mcu_port <port> -rcu_port <port>
RCU logical path addition	raidcom add rcu_path -cu_free <serial#> <id> <pid> -mcu_port <port> -rcu_port <port>
RCU deletion	raidcom delete rcu -cu_free <serial#> <id> <pid>

Function	Command syntax
RCU logical path deletion	raidcom delete rcu_path -cu_free <serial#> <id> <pid> -mcu_port <port> -rcu_port <port>
Creating journal/ Registering journal volume the journal	raidcom add journal -journal_id <journal ID#> {-ldev_id <ldev#> …[-cnt <count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}
Deleting journal/ Deleting journal volume from the journal	raidcom delete journal -journal_id <journal ID#> [-ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]]
Restoration of path for the external path.	raidcom check_ext_storage path -path_grp <path group#> -port <port> -external_wwn <wwn strings>
Setting the external path	raidcom add path -path_grp <path group#> -port <port> -external_wwn <wwn strings>
Mapping the external volume	raidcom add external_grp -path_grp <path group#> -external_grp_id <gno-sgno> -port <port> -external_wwn <wwn strings> -lun_id <lun#> [-emulation <emulation type>]
Deleting the external path	raidcom delete path -path_grp <path group#> -port <port> -external_wwn <wwn strings>
Releasing the mapping of external volume	raidcom delete external_grp -external_grp_id <gno-sgno>
Stopping the use of paths to the external volume	raidcom disconnect path -path_grp <path group#> -port <port> -external_wwn <wwn strings>

Help on configuration setting commands

To see the configuration setting command help, execute any command using the **-h** option, for example, **raidcom - h**.

```
raidcom -h
```

LDEV nickname function

As a function of configuration setting command, a nickname can be set for each LDEV.

The details of the definition for the LDEV nickname function are shown below.

The maximum length of a name is 32 characters. For one LDEV, one nickname can be defined.

A nickname can be defined as follows:

```
raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>
```

Available provisioning operations

The following provisioning operations can be performed using CCI.

Operation type	Description	Corresponding command
Login and logout	Log in.	`raidcom -login <user_name> <password>`
	Log out.	`raidcom -logout`

Operation type	Description	Corresponding command
Resource	Lock resource.	`raidcom lock resource -resource_name <resource group name > [-time <time(sec)>]`
	Unlock resource.	`raidcom unlock resource -resource_name <resource group name >`
	Display resource group information.	`raidcom get resource`
	Add resource group.	`raidcom add resource -resource_name <resource group name> [-resource_id <resource group_id > |-ldev_id <ldev#> | -port <port#> | -port <port#> <host group name> | -parity_grp_id <gno-sgno> | -external_grp_id <gno-sgno>]`
	Delete resource group.	`raidcom delete resource -resource_name <resource group name> [-ldev_id <ldev#> | -port <port#> | -port <port#> <host group name> | -parity_grp_id <gno-sgno> | -external_grp_id <gno-sgno>]`
Host (see the Provisioning Guide for the storage system)	Create host group.	`raidcom add host_grp -port <port> -host_grp_name <host group name>`
	Set host mode.	`raidcom modify host_grp -port <port> [<host group name>] -host_mode < host mode> [-host_mode_opt <host mode option> … ]`
	Register a host to host group.	`raidcom add hba_wwn -port <port> [<host group name>] -hba_wwn <WWN strings>`
	Delete host group.	`raidcom delete host_grp -port <port> [<host group name>]`
	Display host group information.	`raidcom get host_grp -port <port> [<host group name>]`
Port (see the Provisioning Guide for the storage system)	Set port.	`raidcom modify port -port <port>{[-port_speed <value>] [-loop_id<value>] [-topology <topology>] [-security_switch < y/n >]}`
	Set port attribute.	`raidcom modify port -port <port> -port_attribute <port attribute>`
	Display port information.	`raidcom get port [-port <port>]`

Operation type	Description	Corresponding command
Internal volume (see the Provisioning Guide for the storage system)	Create LDEV.	raidcom add ldev {-parity_grp_id <gno-sgno> | - external_grp_id <gno-sgno> | -pool {<pool ID#> | <pool naming> | snap}} -ldev_id <ldev#> {-capacity <size> | -offset_capacity <size> | -cylinder <size>} [-emulation <emulation type>][-location <lba>] [-mp_blade_id <mp#>]
	Display LDEV information.	raidcom get ldev {-ldev_id <ldev#> … [-cnt <count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]} [-key <keyword>]
	Display parity group information.	raidcom get parity_grp [-parity_grp_id <gno-sgno>]
	Define SSID.	raidcom add ssid -rcu <serial#> <mcu#> <rcu#> <id> -ssid <ssid> raidcom delete ssid -rcu <serial#> <mcu#> <rcu#> -ssid <ssid>

Operation type	Description	Corresponding command
Virtual volume (Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, Copy-on-Write Snapshot) (see the Provisioning Guide for the storage system)	Create pool for Dynamic Provisioning or Dynamic Provisioning for Mainframe.	`raidcom add dp_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>}} {-ldev_id <ldev#> …[-cnt<count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}[-user_threshold <threshold_1> [<threshold_2>]]`
	Create pool for Copy-on-Write Snapshot.	`raidcom add snap_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>}} {-ldev_id <ldev#> …[-cnt<count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]} [-user_threshold <%>]`
	Display pool information for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, or Copy-on-Write Snapshot.	`raidcom get pool [-key <keyword>]`
	Delete pool for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, or Copy-on-Write Snapshot.	`raidcom delete pool -pool {<pool ID#> | <pool naming>}`
	Change the threshold value of a pool for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, or Copy-on-Write Snapshot.	`raidcom modify pool -pool {<pool ID#> | <pool naming>} -user_threshold <threshold_1> [<threshold_2>]`
	Restore a pool for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, or Copy-on-Write Snapshot.	`raidcom modify pool -pool {<pool ID#> | <pool naming>} -status nml`
	Set the maximum rate of subscription of a pool for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering.	`raidcom modify pool -pool {<pool ID#> | <pool naming>} -subscription <%>`

Operation type	Description	Corresponding command
	Change the pool for Dynamic Provisioning to the pool for Dynamic Tiering.	`raidcom modify pool -pool {<pool ID#> | <pool naming>} -pool_attribute dt_manual`
	Change the pool for Dynamic Tiering to the pool for Dynamic Provisioning.	`raidcom modify pool -pool {<pool ID#> | <pool naming>} -pool_attribute dp`
	Set the newly allocation free space percentage of the pool for Dynamic Tiering.	`raidcom modify pool -pool {<pool ID#> | <pool naming>} -tier <Tier number><ratio>`
	Create virtual volume for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering, or Copy-on-Write Snapshot.	`raidcom add ldev -pool {<pool ID#> | <pool naming> | snap} -ldev_id <ldev#> -capacity <size> [-emulation <emulation type>] [-location <lba>][-mp_blade_id <mp#>]`
	Extend capacity of virtual volume for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering.	`raidcom extend ldev{-ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]} -capacity <size>`
	Set enabled or disabled of virtual volume tier reallocation for Dynamic Tiering.	`raidcom modify ldev -ldev_id <ldev#> -status {enable_reallocation | disable_reallocation}`
	Release a page of virtual volume for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering.	`raidcom modify ldev -ldev_id <ldev#> -status discard_zero_page`
	Display the information of a pool for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering.	`raidcom get dp_pool [ -key <keyword>]`
	Display the information of a pool for Copy-on-Write Snapshot.	`raidcom get snap_pool`
	Extend the capacity of a pool for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering.	`raidcom add dp_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>}} {-ldev_id <ldev#> … [-cnt<count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}[-user_threshold <threshold_1> [<threshold_2>]]`

Operation type	Description	Corresponding command
	Extend the capacity of a pool for Copy-on-Write Snapshot.	`raidcom add snap_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>}} {-ldev_id <ldev#> …[-cnt<count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]} [-user_threshold <%>]`
	Start or stop the performance monitor for Dynamic Tiering	`raidcom monitor pool -pool {<pool ID#> | <pool naming>} -operation <type>`
	Start or stop the tier reallocation of a pool for Dynamic Tiering.	`raidcom reallocate pool -pool {<pool ID#> | <pool naming>} -operation <type>`
LU path (see the Provisioning Guide for the storage system)	Set LU path.	`raidcom add lun -port <port> [<host group name>] {-ldev_id <ldev#> [-lun_id<lun#>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}`
	Delete LU path.	`raidcom delete lun -port <port> [<host group name>] {-lun_id <lun#> | -ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}`
	Display LU path information.	`raidcom get lun -port <port> [<host group name>]`

Operation type	Description	Corresponding command
External volume (Universal Volume Manager) (see the Provisioning Guide for the storage system)	Search external storage.	`raidcom discover external_storage -port <port>`
	Search external volume.	`raidcom discover lun -port <port> -external_wwn <wwn strings>`
	Map external volume.	`raidcom add external_grp -path_grp <path group#> -external_grp_id <gno-sgno> -port <port> -external_wwn <wwn strings> -lun_id <lun#> [-emulation <emulation type>]`
	Disconnect the connection for external volume.	`raidcom disconnect external_grp {-external_grp_id <gno-sgno> | -ldev_id <ldev#>}`
	Check the connection for external volume and restore it.	`raidcom check_ext_storage external_grp {-external_grp_id <gno-sgno> | -ldev_id <ldev#>}`
	Unmap external volume.	`raidcom delete external_grp -external_grp_id <gno-sgno>`
	Display mapped external volume information.	`raidcom get external_grp [-external_grp_id <gno-sgno>]`
	Create LDEV in external volume.	`raidcom add ldev - external_grp_id <gno-sgno> -ldev_id <ldev#> -capacity <size> [-emulation <emulation type>] [-location <lba>][-mp_blade_id <mp#>]`
	Display LDEV information created in external volume.	`raidcom get ldev {-ldev_id <ldev#> … [-cnt <count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]} [-key <keyword>]`
	Change cache mode of external volume.	`raidcom modify external_grp -external_grp_id <gno-sgno> -cache_mode < y|n >`
	Control cache write of external volume.	`raidcom modify external_grp -external_grp_id <gno-sgno> -cache_inflow < y|n >`
	Modify ownership MP Blade of external volume.	`raidcom modify external_grp -external_grp_id <gno-sgno> -mp_blade_id <mp#>`
	Add external path.	`raidcom add path -path_grp <path group#> -port <port> -external_wwn <wwn strings>`
	Delete external path.	`raidcom delete path -path_grp <path group#> -port <port> -external_wwn <wwn strings>`
	Display external path information.	`raidcom get path [-path_grp <path group#>]`
	Stop the usage of external path.	`raidcom disconnect path -path_grp <path group#> -port <port> -external_wwn <wwn strings>`
	Restore the external path.	`raidcom check_ext_storage path -path_grp <path group#> -port <port> -external_wwn <wwn strings>`
	Define SSID.	`raidcom add ssid -rcu <serial#> <mcu#> <rcu#> <id> -ssid <ssid>` `raidcom delete ssid -rcu <serial#> <mcu#> <rcu#> -ssid <ssid>`

Operation type		Description	Corresponding command
Mainte-nance	Host	Add WWN of host path adapter.	`raidcom add hba_wwn -port <port> [<host group name>] -hba_wwn <WWN strings>`
		Delete WWN of host path adapter.	`raidcom delete hba_wwn -port <port> [<host group name>] -hba_wwn <WWN strings>`
		Set nickname for WWN of host path adapter.	`raidcom set hba_wwn -port <port>[<host group name>] -hba_wwn <WWN strings> -wwn_nickname <WWN Nickname>`
		Delete nickname from WWN of host path adapter.	`raidcom reset hba_wwn -port <port>[<host group name>] -hba_wwn <WWN strings>`
		Display registered WWN information of host path adapter.	`raidcom get host_grp -port <port> [<host group name>]`
	LDEV	Blockade or restore LDEV.	`raidcom modify ldev -ldev_id <ldev#> -status discard_zero_page`
		Create nickname for LDEV.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
		Modify allocated MP Blade to LDEV.	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
		Format LDEV.	`raidcom initialize ldev {-ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]} -operation <type>`
	Device group	Create device group.	`raidcom add device_grp -device_grp_name <ldev group name> <device name> -ldev_id <ldev#>… [-cnt <count>]`
		Delete LDEV from device group.	`raidcom delete device_grp -device_grp_name <device group name> -ldev_id <ldev#>… [-cnt <count>]`
		Display device group information.	`raidcom get device_grp [-device_grp_name <device group name>]`
	Copy group	Create copy group.	`raidcom add copy_grp -copy_grp_name <copy group name> <device group name> [device group name] [-mirror_id <mu#> -journal_id <journal ID#>]`
		Delete copy group.	`raidcom delete copy_grp -copy_grp_name <copy group name>`
		Display copy group information.	`raidcom get copy_grp`
	CLPR	View CLPR configuration.	`raidcom get clpr`
		Modify CLPR (migrate LDEV, parity group, external group).	`raidcom modify clpr`

Operation type		Description	Corresponding command
Remote copy environ-ment	RCU (see the manuals for TC, TCz, UR, and URz)	Register RCU.	`raidcom add rcu -cu_free <serial#> <id> <pid> -mcu_port <port> -rcu_port <port>`
		Delete RCU.	`raidcom delete rcu -cu_free <serial#> <id> <pid>`
		Set RCU attribute.	`raidcom modify rcu -cu_free <serial#> <id> <pid> -rcu_option <mpth> <rto> <rtt>`
		Display RCU information.	`raidcom get rcu [-cu_free <serial#> <id> <pid>]`
	RCU path (see the manuals for TC, TCz, UR, and URz)	Add RCU logical path.	`raidcom add rcu_path -cu_free <serial#> <id> <pid> -mcu_port <port> -rcu_port <port>`
		Delete RCU logical path.	`raidcom delete rcu_path -cu_free <serial#> <id> <pid> -mcu_port <port> -rcu_port <port>`
	Journal (see the manuals for UR and URz)	Register journal volume to Journal.	`raidcom add journal -journal_id <journal ID#> {-ldev_id <ldev#> …[-cnt <count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]} [-mp_blade_id <mp#> | -timer_type <timer type> ]`
		Delete journal volume from Journal/ Delete journal.	`raidcom delete journal -journal_id <journal ID#> [-ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]]`
		Change the Universal Replicator option to be used at Journal.	`raidcom modify journal -journal_id <journal ID#> {[-data_overflow_watch<time>] [-cache_mode <y/n>][-timer_type <type>]} | -path_blocked_watch <time> [-mirror_id <mu#>] | -mp_blade_id <mp#>`
		Display journal information.	`raidcom get journal [ -key <keyword>]raidcom get journal[t]`

Available provisioning operation (specifying device group)

Summary

CCI can execute provisioning operation by specifying a device group. When specifying a device group, the LDEVs belonging to the device group can be operated at a time. For details about device group, see LDEV grouping function on page 3-25.

The following table lists the provisioning operations that can be executed by specifying a device group.

Table 5-2 Performing provisioning operations by specifying a device group

Contents of operation	Command
Register a journal group to a journal	`raidcom add journal`
Delete a journal group from a journal/delete a journal	`raidcom delete journal`
Delete an LDEV/V-VOL	`raidcom delete ldev`

Contents of operation	Command
Extend the capacity of V-VOL for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering	`raidcom extend ldev`
Display the LDEV information	`raidcom get ldev`
Format an LDEV	`raidcom initialize ldev`
Create an LU path	`raidcom add lun`
Delete an LU path	`raidcom delete lun`
Create a pool for Copy-on-Write Snapshot	`raidcom add snap_pool`
Extend the capacity of a pool for Copy-on-Write Snapshot	`raidcom add snap_pool`
Create a pool for Dynamic Provisioning, Dynamic Provisioning for Mainframe	`raidcom add dp_pool`
Extend the capacity of a pool for Dynamic Provisioning, Dynamic Provisioning for Mainframe, Dynamic Tiering	`raidcom add dp_pool`
Create a resource group	`raidcom add resource`
Delete a resource group	`raidcom delete resource`

Operation method

Specify the name of device group (max: 32 characters) and the device name in the device group (max: 32 characters), and execute a command.

The following shows an example to map the LDEV to the LUN by specifying a device group.

When the both of device group name and device name, the operation is executed for the LDEV that matches to the specified device name in the device group. If the device name is omitted to specify, the operation is executed for all of the LDEVs belonging to the device group.

Information of the device group to be operated

```
C:\HORCM\etc>raidcom get device_grp -device_grp_name grp1
LDEV_GROUP            LDEV_NAME           LDEV#    Serial#
grp1                    data0             17000     64577
grp1                    data0             17001     64577
grp1                    data1             17002     64577
grp1                    data1             17003     64577
```

Result

The following shows the result when the raidcom add lun command is executed by specifying device group name: grp1, and device name: data 0.

```
C:\HORCM\etc>raidcom add lun -port CL8-A -grp_opt ldev -device_grp_name
grp1 data0
GROUP = grp1, DEVICE = data0, UnitID = 0, LDEV = 17000(0x4268)[1], PORT =
CL8-A, LUN = none:
raidcom: LUN 0(0x0) will be used for adding.
done
GROUP = grp1, DEVICE = data0, UnitID = 0, LDEV = 17001(0x4269)[1], PORT =
CL8-A, LUN = none:
raidcom: LUN 1(0x1) will be used for adding.
done
C:\HORCM\etc>raidcom get lun -port CL8-A-0
PORT   GID  HMD            LUN  NUM     LDEV  CM    Serial#   HMO_BITs
CL8-A    0  LINUX/IRIX       0    1    17000   -      64577
CL8-A    0  LINUX/IRIX       1    1    17001   -      64577
```

The following shows the result when the **raidcom add lun** command is executed by specifying device group name: grp1 only (omitting device name).

```
C:\HORCM\etc>>raidcom add lun -port CL8-A -grp_opt ldev -device_grp_name
grp1
GROUP = grp1 , DEVICE = data0 , UnitID = 0 , LDEV = 17000(0x4268)[1] , PORT
= CL8-A  , LUN = none :
raidcom: LUN 0(0x0) will be used for adding.
done
GROUP = grp1 , DEVICE = data0 , UnitID = 0 , LDEV = 17001(0x4269)[1] , PORT
= CL8-A  , LUN = none :
raidcom: LUN 1(0x1) will be used for adding.
done
GROUP = grp1 , DEVICE = data1 , UnitID = 0 , LDEV = 17002(0x426A)[1] , PORT
= CL8-A  , LUN = none :
raidcom: LUN 2(0x2) will be used for adding.
done
GROUP = grp1 , DEVICE = data1 , UnitID = 0 , LDEV = 17003(0x426B)[1] , PORT
= CL8-A  , LUN = none :
raidcom: LUN 3(0x3) will be used for adding.
done
C:\HORCM\etc>>raidcom get lun -port CL8-A-0
PORT     GID  HMD          LUN  NUM   LDEV    CM    Serial#   HMO_BITs
CL8-A    0    LINUX/IRIX     0    1   17000   -     64577
CL8-A    0    LINUX/IRIX     1    1   17001   -     64577
CL8-A    0    LINUX/IRIX     2    1   17002   -     64577
CL8-A    0    LINUX/IRIX     3    1   17003   -     64577
```

The following shows the example for specifying device groups and creating journal.

```
C:\HORCM\etc>raidcom add device_grp -device_grp_name dg_jnl1 data1 -
ldev_id 512 513 514 515
 C:\HORCM\etc>raidcom get device_grp
LDEV_GROUP                    Serial#
dg_jnl1                         64539

C:\HORCM\etc>raidcom get device_grp -device_grp_name dg_jnl1
LDEV_GROUP                    LDEV_NAME                       LDEV#     Serial#
dg_jnl1                       data1                             512       64539
dg_jnl1                       data1                             513       64539
dg_jnl1                       data1                             514       64539
dg_jnl1                       data1                             515       64539

C:\HORCM\etc>raidcom add journal -journal_id 2 -grp_opt ldev -
device_grp_name dg_jnl1
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 512(0x0200)[1] ,
PORT = none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 513(0x0201)[1] , PORT
= none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 514(0x0202)[1] , PORT
= none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 515(0x0203)[1] , PORT
= none , LUN = none :done
```

Common operations when executing provisioning operations

When executing each provisioning operation, log in, log out, lock resources, unlock resources, and view resource group information using the following operational flow.

Step	Summary	Contents of operation	Command of Execution
1	Logging in	Specify your user name and password to log in.	`raidcom -login <user_name> <password>`
2	Locking resource group	Lock the resource group.	`raidcom lock resource -resource_name <resource group name > [-time <time(sec)>]`
3	Provisioning operations	Execute provisioning operations.	--
4	Unlocking resource group	Unlock the resource group.	`raidcom unlock resource -resource_name <resource group name>`
5	Displaying a resource group information	Displays a resource group information, and confirms a resource group information and a lock information.	`raidcom get resource`
6	Logging out	Log out.	`raidcom -logout`

Resource group operations

Creating resource groups

To create resource groups, perform the following provisioning operations.

Step	Operation	Description	Command
1	Creating resource groups	Creates resource groups.	`raidcom add resource -resource_name <resource group name>`
2	Allocationg resources to resource groups	Specifies resources that are allocated to meta_resource (resource group), and allocates resources to created resource groups.	`raidcom add resource -resource_name <resource group name> [-ldev_id <ldev#> | -port <port#> | -port <port#> <host group name> | -parity_grp_id <gno-sgno> | -external_grp_id <gno-sgno>]`
3	Displaying a resource group information	Displays a resource group information, and confirms execution results of commands.	`raidcom get resource`

Deleting resource groups

To delete resource groups, perform the following provisioning operations.

Step	Operation	Description	Command
1	Deleting resources that are allocated to resource groups.	Deletes resources that are allocated to resource groups. In other words, this operation allocates resources to resource group: meta_resource.	`raidcom delete resource -resource_name <resource group name> [-ldev_id <ldev#> | -port <port#> | -port <port#> <host group name> | -parity_grp_id <gno-sgno> | -external_grp_id <gno-sgno>]`
2	Confirming resource deletions	Confirms that resources are not allocated to resource groups that you want to delete. At that time, allocation of resources to the resource group: meta_resource must be finished.	`raidcom get resource`
3	Deleting resource groups	Deletes resource groups.	`raidcom delete resource -resource_name <resource group name>`
4	Displaying resource group information	Displays resource group information and confirms results of command executions.	`raidcom get resource`

Allocating resources that are allocated to resource groups to other resource groups

When you want to allocate resources that are already allocated to resource groups to other resource groups, resources must be once allocated to resource group: meta_resource. After that, allocate resources to the resource groups that you want to allocate. LDEVs that configure journals, pools, LUSEs or device groups must be allocated to resource groups particularly. The following shows the necessary provisioning operations.

Step	Operation	Description	Command
1	Deleting resources that are allocated to resource groups	Deletes resources that are allocated to resource groups. In other words, this operation allocates resources to resource group: meta_resource.	`raidcom delete resource -resource_name <resource group name> [-ldev_id <ldev#> | -port <port#> | -port <port#> <host group name> | -parity_grp_id <gno-sgno> | -external_grp_id <gno-sgno>]`
2	Confirming resource deletions	Confirms that resources are not allocated to resource groups that you want to delete. At that time, allocation of resources to the resource group: meta_resource must be finished.	`raidcom get resource`
3	Allocating resources to resource groups	Specifies resources that are allocated to meta_resource (resource group), and allocates resources to resource groups.	`raidcom add resource -resource_name <resource group name> [-ldev_id <ldev#> | -port <port#> | -port <port#> <host group name> | -parity_grp_id <gno-sgno> | -external_grp_id <gno-sgno>]`
4	Displaying resource group information	Displays resource group information and confirms results of command executions.	`raidcom get resource`

LDEVs that are allocated to journals or pools must be migrated by users. We recommend that you register LDEVs that are allocated to journals or pools as device groups, and then operate after specifying them by the device groups.

Execution example

The following shows the execution example of registering LDEVs to the pool as device groups, creating resource groups in the device group unit and migrating created resource groups.

```
C:\HORCM\etc>raidcom add device_grp -device_grp_name dg_jnl1 data1 -
ldev_id 512 513 514 515
 C:\HORCM\etc>raidcom get device_grp
LDEV_GROUP                    Serial#
dg_jnl1                         64539

C:\HORCM\etc>raidcom get device_grp -device_grp_name dg_jnl1
LDEV_GROUP                    LDEV_NAME                       LDEV#     Serial#
dg_jnl1                       data1                             512      64539
dg_jnl1                       data1                             513      64539
dg_jnl1                       data1                             514      64539
dg_jnl1                       data1                             515      64539


C:\HORCM\etc>raidcom add resource -resource_name rsg002 -grp_opt ldev -
device_grp_name dg_jnl1
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 512(0x0200)[1] ,
PORT = none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 513(0x0201)[1] , PORT
= none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 514(0x0202)[1] , PORT
= none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 515(0x0203)[1] , PORT
= none , LUN = none :done


C:\HORCM\etc>raidcom delete resource -resource_name rsg002 -grp_opt ldev
-device_grp_name dg_jnl1
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 512(0x0200)[1] ,
PORT = none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 513(0x0201)[1] , PORT
= none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 514(0x0202)[1] , PORT
= none , LUN = none :done
GROUP = dg_jnl1 , DEVICE = data1 , UnitID = 0 , LDEV = 515(0x0203)[1] , PORT
= none , LUN = none :done
```

Internal volume operations

Creating internal volumes (open-systems)

To create LDEVs of internal open-systems volumes and make the LDEVs available to the host, perform the following provisioning operations.

Step	Operation	Description	Command
1	Setting port	Enable LUN security of the port. Modify settings such as port topology and data transfer speed as needed.	`raidcom modify port -port <port>-security_switch y`
2	Creating host group	Specify port and create host group.	`raidcom add host_grp -port <port> -host_grp_name <host group name>`

Step	Operation	Description	Command
3	Setting host mode	Specify port and set host mode for host group.	`raidcom modify host_grp -port <port> [<host group name>] -host_mode < host mode> [-host_mode_opt <host mode option> … ]`
4	Displaying host group information	Display host group information and confirm result of executing command.	`raidcom get host_grp -port <port> [<host group name>]`
5	Adding host to host group	Register host to host group of the port.	`raidcom add hba_wwn -port <port> [<host group name>] -hba_wwn <WWN strings>`
6	Displaying WWN information	Display WWN of connection host registered to the host group and confirm the result of executing the command.	`raidcom get hba_wwn -port <port> [<host group name>]`
7	Creating LDEV	Specify a parity group and create LDEV.	`raidcom add ldev -parity_grp_id <gno-sgno> -ldev_id <ldev#> -capacity <size> [-emulation <emulation type>] [-location <lba>] [-mp_blade_id <mp#>]`
8	Formatting LDEV	Format created LDEV.	`raidcom initialize ldev -ldev_id <ldev#> -operation <type>`
9	Creating LDEV nickname (arbitrary)	Create nickname for created LDEV. This operation is arbitrary.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
10	Setting MP blade of LDEV	Set MP blade of created LDEV.	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
11	Displaying LDEV information	Display information of created LDEV and confirm the result of executing the command.	`raidcom get ldev -ldev_id <ldev#> … [-cnt <count>] [-key <keyword>]`
12	Creating LU path	Specify port, map LDEV to LUN and create an LU path.	`raidcom add lun -port <port> [<host group name>] -ldev_id <ldev#> [-lun_id<lun#>]`
13	Displaying LU path information	Display LU path information and confirm the result of executing the command.	`raidcom get lun -port <port> [<host group name>]`

Creating internal volumes (Mainframe volume)

To create LDEVs of internal volumes (Mainframe volume) and make the LDEVs available to the host, perform the following provisioning operations.

Step	Operation	Description	Command
1	SSID settings (arbitrarily)	Configures the SSID unless it is configured. Set (register) the SSID by specifying undefined LDEV numbers in the area in which SSIDs are not defined.	`raidcom modify ldev -ldev_id <ldev#> -ssid<value>`
2	Creating LDEVs	Creates LDEVs by specifying parity groups.	`raidcom add ldev -parity_grp_id <gno-sgno> -ldev_id <ldev#> {-capacity <size> | -offset_capacity <size> | -cylinder <size>} [-emulation <emulation type>][-location <lba>][-mp_blade_id <mp#>]`
3	Formatting LDEVs	Formats created LDEVs.	`raidcom initialize ldev -ldev_id <ldev#> -operation <type>`
4	Creating LDEV nicknames (arbitrarily)	Creates LDEV nicknames. This operation is optional.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
5	Configuring MP blades of LDEVs	Configures MP blades of created LDEVs.	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
6	Displaying a LDEV information	Displays an information of created LDEV, and confirms an execution result of the command.	`raidcom get ldev -ldev_id <ldev#> … [-cnt <count>] [-key <keyword>]`

Script examples

The following shows the script examples of internal volume (mainframe volume) operations.

```
raidcom -login USER01 PASS01                    ;Log in with the User ID: USER01 and
                                                ;Password: PASS01.
raidcom lock resource -resource_grp_name        ;Lock the resource group: meta_resource
meta_resource                                   ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Create each 10 of 483078 cylinder LDEV to
raidcom add ldev -parity_grp_id 1-1 -emulation  ;Parity_grp_id 1-1 (LDEV: 0 to 9)
3390-A -cylinder 483078 -ldev_id %%i            ;
)                                               ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Execute Quick format to LDEV: 0 to 9
raidcom initialize ldev -ldev_id %%i -operation ;
qfmt                                            ;
)                                               ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Give a nickname to LDEV: 0 to 9
raidcom modify ldev -ldev_id %%i -device_name   ;(my_volume 0 to 9)
my_volume_%%i                                   ;
)                                               ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Set to 2 the MP blade ID of LDEV: 0 to 9
raidcom modify ldev -ldev_id %%i -mp_blade_id 2 ;
)                                               ;
                                                ;
raidcom get ldev -ldev_id 0 -cnt 10             ;Display the information of LDEV:0 to
                                                ;9(Internal VOL).
for /l %%i in (0,1,9) do (                      ;
raidcom add device_grp -device_grp_name grp1    ;Give the device name: data 0 to 9 to the
data%%i -ldev_id %%i                            ;LDEV:0 to 9, and add it to Device group name
)                                               ;grp1(data0 to 9).
                                                ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
raidcom get device_grp -device_grp_name grp1    ;Display the device group information: grp1.
                                                ;
raidcom add copy_grp -copy_grp_name ora grp1    ;Create a copy group (ora) by the device group
                                                ;(grp1).
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
raidcom get copy_grp                            ;Display the copy group information.
                                                ;
for /l %%i in (0,1,9) do (                      ;Defining paths of LDEV: 0 to 9 to Port: CL1-A
raidcom add lun -port CL1-A HP-UX-P -ldev_id %%i ;host group HP-UX-P
)                                               ;LU number is given automatically.
                                                ;
raidcom get lun -port CL1-A HP-UX-P             ;Display the path information that is set to
                                                ;PortCL1-A, host group HP-UX-P.
                                                ;
raidcom unlock resource -resource_grp_name      ;Unlock the resource group: meta_resource.
meta_resource                                   ;
                                                ;
raidcom get resource                            ;Display the resource group information.
                                                ;
raidcom -logout                                 ;Log out.
```

Figure 5-2 Script examples of internal volume (Mainframe volume) operation

Script examples

The following shows script examples for internal open-system volume operations.

```
raidcom -login USER01 PASS01                    ;Log in with the User ID: USER01 and
                                                ;Password: PASS01.
raidcom lock resource -resource_grp_name        ;Lock the resource group: meta_resource
meta_resource                                   ;
                                                ;
raidcom modify port -port CL1-A -security       ;Turn ON the security switch of PortCL1-A
_switch y                                       ;and PortCL2-A
raidcom modify port -port CL2-A -security       ;
_switch y                                       ;
                                                ;Set Host group#0 to PortCL1-A, and Host
raidcom add host_grp -port CL1-A-0 -            ;group name: HP-UX-P
host_grp_name HP-UX-P                           ;Set Host group#0 to PortCL2-A, and Host
raidcom add host_grp -port CL2-A-0 -            ;group name: HP-UX-S
host_grp_name HP-UX-S                           ;
                                                ;
raidcom modify host_grp -port CL1-A-0 -host_mode ;Set Host mode: HP-UX to the Host group #0
HP-UX                                           ;of PortCL1-A and PortCL2-A
raidcom modify host_grp -port CL2-A-0 -host_mode ;
HP-UX                                           ;
                                                ;
raidcom get host_grp -port CL1-A                ;Display the host group information that is
raidcom get host_grp -port CL2-A                ;set to PortCL1-A and PortCL2-A
                                                ;
raidcom add hba_wwn -port CL1-A HP-UX-P -hba_wwn ;Set Connection host WWN: 210000e0,8b0256f8
210000e0,8b0256f8                               ;to PortCL1-A and Host group   HP-UX-P
raidcom add hba_wwn -port CL2-A HP-UX-S -hba_wwn ;Set Connection host WWN: 210000e0,8b0256f9
210000e0,8b0256f9                               ;to PortCL2-A and Host group HP-UX-S
                                                ;
raidcom get hba_wwn -port CL1-A HP-UX-P         ;Display Connection host WWN that is set
raidcom get hba_wwn -port CL2-A HP-UX-S         ;to PortCL1-A and Host group HP-UX-P
                                                ;Display Connection host WWN that is set
                                                ;to PortCL2-A and Host group HP-UX-S
                                                ;
for /l %%i in (0,1,9) do (raidcom add ldev -    ;Create each 10 of 10G LDEV to Parity_grp_id
ldev_id %%i -capacity 10g -parity_grp_id 1-1    ;1-1 and 1-2 (LDEV: 0 to 9, 10 to 19)
)                                               ;
for /l %%i in (10,1,19) do (                    ;
        raidcom add ldev -ldev_id %%i -capacity ;
10g -parity_grp_id 1-2                          ;
)                                               ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
for /l %%i in (0,1,19) do (                     ;Execute Quick format to LDEV: 0 to 19
raidcom initialize ldev -ldev_id %%i -operation ;
qfmt                                            ;
)                                               ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
for /l %%i in (0,1,19) do (                     ;Give a nickname to LDEV: 0 to 19
raidcom modify ldev -ldev_id %%i -device_name   ;(my_volume 0 to 19)
my_volume_%%i                                   ;
)                                               ;
                                                ;
for /l %%i in (0,1,19) do (                     ;Set to 2 the MP blade ID of LDEV : 0 to 19
raidcom modify ldev -ldev_id %%i -mp_blade_id 2 ;
)                                               ;
```

Figure 5-3 Script examples of internal open-system volume operation (1/2)

```
raidcom get ldev -ldev_id 0 -cnt 20              ;Display the information of LDEV:0 to
                                                 ;19(Internal VOL).
for /l %%i in (0,1,9) do (                       ;
raidcom add device_grp -device_grp_name grp1     ;Give the device name: data 0 to 19 to the
data%%i -ldev_id %%i                             ;LDEV:0 to 19, and add it to Device group name
)                                                ;grp1(data0 to 9) and grp2(data10 to 19).
for /l %%i in (10,1,19) do (                     ;
raidcom add device_grp -device_grp_name grp2     ;
data%%i -ldev_id %%i                             ;
)                                                ;
raidcom get command_status                       ;
raidcom reset command_status                     ;
                                                 ;
raidcom get device_grp -device_grp_name grp1     ;Display the device group information: grp1
raidcom get device_grp -device_grp_name grp2     ;and grp2.
                                                 ;
                                                 ;
raidcom add copy_grp -copy_grp_name ora grp1 grp2;Create a copy group (ora) by the device group
raidcom get command_status                       ;(grp1 and grp2).
raidcom reset command_status                     ;
                                                 ;
raidcom get copy_grp                             ;
                                                 ;Display the copy group information.
for /l %%i in (0,1,9) do (                       ;
raidcom add lun -port CL1-A HP-UX-P -ldev_id %%i ;Defining paths of LDEV: 0 to 9 to Port: CL1-A
)                                                ;host group HP-UX-P
for /l %%i in (10,1,19) do (                     ;Defining paths of LDEV: 10 to 19 to Port:
raidcom add lun -port CL2-A HP-UX-S -ldev_id %%i ;CL2-A host group HP-UX-S
)                                                ;LU number is given automatically.
                                                 ;
raidcom get lun -port CL1-A HP-UX-P              ;Display the path information that is set to
raidcom get lun -port CL2-A HP-UX-S              ;PortCL1-A, host group HP-UX-P, and the path
                                                 ;information that is set to PortCL2-A, host
                                                 ;group HP-UX-S.
                                                 ;
raidcom unlock resource -resource_grp_name       ;Unlock the resource group: meta_resource.
meta_resource                                    ;
                                                 ;
raidcom get resource                             ;Display the resource group information.
                                                 ;
raidcom -logout                                  ;Log out.
```

Figure 5-4 Script examples of internal open-system volume operation (2/2)

Virtual volume (Dynamic Provisioning) operations

Creating virtual volumes (Dynamic Provisioning)

Use the following provisioning operations to create LDEVs of virtual volumes (Dynamic Provisioning) and make the LDEVs available to the host.

Step	Operation overview	Description	Executed command
1	Setting port	Enable LUN security for the port. Modify settings such as port topology and data transfer speed as needed.	`raidcom modify port -port <port>-security_switch y`
2	Creating host group	Specify port and create host group.	`raidcom add host_grp -port <port> -host_grp_name <host group name>`

Step	Operation overview	Description	Executed command
3	Setting host mode	Specify port and set host mode for host group.	`raidcom modify host_grp -port <port> [<host group name>] -host_mode <host mode> [-host_mode_opt <host mode option> … ]`
4	Displaying host group information	Display host group information and confirm result of executing command.	`raidcom get host_grp -port <port> [<host group name>]`
5	Adding host to host group	Register host to host group of the port.	`raidcom add hba_wwn -port <port> [<host group name>] -hba_wwn <WWN strings>`
6	Displaying WWN information	Display WWN of connection host registered to the host group and confirm the result of executing the command.	`raidcom get hba_wwn -port <port> [<host group name>]`
7	Creating LDEV	Specify a parity group and create LDEV.	`raidcom add ldev -parity_grp_id <gno-sgno> -ldev_id <ldev#> {-capacity <size> | -offset_capacity <size> | -cylinder <size>} [-emulation <emulation type>][-location <lba>] [-mp_blade_id <mp#>]`
8	Formatting LDEV	Format created LDEV.	`raidcom initialize ldev -ldev_id <ldev#> -operation <type>`
9	Creating LDEV nickname (arbitrary)	Create nickname for LDEV. This operation is arbitrary.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
10	Setting MP blade of LDEV	Set MP blade of created LDEV.	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
11	Displaying LDEV information	Display information of created LDEV and confirm the result of executing the command.	`raidcom get ldev -ldev_id <ldev#> … [-cnt <count>] [-key <keyword>]`
12	Creating pool (for Dynamic Provisioning)	Create pool (for Dynamic Provisioning).	`raidcom add dp_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>}} -ldev_id <ldev#> …[-cnt <count>] [-user_threshold <threshold_1> [<threshold_2>]]`

Step	Operation overview	Description	Executed command
13	Creating LDEV (V-VOL)	Specify pool and create an LDEV(V-VOL).	`raidcom add ldev -pool {<pool ID#> | <pool naming> | snap} -ldev_id <ldev#> {-capacity <size> | -offset_capacity <size> | -cylinder <size>} [-emulation <emulation type>][-location <lba>] [-mp_blade_id <mp#>]`
14	Creating LDEV (V-VOL) nickname (arbitrary)	Create nickname for the created LDEV. This operation is arbitrary.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
15	Setting MP blade of LDEV (V-VOL)	Set MP blade of created LDEV (V-VOL).	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
16	Displaying LDEV information (V-VOL)	Display information of created LDEV (V-VOL) and confirm the result of executing the command.	`raidcom get ldev -ldev_id <ldev#> … [-cnt <count>] [-key <keyword>]`
17	Creating LU path	Specify port, map LDEV to LUN and create an LU path.	`raidcom add lun -port <port> [host group name] -ldev_id <ldev#> [-lun_id <lun#>]`
18	Displaying LU path information	Display LU path information and confirm the result of executing the command.	`raidcom get lun -port <port> [<host group name>]`

Script examples

The following shows script examples of virtual volume (Dynamic Provisioning) operation.

```
raidcom -login USER01 PASS01                    ;Log in with the user ID : USER01 and the
                                                ;password : PASS01.
raidcom lock resource -resource_grp_name        ;Lock the resource group: meta_resource.
meta_resource                                   ;
                                                ;
raidcom modify port -port CL1-A -security       ;Turn ON the security switch of PortCL1-A and
_switch y                                       ;PortCL2-A.
raidcom modify port -port CL2-A -security       ;
_switch y                                       ;
                                                ;
raidcom add host_grp -port CL1-A-0 -            ;Set the host group #0 to PortCL1-A, host
host_grp_name HP-UX-P                           ;group name: HP-UX-P, and the host group #0 to
raidcom add host_grp -port CL2-A-0 -            ;PortCL2-A, host group name: HP-UX-S.
host_grp_name HP-UX-S                           ;
                                                ;
raidcom modify host_grp -port CL1-A-0 -         ;Set the host mode: HP-UX to the host group#0
host_mode HP-UX                                 ;of PortCL1-A and PortCL2-A.
raidcom modify host_grp -port CL2-A-0 -         ;
host_mode HP-UX                                 ;
                                                ;Display the host group information that is
raidcom get host_grp -port CL1-A                ;set to PortCL1-A and PortCL2-A.
raidcom get host_grp -port CL2-A                ;
                                                ;Set the connection host WWN:210000e0,8b0256f8
raidcom add hba_wwn -port CL1-A HP-UX-P -       ;to the PortCL1-A, host group HP-UX-P, and
hba_wwn 210000e0,8b0256f8                       ;the connection host WWN: 210000e0,8b0256f9 to
raidcom add hba_wwn -port CL2-A HP-UX-S -       ;the PortCL2-A, host group HP-UX-S.
hba_wwn 210000e0,8b0256f9                       ;
                                                ;Display the connection host WWN that is set
raidcom get hba_wwn -port CL1-A HP-UX-P         ;to PortCL1-A, host group HP-UX-P, and the
raidcom get hba_wwn -port CL2-A HP-UX-S         ;connection host WWN that is set to PortCL2-A,
                                                ;host group HP-UX-S.
for /l %%i in (0,1,9) do (raidcom add ldev -    ;Create each 10 of 10G Ldev to the
ldev_id %%i -capacity 10g -parity_grp_id 1-1    ;Parity_grp_id 1-1 (LDEV: 0 to 9).
)                                               ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Execute the quick format to LDEV:0 to 9.
raidcom initialize ldev -ldev_id %%i -operation ;
qfmt                                            ;
)                                               ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;Give a nickname to LDEV:0 to 9.
for /l %%i in (0,1,9) do (                      ;(my_volume 0 to 9)
raidcom modify ldev -ldev_id %%i -device_name   ;
my_volume_%%i
)
```

Figure 5-5 Script examples of virtual volume operation (Dynamic Provisioning) (1/3)

```
for /l %%i in (0,1,9) do (                    :Set the LDEV MP Blade ID of LDEV: 0 to 9 to
raidcom modify ldev -ldev_id %%i -mp_blade_id 2 :2.
)                                             :
                                              :Display the information of LDEV: 0 to
raidcom get ldev -ldev_id 0 -cnt 10           :9(Internal VOL).
                                              :
raidcom add dp_pool -pool_id 1 -ldev_id 0 -cnt :Create Pool:1 by using LDEV: 0 to 9.
10                                            :
raidcom get command_status                    :
raidcom reset command_status                  :
                                              :
for /l %%i in (10,1,19) do (                  :Create each 10 of 10G VVOL to Pool_id 1.
raidcom add ldev -ldev_id %%i                 :(LDEV: 10 to 19, 20 to 29)
-capacity 10g -pool 1                         :
)                                             :
                                              :
for /l %%i in (20,1,29) do (                  :
raidcom add ldev -ldev_id %%i                 :
-capacity 10g -pool 1                         :
)                                             :
raidcom get command_status                    :
raidcom reset command_status                  :
                                              :
for /l %%i in (10,1,29) do (                  :Give a nickname to VVOL: 10 to 29.
raidcom modify ldev -ldev_id %%i -device_name :(my_virtual_volume 10 to 29)
my_virtual_volume_%%i                         :
)                                             :
                                              :
for /l %%i in (10,1,29) do (                  :Set the VVOL MP Blade ID of VVOL:10 to 29 to
raidcom modify ldev -ldev_id %%i -mp_blade_id 2 :2.
)                                             :
                                              :Display the information of VVOL: 10 to
raidcom get ldev -ldev_id 10 -cnt 20          :29(virtual VOL).
                                              :
for /l %%i in (10,1,19) do (                  :Give the device name: data 10 to 29 to VVOL:
raidcom add device_grp -device_grp_name grp1  :10 to 29, and add it to the device group name
data%%i -ldev_id %%i                          :grp1(data10 to 19) and grp2(data20 to 29).
)                                             :
for /l %%i in (20,1,29) do (                  :
raidcom add device_grp -device_grp_name grp2  :
data%%i -ldev_id %%i                          :
)                                             :
raidcom get command_status                    :
raidcom reset command_status                  :
                                              :
raidcom get device_grp -device_grp_name grp1  :Display the device group information:grp1 and
raidcom get device_grp -device_grp_name grp2  :grp2.
                                              :
raidcom add copy_grp -copy_grp_name ora grp1  :Create a copy group (ora) with the device
grp2                                          :group (grp1 and grp2).
                                              :
raidcom get command_status                    :
raidcom reset command_status                  :
```

Figure 5-6 Script examples of virtual volume operation (Dynamic Provisioning) (2/3)

```
raidcom get copy_grp                          :Display the copy group information
                                              :
for /l %%i in (10,1,19) do (                  :Define a path of VVOL: 10 to 19 to Port: CL1-
raidcom add lun -port CL1-A HP-UX-P -ldev_id  :A host group HP-UX-P.
%%i                                           :Define a path of VVOL: 20 to 29 to Port: CL2-
)                                             :A host group HP-UX-S.
for /l %%i in (20,1,29) do (                  :Given an LU number automatically.
raidcom add lun -port CL2-A HP-UX-S -ldev_id  :
%%i                                           :
)                                             :Display the path information that is set to
                                              :PortCL1-A, host group HP-UX-P, and the path
raidcom get lun -port CL1-A HP-UX-P           :information that is set to PortCL2-A, host
raidcom get lun -port CL2-A HP-UX-S           :group HP-UX-S.
                                              :
                                              :
raidcom unlock resource -resource_grp_name    :Unlock the resource group: meta_resource.
meta_resource                                 :
                                              :
raidcom get resource                          :Display the resource group information.
                                              :
raidcom -logout                               :
                                              :Log out.
```

Figure 5-7 Script examples of virtual volume operation (Dynamic Provisioning) (3/3)

Virtual volume (Dynamic Provisioning for Mainframe) operations

Creating virtual volumes (Dynamic Provisioning for Mainframe)

To create LDEVs of virtual volumes (Dynamic Provisioning for Mainframe) and make the LDEVs available to the host, perform the following Provisioning operations.

Step	Operation overview	Description	Executed command
1	SSID settings (arbitrarily)	Configures the SSID unless it is configured. Set (register) the SSID by specifying undefined LDEV numbers in the area in which SSIDs are not defined.	`raidcom modify ldev -ldev_id<ldev#> -ssid<value>`
2	Creating LDEVs	Creates LDEVs by specifying parity groups. Specifies only 3390-V for the emulation type.	`raidcom add ldev -parity_grp_id <gno-sgno> -ldev_id <ldev#> {-capacity <size> | -offset_capacity <size> | -cylinder <size>} -emulation 3390-V -location <lba>] [-mp_blade_id <mp#>]`
3	Formatting LDEVs	Formats created LDEVs.	`raidcom initialize ldev -ldev_id <ldev#> -operation <type>`
4	Creating LDEV nicknames (arbitrarily)	Creates LDEV nicknames. This operation is optional.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`

Step	Operation overview	Description	Executed command
5	Configuring MP blades of LDEVs	Configures MP blades of created LDEVs.	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
6	Displaying a LDEV information	Displays an information of created LDEV, and confirms an execution result of the command.	`raidcom get ldev -ldev_id <ldev#> … [-cnt <count>] [-key <keyword>]`
7	Creating the pool (for the Hitachi Dynamic Provisioning for mainframe)	Creates the pool for the Hitachi Dynamic Provisioning for mainframe.	`raidcom add dp_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>} {-ldev_id <ldev#> …[-cnt <count>] | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}[-user_threshold <threshold_1> [<threshold_2>]]`
8	Creating LDEV (V-VOL)	Specifies the pool and creates LDEV (V-VOL).	`raidcom add ldev -pool {<pool ID#> | <pool naming> | snap} -ldev_id <ldev#>{-capacity <size> | -offset_capacity <size> | -cylinder <size>} [-emulation <emulation type>][-location <lba>] [-mp_blade_id <mp#>]`
9	Creating LDEV (V-VOL) nicknames (arbitrarily)	Creates LDEV (V-VOL) nicknames. This operation is optional.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
10	Configuring MP blades of LDEVs (V-VOL)	Configures MP blades of created LDEVs (V-VOL).	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
11	Displaying a LDEV (V-VOL) information	Displays an information of created LDEV (V-VOL), and confirms an execution result of the command.	`raidcom get ldev -ldev_id <ldev#> [-cnt <count>] [-key <keyword>]`

Script examples

The following shows the script examples of virtual volume (Dynamic Provisioning for mainframe) operation.

```
raidcom -login USER01 PASS01                    ;Log in with the user ID: USER01 and the
                                                ;password: PASS01.
raidcom lock resource -resource_grp_name        ;Lock the resource group: meta_resource.
meta_resource                                   ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Create each 10 of 483078 cylinder LDEV to
raidcom add ldev -parity_grp_id 1-1 -emulation  ;Parity_grp_id 1-1 (LDEV: 0 to 9)
3390-V -cylinder 483078 -ldev_id %%i            ;
)                                               ;
raidcom get command_status                      ;
raidcom reset command_statu                     ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Execute the quick format to LDEV:0 to 9.
raidcom initialize ldev -ldev_id %%i -operation ;
qfmt                                            ;
)                                               ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Give a nickname to LDEV:0 to 9.
raidcom modify ldev -ldev_id %%i -device_name   ;(my_volume 0 to 9)
my_volume_%%i                                   ;
)                                               ;
                                                ;
for /l %%i in (0,1,9) do (                      ;Set the LDEV MP Blade ID of LDEV: 0 to 9 to
raidcom modify ldev -ldev_id %%i -mp_blade_id 2 ;2.
)                                               ;
                                                ;
raidcom get ldev -ldev_id 0 -cnt 10             ;Display the information of LDEV: 0 to
                                                ;9(Internal VOL).
                                                ;
raidcom add dp_pool -pool_id 1 -ldev_id 0 -cnt  ;Create Pool:1 by using LDEV: 0 to 9.
10                                              ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
for /l %%i in (10,1,19) do(                     ;Create 10 of 5420 cylinder VVOL to
raidcom add lcev -ldev_id %%i -emulation 3390-A ;Pool 1.(LDEV: 10 to 19)
-cylinder 5420 -pool 1                          ;
)                                               ;
                                                ;
raidcom get command_status                      ;
raidcom reset command_status                    ;
                                                ;
for /l %%i in (10,1,29) do (                    ;Give a nickname to VVOL: 10 to 29.
raidcom modify ldev -ldev_id %%i -device_name   ;(my_virtual_volume 10 to 29)
my_virtual_volume_%%i                           ;
)
```

Figure 5-8 Script examples of virtual volume operation (Dynamic Provisioning for Mainframe) (1/2)

```
for /l %%i in (10,1,29) do (                    ;Set the VVOL MP Blade ID of VVOL:10 to 29 to
raidcom modify ldev -ldev_id %%i -mp_blade_id 2 ;2.
)                                               ;
                                                ;
raidcom get ldev -ldev_id 10 -cnt 20            ;Display the information of VVOL: 10 to
                                                ;29(virtual VOL).
                                                ;
raidcom unlock resource -resource_grp_name      ;Unlock the resource group: meta_resource.
meta_resource                                   ;
                                                ;
raidcom get resource                            ;Display the resource group information.
                                                ;
raidcom -logout                                 ;Log out.
```

Figure 5-9 Script examples of virtual volume operation (Dynamic Provisioning for Mainframe) (2/2)

Virtual volume (Dynamic Tiering) operations

Operational flow

When using the V-VOL (Dynamic Tiering), tiers of pools must be created after creating pools, and then the performance of pools must be monitored before the operation. If the performance of pools are insufficient, extend the capacity of pool volumes (addition of pool volumes) and of the V-VOL.

The following diagram shows the flow of work to use a virtual volume (Dynamic Tiering) when operating with GUI (Storage Navigator) or CCI:


1. Preparing for operations
GUI
CCI
Expanding cache memory
Creating pool-VOLs and formatting LDEVs
Create LDEVs wizard
Format LDEVs wizard
raidcom add ldev
raidcom initialize ldev
Creating a pool and adding the pool-VOLs (Tier reallocation: Disable) *1
Create Pools wizard
raidcom add dp_pool
Changing Multi-Tier Pool from Disable to Enable *2
raidcom modify pool
Creating V-VOLs
Crate LDEVs wizard
raidcom add ldev
Defining V-VOL LU paths
Add LUN paths wizard
raidcom add lun
Monitoring performance of the pool
Edit Pools wizard
View Tier Properties
raidcom monitor pool
Adding pool-VOLs (Creating tiers)
Create Pools wizard
raidcom add dp_pool
raidcom modify pool
2. Operating
Monitoring performance of the pool
Edit Pools wizard
View Tier Properties
raidcom monitor pool
Luck of performance
Reallocating tiers of the pool
raidcom reallocate pool
Monitoring the pool's free area
Pool window
raidcom get pool
raidcom get dp_pool
If expansion is required
Increasing the pool capacity
(Adding pool-VOLs)
Increasing the V-VOL capacity
Expand Pool wizard
Expand V-VOLs wizard
raidcom add dp_pool
raidcom extend ldev
3. Discontinuing operations
Deleting V-VOL LU paths
Delete LUN paths wizard
raidcom delete lun
Deleting V-VOLs
Delete LDEVs window
raidcom delete ldev
Deleting the Dynamic Tiering pool
Delete Pools wizard
raidcom delete pool
Deleting Dynamic Tiering pool-VOLs
Delete LDEVs window
raidcom delete ldev

Note *1: The multiple tiering pool is disabled when a pool is creating at CCI. And multiple media cannot be registered as a pool volume when a pool is created. Execute tiering after changing the multiple tiering pool to the enabled status.

Note *2: When the multiple tiering pool is enabled, the tiering control is set to "Manual" automatically. To change the setting to "Auto", it is required to execute from Storage Navigator.

Note: Before creating a pool, it is required to create a virtual volume management area on the cache memory. The virtual volume management area is created automatically when add a cache memory. For the information about adding cache memory, please contact the Support Center.

Caution: The operations are explained here are executable by the storage administrator only.

Creating virtual volumes (Dynamic Tiering)

Use the following operations to create LDEVs of virtual volumes (Dynamic Tiering) and making the LDEVs available to the host.

Step	Operation overview	Description	Executed command
1	Setting port	Make enabled the LUN security of port. Modify setting such as port topology and data transfer speed as needed.	`raidcom modify port -port <port>-security_switch y`
2	Creating host group	Specify port and create host group.	`raidcom add host_grp -port <port> -host_grp_name <host group name>`
3	Setting host mode	Specify port and set host mode for host group.	`raidcom modify host_grp -port <port> [<host group name>] -host_mode <host mode> [-host_mode_opt <host mode option> … ]`
4	Displaying host group information	Display host group information and confirm result of executing command.	`raidcom get host_grp -port <port> [<host group name>]`
5	Adding host to host group	Register host to host group of the port.	`raidcom add hba_wwn -port <port> [<host group name>] -hba_wwn <WWN strings>`
6	Displaying WWN information	Display WWN of connection host registered to the host group and confirm the result of executing the command.	`raidcom get hba_wwn {-port <port> [<host group name>]}`

Step	Operation overview	Description	Executed command
7	Creating LDEV	Specify a parity group and create LDEV.	`raidcom add ldev {-parity_grp_id <gno-sgno> -ldev_id <ldev#> {-capacity <size> | -offset_capacity <size> | -cylinder <size>} [-emulation <emulation type>][-location <lba>] [-mp_blade_id <mp#>]`
8	Formatting LDEV	Format created LDEV.	`raidcom initialize ldev -ldev_id <ldev#> -operation <type>`
9	Creating LDEV nickname (arbitrary)	Create LDEV nickname. This operation is arbitrary.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
10	Setting MP blade of LDEV	Set MP blade of created LDEV.	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
11	Displaying LDEV information	Display information of created LDEV and confirm the result of executing the command.	`raidcom get ldev -ldev_id <ldev#> … [-cnt <count>] [-key <keyword>]`
12	Creating pool (for Dynamic Provisioning)	Create pool (for Dynamic Provisioning).	`raidcom add snap_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>}} -ldev_id <ldev#> …[-cnt count>] [-user_threshold <%> ]`
13	Setting pool option	Modify pool for Dynamic Provisioning to pool for Dynamic Tiering.	`raidcom modify pool -pool {<pool ID#> | <pool naming>} -pool_attribute dt_manual`
14	Adding different media to pool volume	Add a pool volume of different media to a pool for Dynamic Tiering.	`raidcom add dp_pool {{-pool_id <pool ID#> [-pool_name <pool naming>] | -pool_name <pool naming>[-pool_id <pool ID#>]} | -pool_id <pool ID#> -pool_name <pool naming>} -ldev_id <ldev#> …[-cnt <count>] [ -user_threshold <threshold_1> [<threshold_2>] ]`
15	Creating LDEV (V-VOL)	Specify pool and create LDEV (V-VOL).	`raidcom add ldev -pool {<pool ID#> | <pool naming> | snap} -ldev_id <ldev#> -capacity <size> [-emulation <emulation type>][-location <lba>] [-mp_blade_id <mp#>]`

Step	Operation overview	Description	Executed command
16	Creating LDEV (V-VOL) nickname (arbitrary)	Create nickname for created LDEV (V-VOL). This operation is arbitrary.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
17	Setting MP blade of LDEV (V-VOL)	Set MP blade of created LDEV (V-VOL).	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
18	Displaying LDEV (V-VOL) information	Display information of created LDEV (V-VOL) and confirm the result of executing the command.	`raidcom get ldev -ldev_id <ldev#> … [-cnt <count>] [-key <keyword>]`
19	Creating LU path	Specify port, map LDEV to LUN and create an LU path.	`raidcom add lun -port <port> [host group name] -ldev_id <ldev#> [-lun_id <lun#>]`
20	Displaying LU path information	Display LU path information and confirm the result of executing the command.	`raidcom get lun -port <port> [<host group name>]`
21	Starting performance monitoring of a pool for Dynamic Tiering.	Start the performance monitoring of a pool for Dynamic Tiering.	`raidcom monitor pool -pool {<pool ID#> | <pool naming>} -operation start`
22	Stopping performance monitoring of a pool for Dynamic Tiering.	Stop the performance monitoring of a pool for Dynamic Tiering.	`raidcom monitor pool -pool {<pool ID#> | <pool naming>} -operation stop`
23	Instructing reallocation of pool for Dynamic Tiering	Perform instruction of reallocation of pool for Dynamic Tiering.	`raidcom reallocate pool -pool {<pool ID#> | <pool naming>} -operation <type>`

Script examples

The following shows the script examples of virtual volume (Dynamic Tiering) operation.

```
raidcom -login USER01 PASS01                    ;Log on with the user ID : USER01
                                                and ;password: PASS01.
raidcom lock resource -resource_grp_name        ;Lock the resource group:meta_resource.
meta_resource                                   ;
                                                ;
raidcom modify port -port CL1-A -security       ;Turn ON the security switch of PortCL1-A
_switch y                                       ;and PortCL2-A.
raidcom modify port -port CL2-A -security       ;
_switch y                                       ;
                                                ;
raidcom add host_grp -port CL1-A-0 -            ;Set the host group #0, host group name: HP-
host_grp_name HP-UX-P                           ;UX-P to the PortCL1-A, and the host group
raidcom add host_grp -port CL2-A-0 -            ;#0, host group name: HP-UX-S to the
host_grp_name HP-UX-S                           ;PortCL2-A.
                                                ;
raidcom modify host_grp -port CL1-A-0 -         ;Set the host mode: HP-UX to the host group
host_mode HP-UX                                 ;#0 of PortCL1-A and PortCL2-A.
raidcom modify host_grp -port CL2-A-0 -         ;
host_mode HP-UX                                 ;
                                                ;
raidcom get host_grp -port CL1-A                ;Display the host group information that is
raidcom get host_grp -port CL2-A                ;set to the PortCL1-A and the PortCL2-A.
                                                ;
raidcom add hba_wwn -port CL1-A HP-UX-P -       ;Set the connection host
hba_wwn 210000e0,8b0256f8                       ;WWN:210000e0,8b0256f8 to the PortCL1-A,
raidcom add hba_wwn -port CL2-A HP-UX-S -       ;host group HP-UX-P, and the connection host
hba_wwn 210000e0,8b0256f9                       ;WWN:210000e0,8b0256f9 to the PortCL2-A,
                                                ;host group HP-UX-S.
                                                ;
raidcom get hba_wwn -port CL1-A HP-UX-P         ;Display the connection host WWN that is set
raidcom get hba_wwn -port CL2-A HP-UX-S         ;to the PortCL1-A, host group HP-UX-P, and
                                                ;the connection host WWN that is set to the
                                                ;PortCL2-A, host group HP-UX-S.
```

Figure 5-10 Script examples of virtual volume operation (Dynamic Tiering) (1/3)

```
for /l %%i in (0,1,4) do (                    :Create 5 of 10G LDEV to Parity_grp_id 1-1
raidcom add ldev -ldev_id %%i -capacity 10g   :(LDEV:0 to 4) Low speed media
-parity_grp_id 1-1
)
for /l %%i in (5,1,9) do (                    :Create 5 of 10G LDEV to Parity_grp_id 1-2
raidcom add ldev -ldev_id %%i -capacity 10g   :(LDEV: 5 to 9) High speed media
-parity_grp_id 1-2
)
raidcom get command_status
raidcom reset command_status

for /l %%i in (0,1,9) do (
raidcom initialize ldev -ldev_id %%i -operation  :LDEV: Execute Quick format to 0 to 9
qfmt
)
raidcom get command_status
raidcom reset command_status

for /l %%i in (0,1,9) do (                    :Give an nickname to LDEV: 0 to 9
raidcom modify ldev -ldev_id %%i -device_name :(my_volume 0 ot 9)
my_volume_%%i
)

for /l %%i in (0,1,9) do (                    :Set to 2 the LDEV owner MP blade of LDEV:
raidcom modify ldev -ldev_id %%i -mp_blade_id 2  :0 to 9
)
raidcom get ldev -ldev_id 0 -cnt 10           :Display the information of LDEV: 0 to 9
                                              :(Internal VOL)
raidcom add dp_pool -pool_id 1 -ldev_id 0 -cnt 5  :Use LDEV: 0 to 4, then create pool:1
raidcom get command_status
raidcom reset command_status

raidcom modify pool -pool 1 -pool_attribute   :Change the setting of pool:1,
dt_manual                                     :from Dynamic Provisioning pool to
raidcom add dp_pool -pool_id 1 -ldev_id 5 -cnt  :Dynamic Tiering pool.
5
for /l %%i in (10,1,19) do (                  :Add a pool volume of different  media to
raidcom add ldev -ldev_id %%i -capacity 10g -  : pool:1 (LDEV: 5 to 9)
pool 1
)                                             :Create each 10 of 10G VVOL to Pool_id 1
for /l %%i in (20,1,29) do (                  :(LDEV:10 to 19, 20 to 29)
raidcom add ldev -ldev_id %%i -capacity 10g -
pool 1
)
raidcom get command_status
raidcom reset command_status

for /l %%i in (10,1,29) do (                  :Give a nickname to VVOL: 10 to 29
raidcom modify ldev -ldev_id %%i -device_name :(my_virtual_volume 10 to 29)
my_virtual_volume_%%i
)

for /l %%i in (10,1,29) do (                  :Set to 2 the VVOL owner MP blade of
raidcom modify ldev -ldev_id %%i -mp_blade_id 2  :VVOL:10 to 29
)
```

Figure 5-11 Script examples of virtual volume operation (Dynamic Tiering) (2/3)

```
raidcom get ldev -ldev_id 10 -cnt 20            :Display the information of VVOL:10 to
                                                :29(virtual VOL)
                                                :
for /l %%i in (10,1,19) do (                    :Give the device name: data0 to 19 to VVOL:
raidcom add device_grp -device_grp_name grp1    :10 to 29, and add it to Device group name
data%%i -ldev_id %%i                            :grp1(data0 to 9) and grp2(data10 to 19).
)                                               :
for /l %%i in (20,1,29) do (                    :
raidcom add device_grp -device_grp_name grp2    :
data%%i -ldev_id %%i                            :
)                                               :
raidcom get command_status                      :
raidcom reset command_status                    :
                                                :
raidcom get device_grp -device_grp_name grp1    :Display the device group information: grp1
raidcom get device_grp -device_grp_name grp2    :and grp2.
                                                :
raidcom add copy_grp -copy_grp_name ora grp1    :Create a copy group (ora) at the device
grp2                                            :group (grp1 and grp2).
                                                :
raidcom get command_status                      :
raidcom reset command_status                    :
                                                :
raidcom get copy_grp                            :Display the copy group information.
                                                :
for /l %%i in (10,1,19) do (                    :Execute the path definition of VVOL:10 to
raidcom add lun -port CL1-A HP-UX-P -ldev_id    :19 to Port CL1-A host group HP-UX-P.
%%i                                             :Execute the path definition of VVOL:20 to
)                                               :29 to Port CL2-A host group HP-UX-S.
for /l %%i in (20,1,29) do (                    :Give an LU number automatically.
raidcom add lun -port CL2-A HP-UX-S -ldev_id    :
%%i                                             :
)                                               :
                                                :Display the path information that is set to
raidcom get lun -port CL1-A HP-UX-P             :PortCL1-A, host group HP-UX-P, and
raidcom get lun -port CL2-A HP-UX-S             :the path information that is set to
                                                :PortCL2-A, host group HP-UX-S.
                                                :
raidcom unlock resource -resource_grp_name      :Unlock the resource group:meta_resource.
meta_resource                                   :
                                                :
raidcom get resource                            :Display the resource group information.
                                                :
raidcom monitor pool -pool 1 -operation start   :
                                                :Start monitoring of Pool:1
raidcom monitor pool -pool 1 -operation stop    :Stop monitoring of Pool:1
                                                :
raidcom reallocate pool -pool 1 -operation      :Start reallocation processing of Pool:1
start                                           :
                                                :
raidcom -logout                                 :Log out
```

Figure 5-12 Script examples of virtual volume operation (Dynamic Tiering) (3/3)

External volume operations

Creating external volumes

Use the following provisioning operations to create LDEVs of external volumes and make the LDEVs available from the host.

Step	Operation overview	Description	Executed command
1	Setting port attribute of local storage system	Set port attribute of local storage system to External (ELUN)port	`raidcom modify port -port <port> -port_attribute ELUN`
2	Searching external storage	Display port information on the external storage connected to the External port.	`raidcom discover external_storage -port <port>`
3	Searching external volume	Display a list of external volumes that can be mapped from External port.	`raidcom discover lun -port <port> -external_wwn <wwn strings>`
4	Creating external volume	Create external volume.	`raidcom add ldev - external_grp_id <gno-sgno> -ldev_id <ldev#> -capacity <size> [-emulation <emulation type>][-location <lba>] [-mp_blade_id <mp#>]`
5	Modifying external volume option	Modify external volume option (cache mode, inflow mode, and MP blade setting).	`raidcom modify external_grp -external_grp_id <gno-sgno> {-cache_mode < y|n > | -cache_inflow < y|n > | -mp_blade_id <mp#>}`
6	Checking external volume information	Display external volume information and confirm result of executing command.	`raidcom get external_grp [-external_grp_id <gno-sgno>]`
7	Setting external path	Set external path. Execute the required number of commands.	`raidcom add path -path_grp <path group#> -port <port> -external_wwn <wwn strings>`
8	Displaying external path information	Display external path information for and confirm the result of executing the command.	`raidcom get path [-path_grp <path group#>]`
9	Setting port of external storage system	Make enabled the LUN security of port. Modify setting such as port topology and data transfer speed as needed.	`raidcom modify port -port <port> -security_switch y`
10	Creating host group	Specify port, map LDEV to LUN and create an LU path.	`raidcom add host_grp -port <port> -host_grp_name <host group name>`
11	Setting host mode	Specify port and set host mode for host group.	`raidcom modify host_grp -port <port> [<host group name>] -host_mode <host mode> [-host_mode_opt <host mode option> … ]`
12	Displaying host group information	Display host group information and confirm result of executing command.	`raidcom get host_grp -port <port> [<host group name>]`

Step	Operation overview	Description	Executed command
13	Adding host to host group	Register host to host group of the port.	`raidcom add hba_wwn -port <port> [<host group name>] -hba_wwn <WWN strings>`
14	Displaying WWN information	Display WWN of connection host registered to the host group and confirm the result of executing the command.	`raidcom get hba_wwn -port <port> [<host group name>]`
15	Creating LDEV	Specify external volume group and create LDEV.	`raidcom add ldev - external_grp_id <gno-sgno> -ldev_id <ldev#> {-capacity <size> | -offset_capacity <size> | -cylinder <size>} [-emulation <emulation type>][-location <lba>] [-mp_blade_id <mp#>]`
16	Creating LDEV nickname (arbitrary)	Create nickname of created LDEV. This operation is arbitrary.	`raidcom modify ldev -ldev_id <ldev#> -ldev_name <ldev naming>`
17	Setting MP blade of LDEV	Set MP blade of created LDEV.	`raidcom modify ldev -ldev_id <ldev#> -mp_blade_id <mp#>`
18	Displaying LDEV information	Display information of created LDEV and confirm the result of executing the command.	`raidcom get ldev -ldev_id <ldev#> … [-cnt <count>] [-key <keyword>]`
19	Creating LU path	Specify port, map LDEV to LUN and create an LU path.	`raidcom add lun -port <port> [<host group name>] -ldev_id <ldev#> [-lun_id<lun#>]`
20	Displaying LU path information	Display LU path information and confirm the result of executing the command.	`raidcom get lun -port <port> [<host group name>]`

Script Examples

The following shows the script examples of external volume operations.

```
raidcom -login USER01 PASS01                    ;Log in with user ID: USER01, and password:
                                                ;PASS01.
raidcom lock resource -resource_grp_name        ;Lock the resource group: meta_resource
meta_resource                                   ;
                                                ;
raidcom modify port -port CL3-A -port_attribute ;Change the attribute of Port CL3-A to Port
ELUN                                            ;External (ELUN) and of Port CL4-A to
raidcom modify port -port CL4-A -port_attribute ;External (ELUN)
ELUN                                            ;
                                                ;
raidcom discover external_storage -port CL3-A   ;Display the port on the external storage
                                                ;from port:CL3-A.
raidcom discover lun -port CL3-A -external_wwn  ;Display LU that is defined to the port on
50060e80,1611a870                               ;the external port: 50060e80,1611a870 and
                                                ;connected to the port:CL3-A(External port)
                                                ;
                                                ;
raidcom add external_grp -path_grp 1 -          ;Map LU:0 that is defined to the port on the
external_grp_id 1-1 -port CL3-A -external_wwn   ;external port: 50060e80,1611a80 and
50060e80, 1611a870 -lun_id 0                    ;connected to the port:CL3-A (External  port)
                                                ;with the external volume group #1-1, path
raidcom get command_status                      ;group #1.
raidcom reset command_status
```

Figure 5-13 Script Examples of External Volume Operation (1/3)

```
raidcom modify external_grp -external_grp_id 1-  :Turn ON the cache mode of External volume
1 -cache_mode y                                  :group #1-1.
                                                 :
raidcom get external_grp -external_grp_id 1-1    :Specify the external volume group and
                                                 :display the external volume information.
raidcom add path -path_grp 1 -port CL4-A -       :Add paths of External port CL4-A and the
external_wwn 50060e80,05fa0f36                   :port 50060e80 and 05fa0f36 on the side of
raidcom get command_status                       :External storage :to the path group:1.
raidcom reset command_status                     :
                                                 :Display the information of Path Group: 1.
raidcom get path -path_grp 1                     :
                                                 :
raidcom modify port -port CL1-A -security
_switch y                                        :Turn ON the security switches of PortCL1-A
raidcom modify port -port CL2-A -security        :and PortCL2-A.
_switch y                                        :
                                                 :
raidcom add host_grp -port CL1-A-0 -             :Set the host group#0, host group name:
host_grp_name HP-UX-P                            :HP-UX-P to PortCL1-A and host group#0,
raidcom add host_grp -port CL2-A-0 -             :host group name: HP-UX-S to PortCL2-A.
host_grp_name HP-UX-S                            :
                                                 :
raidcom modify host_grp -port CL1-A-0 -          :Set the host mode: HP-UX to host group #0
host_mode HP-UX                                  :of PortCL1-A and PortCL2-A.
raidcom modify host_grp -port CL2-A-0 -          :
host_mode HP-UX                                  :
                                                 :
raidcom get host_grp -port CL1-A                 :Display the host group information set to
raidcom get host_grp -port CL2-A                 :PortCL1-A and PortCL2-A.
                                                 :
raidcom add hba_wwn -port CL1-A HP-UX-P -        :Set the connection host WWN:210000e0,
hba_wwn 210000e0,8b0256f8                        :8b0256f8 to PortCL1-A, host group :HP-UX-P
raidcom add hba_wwn -port CL2-A HP-UX-S -        :and the connection host WWN:210000e0,
hba_wwn 210000e0,8b0256f9                        :8b0256f9 to PortCL2-A, host group HP-UX-S.
                                                 :
raidcom get hba_wwn -port CL1-A HP-UX-P          :Display the connection host WWNs set to
raidcom get hba_wwn -port CL2-A HP-UX-S          :PortCL1-A, host group HP-UX-P and to
                                                 :PortCL2-A, host group HP-UX-S.
for /l %%i in (0,1,19) do (                      :Create each 10 of 10G Ldev to
        raidcom add ldev -ldev_id %%i -capacity  :external_grp_id 1-1 (LDEV:0 to 9, 10 to
10g -external_grp_id  1-1                        :19).
)                                                :
raidcom get command_status                       :
raidcom reset command_status                     :
                                                 :Give a nickname to LDEV: 0 to 19
for /l %%i in (0,1,19) do (                      :(my_volume 0 to 19)
raidcom modify ldev -ldev_id %%i -device_name    :
my_volume_%%i
)                                                :Set the LDEV MP Blade ID of LDEV: 0 to 19
                                                 :to 2.
for /l %%i in (0,1,19) do (                      :
raidcom modify ldev -ldev_id %%i -mp_blade_id 2  :
)                                                :
                                                 :Display the information of LDEV: 0 to 19
raidcom get ldev -ldev_id 0 -cnt 20              :(internal VOL).
                                                 :
for /l %%i in (0,1,9) do (                       :Give a device name: data 0 to 19 to LDEV:
raidcom add device_grp -device_grp_name grp1     :0 to 19, and add it to device group name:
data%%i -ldev_id %%i                             :grp1(data0 to 9) and grp2(data10 to 19).
)                                                :
```

Figure 5-14 Script Examples of External Volume Operation (2/3)

```
for /l %%i in (10,1,19) do (
raidcom add device_grp -device_grp_name grp2
data%%i -ldev_id %%i
)
raidcom get command_status
raidcom reset command_status

raidcom get device_grp -device_grp_name grp1
raidcom get device_grp -device_grp_name grp2

raidcom add copy_grp -copy_grp_name ora grp1
grp2
raidcom get command_status
raidcom reset command_status

raidcom get copy_grp

for /l %%i in (0,1,9) do (
raidcom add lun -port CL1-A HP-UX-P -ldev_id
%%i
)
for /l %%i in (10,1,19) do (
raidcom add lun -port CL2-A HP-UX-S -ldev_id
%%i
)

raidcom get lun -port CL1-A HP-UX-P
raidcom get lun -port CL2-A HP-UX-S


raidcom unlock resource -resource_grp_name
meta_resource

raidcom get resource

raidcom -logout
```

```
;
;
;
;
;
;
;
;
;Display the device group information:
;grp1, grp2.
;
;
;Create copy group (ora) with the device
;group (grp1, grp2).
;
;
;Display the copy group information.
;
;Defining paths of LDEV: 0 to 9 to Port:
;CL1-A host group HP-UX-P.
;Defining path of LDEV: 10 to 19 to Port:
;CL2-A host group HP-UX-S.
;Give an LU number automatically.
;
;
;
;
;Display the path information that is set
;to PortCL1-A, host group HP-UX-P and
;PortCL2-A, host group HP-UX-S.
;
;Unlock the resource group: meta_resource.
;
;
;Display the resource group information.
;
;
;Log out.
```

Figure 5-15 Script Examples of External Volume Operation (3/3)

Virtual Partition Manager operations

Virtual Partition Manager operations using CCI include migrating LDEVs, parity groups, and external volume groups to other CLPRs.

- For information about Virtual Partition Manager operations, including important warnings and restrictions, see the *Hitachi Virtual Partition Manager User Guide* for USP V/VM or the *Performance Guide for VSP*.
- For details about the CCI commands for Virtual Partition Manager operations, see the Command Control Interface Command Reference.

Performing Virtual Partition Manager operations

The following table shows the procedure for migrating LDEVs, parity groups, and external volume groups to other CLPRs.

Step	Operation overview	Description	Command
1	Confirming the CLPR configuration.	Check the status of the CLPRs.	`raidcom get clpr`

Step	Operation overview	Description	Command
2	Migrating one of the following to other CLPRs: • LDEV • parity group • external volume group	Specify the LDEV number, parity group number, or external volume group number.	`raidcom modify clpr -clpr <clpr#> { -ldev_id <ldev#> | -parity_grp_id <gno-sgno> | - external_grp_id <gnosgno>}`
3	Verifying the CLPR migration.	For parity group migration, check the status of the parity group.	`raidcom get parity_grp`

Displaying CLPR information

The raidcom get clpr command lists and displays the status of the CLPRs in the storage system. If no CLPRs have been created, CLPR0 is displayed as entire cache. Display example:

```
# raidcom get clpr
CLPR CLPR_NAME    TC_CAP(MB) TU_CAP(MB) WP_CAP(MB) SF_CAP(MB) U(%)
W(%)S(%)
 000  Oracle_DB       40000     20000       4000        0    50
30    0
 001  Oracle_DB_PROD  20000     10000       2000        0    50
10    0
 003  Oracle_DB_BACK  10000      5000        500        0    50
5    0
```

Migrating parity groups in a CLPR

This section explains operations from checking the parity group information to moving the parity group.

Displaying parity group information

The raidcom check the status, display the information about the parity group. The following shows the display example of parity groups.

```
# raidcom get parity_grp
T GROUP Num_LDEV U(%) AV_CAP(GB) R_LVL R_TYPE SL CL  DRIVE_TYPE
R  32-16       4  45     140000  RAID1  2D+2D  0  0  DKS2C-K072FC
R  32-17       4  45     140000  RAID1  2D+2D  0  0  DKS2C-K072FC
R  33-16       4  45     140000  RAID1  2D+2D  0  0  DKS2C-K072FC
R  33-17       4  45     140000  RAID1  2D+2D  0  3  DKS2C-K072FC
```

Moving parity groups

If you change the allocation of parity groups, parity groups are moved from another CLPR. In this case, plural parity groups which configure the distributed parity group have to be allocated the same CLPR. Parity groups including LDEVs where cache area of Cache Residency is defined cannot be

moved to another CLPR. For the restrictions on the CLPR's transfer, see the *Performance Guide*. The following shows examples of parity groups transfer in CLPR.

Move the parity group 32-17 to the CLPR number 1.

```
# raidcom modify clpr -clpr 1 -parity_grp_id 32-17
```

Checking result of CLPR transfer

By displaying the information about parity groups, check the result of CLPR transfer. The following shows an example of parity group list.

```
# raidcom get parity_grp
T GROUP Num_LDEV U(%) AV_CAP(GB) R_LVL R_TYPE SL CL DRIVE_TYPE
R  32-16       4  45     140000  RAID1  2D+2D  0  0 DKS2C-K072FC
R  32-17       4  45     140000  RAID1  2D+2D  0  1 DKS2C-K072FC
R  33-16       4  45     140000  RAID1  2D+2D  0  3 DKS2C-K072FC
R  33-17       4  45     140000  RAID1  2D+2D  0  3 DKS2C-K072FC
```

Server Priority Manager operations

Server Priority Manager enables you to prioritize host I/O operations to provide high-speed processing for specified hosts. The host is identified by WWN of host bus adapter. Server Priority Manager has two settings: prioritized and non-prioritized. Set the prioritized option for hosts that require high-speed processing, and the non-prioritized option for the other hosts.

The upper limit of the non-prioritized WWN is set to each port to which the non-prioritized WWN belongs and is applied only to the port. If the threshold is set to the port to which the prioritized WWN belongs, the threshold overwrites the thresholds of all the ports in the storage system to which the prioritized WWN belongs as well. For more details about the upper limit and the threshold, see Setting the priority on host bus adapter on page 5-49.

For details about the CCI commands for Server Priority Manager operations, see the Command Control Interface Command Reference.

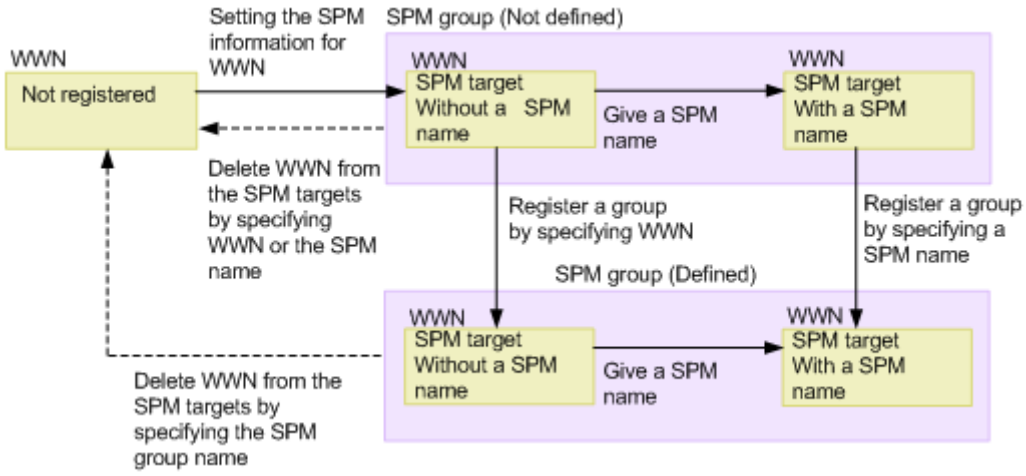
You can give a nickname (SPM name) to each host WWN to assist in managing the hosts. You can also manage WWN and the SPM name per group. The groups to which WWN and the SPM name are registered are managed uniquely. The following table lists the details for the Server Priority Manager operations and the management unit.

SPM Operation	Management per port	Management per system
raidcom modify spm_wwn	prioritized or non-prioritized upper limit WWN or SPM name	threshold
raidcom modify spm_group	prioritized or non-prioritized upper limit SPM group name	threshold
raidcom add spm_wwn	-	SPM name

SPM Operation	Management per port	Management per system
raidcom add spm_group	-	SPM group name
raidcom delete spm_wwn	-	SPM name (SPM information per port is also deleted.)
raidcom delete spm_group	-	SPM group name (SPM information per port is also deleted.)
raidcom get spm_wwn	prioritized or non-prioritized upper limit WWN or SPM name SPM group name	threshold
raidcom get spm_group	prioritized or non-prioritized upper limit SPM group name	threshold
raidcom monitor spm_wwn	performance of server (IOps/ KBps)	control mode of SPM
raidcom monitor spm_group	performance of server (IOps/ KBps)	control mode of SPM

State transitions of Server Priority Manager

The following shows the state by the SPM operation and its state transition.



Controlling server performance

The server performance is controlled by setting the priority of the I/O operation, the upper limit, and a threshold (per system) for the host bus adapter.

The following table shows the procedure for controlling the server performance by setting the priority of the I/O operation, the upper limit, and a threshold (per system) for the host bus adapter.

Step	Operation overview	Description	Executed command
1	Setting the SPM information for WWN	Set the priority (prioritized or non-prioritized option) for the SPM controlling by specifying the number of port to which the host bus adapter is connected and WWN of the host bus adapter.	`raidcom modify spm_wwn -port <port#> [-spm_priority <y/n>] {-limit_io | -limit_kb | -limit_mb } <value> {-hba_wwn <wwn_strings> | -spm_name <nick_name>}`
2	Giving a nickname (SPM name).	Give a nickname to WWN for the SPM controlling to make the host bus adapter distinguishable.	`raidcom add spm_wwn -port <port#> -spm_name <nick_name> -hba_wwn <wwn_strings>`
3	Registering WWN for SPM to SPM group	Specifying WWN: To operate per group, group multiple WWNs for SPM control into one group.	`raidcom add spm_group -port <port#> -spm_group <group_name> -hba_wwn <wwn_strings>`
		Specifying nickname: To operate per group, group multiple WWNs for SPM control into one group.	`raidcom add spm_group -port <port#> -spm_group <group_name> <nick_name>`
4	Checking the SPM information	Display the setting state of SPM by specifying WWN or the SPM name.	`raidcom get spm_wwn -port <port#> [ -hba_wwn <wwn_strings> | -spm_name <nick_name> ]`
		Display the SPM information by specifying the SPM group name.	`raidcom get spm_group -port <port#> -spm_group <group_name>`
5	Displaying the monitoring information of the prioritized WWN or the non-prioritized WWN	Display the monitoring information by specifying WWN or the SPM name.	`raidcom monitor spm_wwn {-hba_wwn <wwn_strings> | -spm_name <nick_name>}`
		Display the monitoring information by specifying the SPM group name.	`raidcom monitor spm_group -spm_group <group_name>`
6	Changing the threshold or the upper limit value of the non-prioritized WWN	Change the threshold or the upper limit value of the non-prioritized WWN by specifying WWN or the SPM name.	`raidcom modify spm_wwn -port <port#> [-spm_priority <y/n>] {-limit_io | -limit_kb | -limit_mb } <value> {-hba_wwn <wwn_strings> | -spm_name <nick_name>}`
		Change the threshold or the upper limit value of the non-prioritized WWN by specifying the SPM group name.	`raidcom modify spm_group -port <port> [-spm_priority <y/n>] {-limit_io | -limit_kb | -limit_mb } <value> -spm_group <group_name>`

Step	Operation overview	Description	Executed command
7	Deleting WWN from the SPM targets	Delete WWN from the SPM targets by specifying WWN or the SPM name.	`raidcom delete spm_wwn -port <port#> [-hba_wwn <wwn_strings> | -spm_name <nick_name> ]`
		Delete WWN from the SPM targets by specifying the SPM group name.	`raidcom delete spm_group -port <port#> -spm_group <group_name>`

Checking WWN of host bus adapters

Displays the WWN of the host bus adapters that are registered in host groups. Display example:

```
# raidcom get hba_wwn -port CL4-E-0
PORT  GID  GROUP_NAME HWWN             Serial#  NICK_NAME
CL4-E   0  Linux_x86  210000e08b0256f8  63528  ORA_NODE0_CTL_0
CL4-E   0  Linux_x86  210000e08b039c15  63528  ORA_NODE1_CTL_1
```

Setting the priority on host bus adapter

Set the high-priority host bus adapter for the prioritized WWN, and set the low-priority host bus adapter for the non-prioritized WWN. You need to set the upper limit and the threshold with the priority.

The upper limit is set for the non-prioritized WWN. In the low-priority server, the frequency of the access to the storage system or the data traffic is restricted with the upper limit. The threshold is set for the prioritized WWN. Only one threshold can be set for the entire storage system. The threshold cannot be set for each prioritized WWN. When the traffic of the high-priority server declines to the threshold, the control with the upper limit becomes invalid automatically.

By adjusting the upper limit or the threshold to the appropriate value, the frequency of the access to the storage system or the data traffic becomes stabilized in a high level in the high-priority server. The following shows examples of the priority settings.

Set the host bus adapter (WWN: 210000e0,8b0256f8) to the non-prioritized WWN, and set 5000 [IOPS] as the upper limit.

```
# raidcom modify spm_wwn -port CL4-E -spm_priority
n -limit_io 5000 -hba_wwn 210000e0,8b0256f8
```

Set the host bus adapter (WWN: 210000e0,8b039c15) to the prioritized WWN, and set 3000 [IOPS] as the threshold.

```
# raidcom modify spm_wwn -port CL4-E -spm_priority
y -limit_io 3000 -hba_wwn 210000e0,8b039c15
```

-limit_io 3000 shown in the example of the priority setting is the threshold value of the entire system.

Checking the status of the prioritized WWN and the non-prioritized WWN settings

Display the status of the prioritized WWN and the non-prioritized WWN settings and check it. Display examples of the status of the prioritized WWN and the non-prioritized WWN settings.

Display the status of settings of the prioritized WWN and the non-prioritized WWN assigned under the specified port (CL4-E).

```
# raidcom get spm_wwn -port CL4-E
PORT  SPM_MD SPM_WWN          NICK_NAME GRP_NAME Serial#
CL4-E WWN       210000e08b0256f8    -         -        63528
CL4-E WWN       210000e08b039c15    -         -        63528
```

Display the status of setting to specify the WWN (210000e08b0256f8).

```
# raidcom get spm_wwn -port CL4-E -hba_wwn 210000e0,8b0256f8
PORT  SPM_MD  PRI  IOps  KBps  Serial#
CL4-E WWN        N    5000   -    63528
```

Displays the status of setting to specify the WWN (210000e08b039c15).

```
# raidcom get spm_wwn -port CL4-E -hba_wwn 210000e0,8b039c15
PORT  SPM_MD  FRI  IOps  KBps  Serial#
CL4-E WWN        Y    3000   -    63528
```

The threshold value displayed for the prioritized WWN by using the get spm_wwn command is set for the entire system.

Setting SPM name for host bus adapter

The host bus adapters can be identified by checking the WWNs, but using SPM names may make it easier to identify the host bus adapters. Display examples of setting the SPM name of the host bus adapter:

Set the SPM name (ORA_NODE0_CTL_0) for the WWN (210000e08b0256f8).

```
# raidcom add spm_wwn -port CL4-E -spm_name
ORA_NODE0_CTL_0 -hba_wwn 210000e0,8b0256f8
```

Set the SPM name (ORA_NODE1_CTL_1) for the WWN (210000e08b039c15).

```
# raidcom add spm_wwn -port CL4-E -spm_name
ORA_NODE1_CTL_1 -hba_wwn 210000e0,8b039c15
```

SPM names are managed uniquely in the entire system.

Grouping multiple host bus adapters into one group

You can group the host bus adapters into SPM groups, and then use the SPM groups to change the priorities of multiple host bus adapters at the same time. You can also set the same upper limit value for all host bus adapters in a SPM group at the same time.

Examples of setting the SPM group:

Set the SPM name (ORA_NODE0_CTL_0) for the SPM gropup name (WWN_GRP_LINUX0).

```
# raidcom add spm_group -port CL4-E -spm_group WWN_GRP_LINUX0
ORA_NODE0_CTL_0
```

Set the WWN (210000e08b039c15) for the SPM gropup name (WWN_GRP_LINUX1).

```
# raidcom add spm_group -port CL4-E -spm_group
WWN_GRP_LINUX1 -hba_wwn 210000e0,8b039c15
```

SPM group names are managed uniquely in the entire system.

Checking the traffic of the prioritized WWN and the non-prioritized WWN

You can use the monitoring function to check whether the performance of the prioritized WWN can be secured by setting the upper limit. Example of acquiring the monitoring information:

Acquires the monitoring information by specifying the WWN (210000e08b039c15).

```
# raidcom monitor spm_wwn -hba_wwn 210000e0,8b039c15
PORT   SPM_MD  IOps  KBps    Serial#
CL4-E  WWN        5000  5000000 63528
```

Stopping performance control of server by using SPM function

To stop controlling the performance of the server by using the SPM function, delete the SPM name from the SPM targets.

Example of deleting from the SPM targets:

Delete the SPM name ("ORA_NODE0_CTL_0") from the SPM targets.

```
# raidcom delete spm_wwn -port CL4-E -spm_name ORA_NODE0_CTL_0
```

Caution about exclusive access control with Storage Navigator

Server Priority Manager settings are exclusive for CCI operations and Storage Navigator operations:

- If you set Server Priority Manager using CCI, you cannot set Server Priority Manager from Storage Navigator. You need to delete all Server Priority Manager settings made using CCI, and then use Server Priority Manager on Storage Navigator to make the Server Priority Manager settings.
- If you set Server Priority Manager using Storage Navigator, you cannot set Server Priority Manager using CCI. You need to delete all Server Priority Manager settings made using Storage Navigator, and then use Server Priority Manager from CCI to make the Server Priority Manager settings.

Deleting WWN from the SPM targets with SPM name or SPM group name

If you delete WWN from the SPM targets by using the SPM name, the SPM setting and SPM name under the specified port are deleted. If the same SPM name is set to another port, only the SPM setting of the specified port is deleted.

If you delete WWN from the SPM targets by using the SPM group name, the SPM setting and the group under the specified port are deleted. If the same SPM group name is set to another port, only the SPM setting of the specified port is deleted.

Resource group function and restrictions when running Server Priority Manager

When you use the resource group function, the range of operation is limited per port of resource group by Server Priority Manager. The threshold value, the SPM name, and the SPM group name, which are managed in the entire system, are common among the resource groups.

When you perform Server Priority Manager operations using the resource group function, share the threshold value that the storage administrator determines among users of resource groups. Determine rules for SPM names and SPM group names including port names to avoid redundant names between ports.

Virtual storage machine operations (VSP G1000 only)

Creating host groups in a virtual storage machine

Use the following provisioning operations to create host groups in a virtual storage machine and to assign virtualized LDEV to LU.

Step	Operation overview	Description	Executed command
1	Reserving host group IDs	Reserve ports and host group IDs to the resource groups in the virtual storage machine. Be sure to execute the command before creating host groups.	`raidcom add resource -resource_name <resource group name> -port <port#>-<HG#>`
2	Creating host groups	Create host groups by specifying the reserved port and host group ID to the resource group.	`raidcom add host_grp -port <port>-<HG#> -host_grp_name <host group name>`
3	Specifying the host mode and host mode options	Specify the host mode to the created host group. Also, specify the host mode options if necessary.	`raidcom modify host_grp -port <port> [<host group name>] - host_mode < host mode> [- host_mode_opt <host mode option> … ]`
4	Adding hosts to the host group	Register hosts to the host group.	`raidcom add hba_wwn -port <port> [<host group name>] -hba_wwn <WWN strings>`

Adding LDEVs to a virtual storage machine

Use the following provisioning operations to add LDEVs to a virtual storage machine and to use LDEVs from hosts.

Step	Operation overview	Description	Executed command
1	Delete the virtual LDEV ID set by default	Specify an LDEV ID to delete the virtual LDEV ID set by default. By default, the virtual LDEV ID is the same as the real LDEV ID.	`raidcom unmap resource -ldev_id <ldev#> -virtual_ldev_id <ldev#>`
2	Add the LDEV to the resource group	Add the LDEV of which the virtual LDEV ID was deleted to the resource group in the virtual storage machine.	`raidcom add resource -resource_name <resource group name> -ldev_id <ldev#>`
3	Virtualize LDEVs	Set a virtual LDEV ID to the specified LDEV. Also, specify the product ID and SSID if necessary.	`raidcom map resource -ldev_id <ldev#> -virtual_ldev_id <ldev#> [-ssid<ssid> -emulation <emulation type>]`
4	Create LU path	To create LU path, assign LDEVs to the host group that belongs to the resource group in the virtual storage machine.	`raidcom add lun -port <port> [<host group name>] -ldev_id <ldev#> [-lun_id<lun#>]`

Removing the virtual storage machine

Use the following provisioning operations to remove resources from the virtual storage machine and to remove the virtual storage machine.

Step	Operation overview	Description	Executed command
1	Remove the LU path	Remove the LU path from the LDEV in the virtual storage machine.	`raidcom delete lun -port <port#> [<host group name>] {-lun_id <lun#> | -ldev_id <ldev#> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]}`
2	Remove the virtual LDEV ID	Remove the virtual LDEV ID from the LDEV in the virtual storage machine.	`raidcom unmap resource -ldev_id <ldev#> -virtual_ldev_id <ldev#>`
3	Remove the LDEV from the resource group	Remove the LDEV from the resource group in the virtual storage machine	`raidcom delete resource -resource_name <resource group name> -ldev_id <ldev#>`
4	Invalidate the LDEV virtualization	Specify the virtual LDEV ID that is the same as the real LDEV ID in order to invalidate the LDEV virtualization.	`raidcom map resource -ldev_id <ldev#> -virtual_ldev_id <ldev#>`

Step	Operation overview	Description	Executed command
5	Delete the host group	Delete the host group in the virtual storage machine.	`raidcom delete host_grp -port <port#> [<host group name>]`
6	Remove the host group ID from the resource group	Remove the host group ID that belongs to the resource group in the virtual storage machine	`raidcom delete resource -resource_name <resource group name> -port <port#> -<HG#>`
7	Remove the resource from the resource group	Remove the resource from the resource group in the virtual storage machine.	`raidcom delete resource -resource_name <resource group name> [-ldev_id <ldev#> | -port <port#> [<host group name>] | -parity_grp <gno-sgno> | -external_grp_id <gno-sgno> | -grp_opt <group option> -device_grp_name <device group name> [<device name>]]`
8	Remove the virtual storage machine	Delete all resource groups in the virtual storage machine in order to remove the virtual storage machine.	`raidcom delete resource -resource_name <resource group name>`

6

Data replication operations with CCI

This chapter describes data replication operations with CCI.

About data replication operations

The data replication features of the RAID storage systems include:

- Local replication:
  - ShadowImage
  - ShadowImage for Mainframe
  - Thin Image
  - Copy-on-Write Snapshot
- Remote replication:
  - TrueCopy
  - TrueCopy for Mainframe
  - Universal Replicator
  - Universal Replicator for Mainframe
  - global-active device
- Mainframe replication:
  - Compatible XRC
  - Compatible FlashCopy® V2
  - Business Continuity Manager

For detailed information about any of these features, see the applicable user guide (for example, *Hitachi ShadowImage® User Guide*).

Features of paired volumes

Paired logical volumes are often handled independently by servers. When CCI is used, the paired volumes can be managed by the replication functions (for example, TrueCopy, ShadowImage, Universal Replicator) as combined or separated pairs. The replication function regards the two volumes being combined or separated as a uniquely paired logical volume used by the servers. Paired volumes can also be handled as groups, grouping them by units of server software or units of databases and their attributes.

For detailed information about volume pairs (for example, maximum number of pairs per storage system, maximum P-VOL size), see the user guide for your storage system and copy function (for example, *Hitachi ShadowImage® User Guide*).

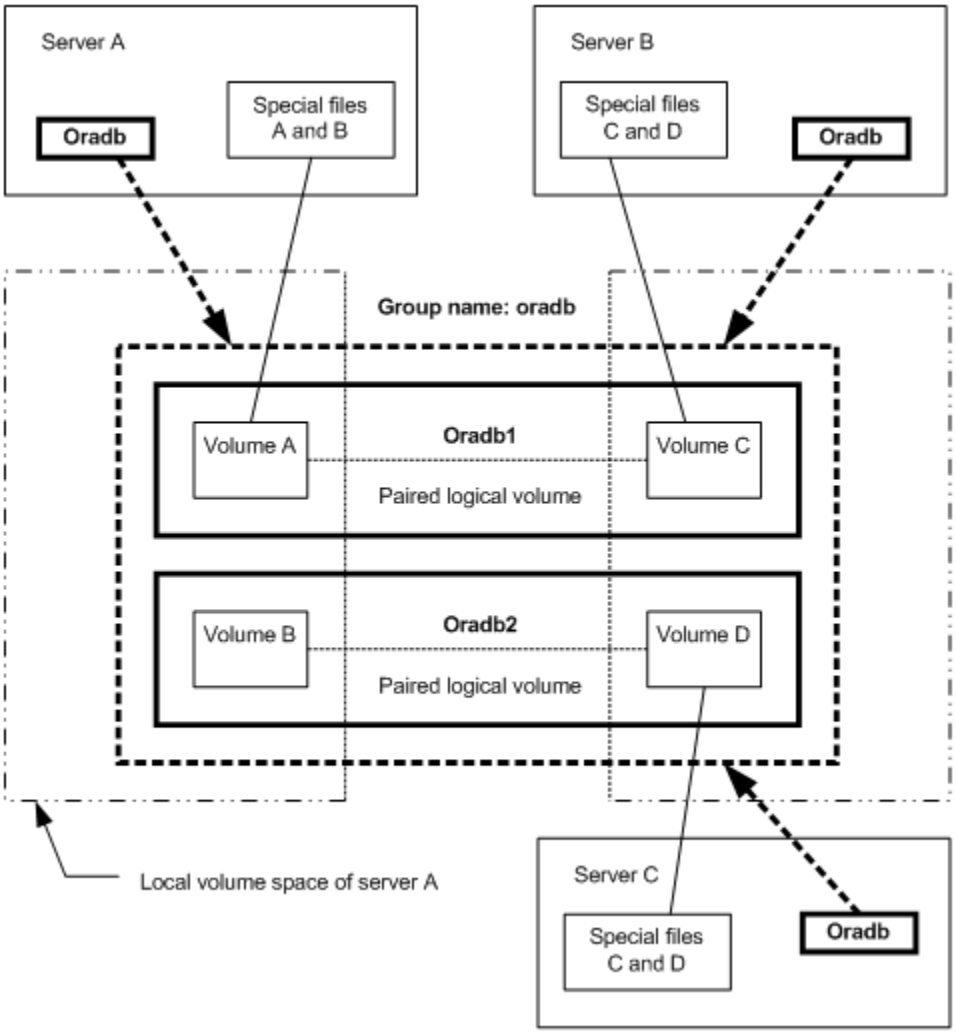


Figure 6-1 Concept of paired volumes

Addressing paired logical volumes: The correspondence of paired logical volumes to their physical volumes is defined by describing the paired logical volume names and group names in the configuration definition files of each server. It is possible to define a server for the paired logical volumes in units of group name. Each paired logical volume must belong to a group in order to determine the corresponding server.

Specification of volumes by commands: Volume names to be used by the CCI commands must be referenced via the paired logical volume names or the group names.

Using CCI with ShadowImage and TrueCopy

CCI allows you to perform ShadowImage and TrueCopy operations by issuing ShadowImage and TrueCopy commands from the UNIX/PC server host to the RAID storage system. ShadowImage and TrueCopy operations are nondisruptive and allow the primary volume of each volume pair to

remain online to all hosts for both read and write operations. Once established, ShadowImage and TrueCopy operations continue unattended to provide continuous data backup.

There are specific requirements for using ShadowImage and TrueCopy in high-availability (HA) configurations. UNIX/PC servers in HA configurations normally support disk duplication functions to enhance disk reliability (for example, mirroring provided by the LVM or device driver, RAID5 or an equivalent function provided by the LVM). UNIX/PC servers also feature hot standby and mutual hot standby functions in case of failures on the server side. However, mutual hot standby for disaster recovery has not yet been achieved since it requires the remote mirroring function.

ShadowImage provides the mirroring function within the storage system. For detailed information about ShadowImage operations, please see the *Hitachi ShadowImage® User Guide* for your storage system.

TrueCopy provides remote mirroring functionality, linkage functionality with failover switching, and remote backup operations among servers, all of which are required by UNIX/PC servers in HA configurations for disaster recovery. For detailed information about TrueCopy operations, please see the *Hitachi TrueCopy® User Guide* for your storage system.

Using CCI with Thin Image

CCI allows you to perform Hitachi Thin Image operations by issuing raidcom commands (for example, `raidcom add snapshot`) to the RAID storage system. Hitachi Thin Image stores snapshots in storage system. Creating a Thin Image pair changes the status to "PAIR" and stores snapshot data as a copy of the data on the Thin Image P-VOL. A Thin Image pair consists of a P-VOL, one or more S-VOLs that are virtual volumes (V-VOLs), and one or more pool-VOLs that are LDEVs. P-VOL differential data is stored as snapshot data in the pool-VOLs. If your storage system experiences a data storage failure, you can restore the data using the snapshot data in the pool. Splitting a Thin Image pair saves a snapshot and stops the copying of replaced data in the pool.

Consistency groups and snapshot groups are groups of pairs for which you can simultaneously perform pair tasks on all pairs within the group. You can use CCI raidcom commands to create consistency groups and snapshot groups and to split pairs to store the snapshot data for the groups.

- A consistency group can include HTI, SI, and SIz pairs. Splitting the pairs using the group assures data consistency at the time the storage system receives the request.

- A snapshot group is a group of only Thin Image pairs. Use consistency or snapshot groups to perform Thin Image tasks on all of the pairs within the group. You define Thin Image pairs to a snapshot group when you create the pairs.

Note: When you use the CCI to define multiple Thin Image pairs in a consistency group, you can only specify one consistency group for a group defined in the CCI configuration definition file.

The configuration definition file for CCI is a group that is not a consistency group.

Creating a new pair and defining the pairs in a consistency group for a group you defined using the CCI configuration definition file and the pair is already defined in a consistency group defines the pair in the same consistency group, even if you try to create a new pair and assign it to a different consistency group.

For details about Hitachi Thin Image, see the *Hitachi Thin Image User Guide* for your storage system.

Using CCI with global-active device

The CCI software is installed on the host servers and used for global-active device operations. The CCI command devices and CCI configuration definition files are required for global-active device operations. You can execute CCI commands for global-active device using the in-band or out-of-band method of CCI command execution.

For details about global-active device, see the *Global-Active Device User Guide*. For details about the CCI command options and display results for global-active device operations (for example, PHY_LDEV, VIR_LDEV), see the *Command Control Interface Command Reference*.

Note: If you set the S-VOL Disable attribute of Data Retention Utility to a GAD secondary volume, GAD pair operations from CCI are restricted. Release the S-VOL Disable attribute of the GAD secondary volume, and then perform the GAD pair operations.

ShadowImage operations

Figure 6-2 ShadowImage system configuration on page 6-6 illustrates a ShadowImage configuration. The ShadowImage commands also support the functionality that links the system operation for the purpose of volume backup among UNIX servers managed by the operating system. For detailed information about the operational requirements and specifications for ShadowImage, see the *Hitachi ShadowImage® User Guide* for your storage system.

Following is a list of sample ShadowImage functions that can be executed using CCI commands:

- Pair creation: Creates a new volume pair. Volume pairs can be created in units of volumes or groups.

- Pair splitting: Splits a volume pair and allows read and write access to the secondary volume.
- Pair resynchronization: Resynchronizes a split volume pair based on the primary volume. The primary volume remains accessible during resynchronization.
- Pair resynchronization with restore option: Resynchronizes a split pair based on the secondary volume (reverse resync). The primary volume is not accessible during resync with restore option.
- Event waiting: Used for waiting for the completion of a volume pair creation or resynchronization to check the pair status.
- Pair status display and configuration confirmation: Displays the pair status and configuration of the volume pairs; this can also be used for checking the completion of a pair creation or pair resynchronization.

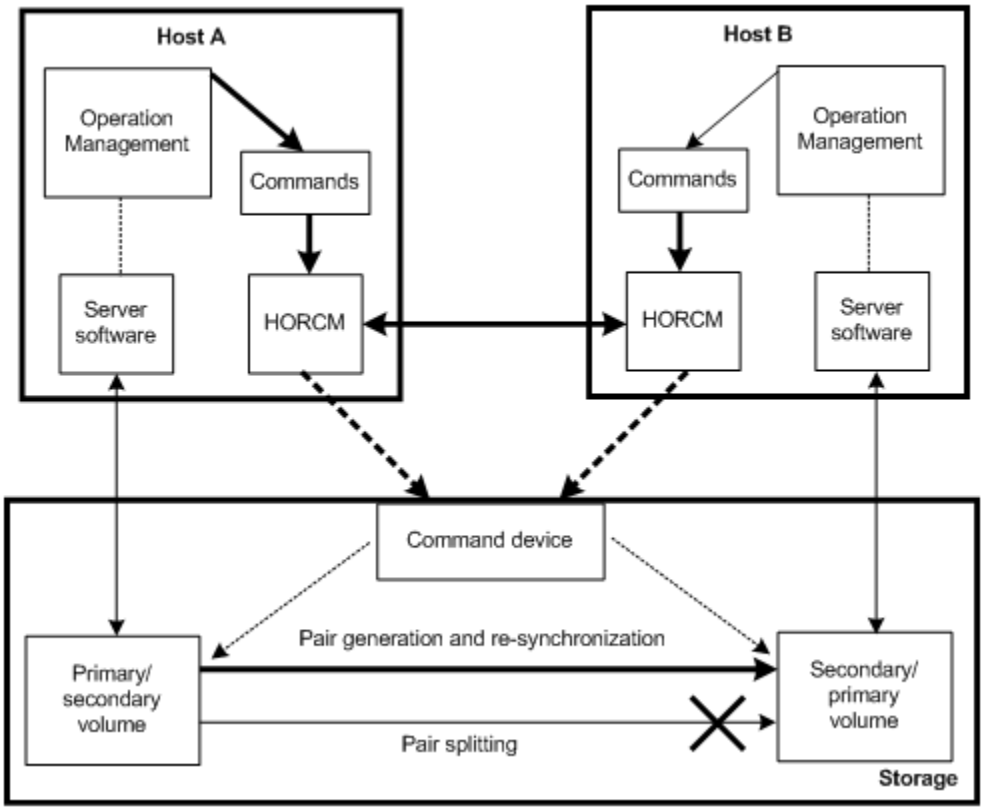


Figure 6-2 ShadowImage system configuration

ShadowImage duplicated mirroring

Duplicated mirroring of a single primary volume is possible when the ShadowImage feature is used. Duplicated mirror volumes can be specified up tp the maximum quantity 3. The duplicated mirror volumes of the P-VOL are expressed as virtual volumes using the mirror descriptors (MU#0-2) in the configuration diagram as shown below.

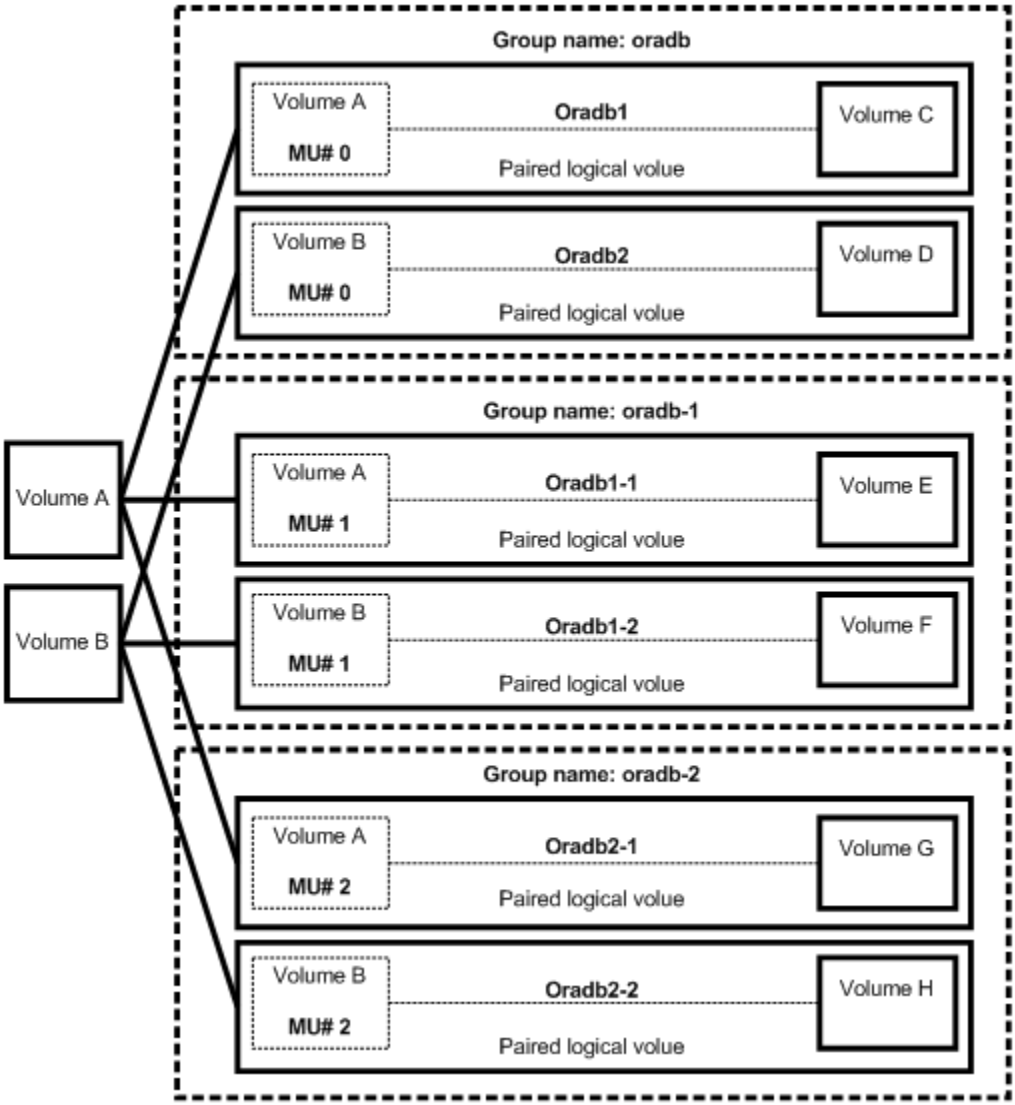


Figure 6-3 ShadowImage duplicated mirrors

ShadowImage cascading pairs

ShadowImage provides a cascading function for the ShadowImage S-VOL. Cascading mirror volumes can be specified up to the maximum quantity 2. The cascading mirrors of the S-VOL are expressed as virtual volumes using the mirror descriptors (MU#1-2) in the configuration diagram as shown below. The MU#0 of a mirror descriptor is used for connection of the S-VOL.

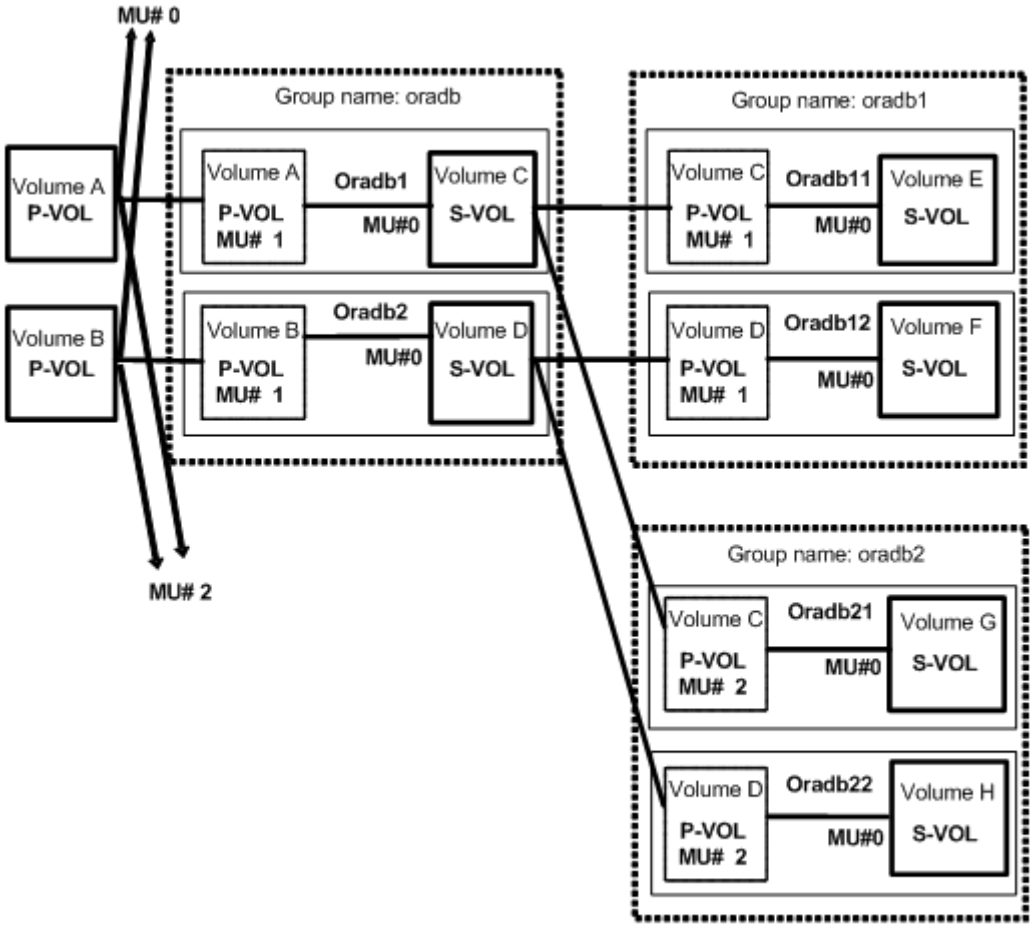
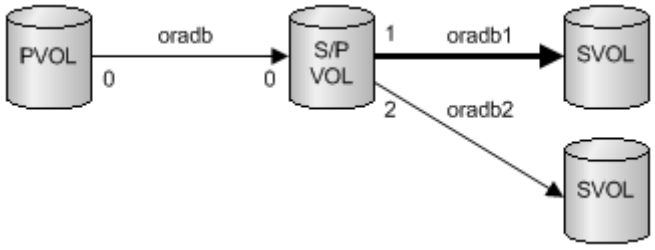


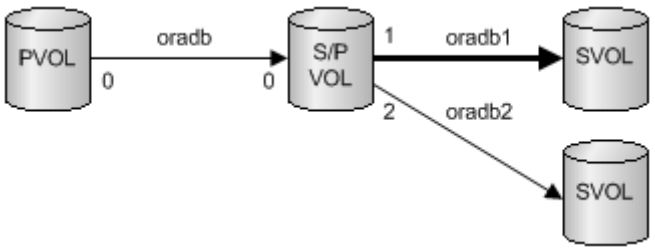
Figure 6-4 ShadowImage cascade volume pairs

Restrictions for ShadowImage cascading volumes

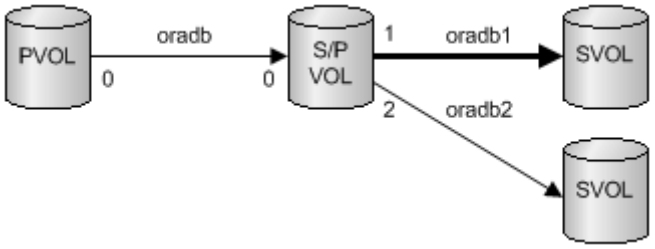
Pair Creation. Pair creation of SVOL (oradb1) can only be performed after the pair creation of S/PVOL (oradb). If you create the oradb1 pair first without creating the oradb, the subsequent oradb creation will be rejected with EX_CMDRJE or EX_CMDIOE.



Pair splitting. Pair splitting of SVOL (oradb1) can only be performed after the S/PVOL (oradb) is in a SMPL or PSUS state, since ShadowImage copies are asynchronous. If pair splitting of the SVOL (oradb1) is attempted while the S/PVOL (oradb) is in a COPY or PAIR state, the **`pairsplit`** command is rejected with EX_CMDRJE or EX_CMDIOE.

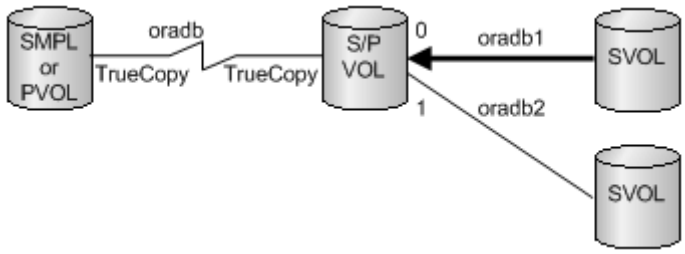


Pair restore. Pair restore (resync from SVOL (oradb1) to S/PVOL) can only be performed when the SVOL (oradb) and the PVOL (oradb2) on the S/PVOL are in the SMPL and PSUS states. If the pair restore of SVOL (oradb1) is performed while either the SVOL (oradb) or PVOL (oradb2) on the S/PVOL are in a COPY, PAIR or PSUS state, the **`pairresync -restore`** command is rejected with EX_CMDRJE or EX_CMDIOE.



Restriction for TrueCopy/ShadowImage cascading volumes

Pair restore (resynchronization from SVOL (oradb1) to S/PVOL) can only be performed when the TrueCopy SVOL (oradb) and the PVOL (oradb2) on the S/PVOL are in the SMPL or PSUS(SSUS) state. If pairresync of S-VOL (oradb1) is performed when the S/PVOL (oradb or oradb2) is in any other state, the **`pairresync -restore`** option command is rejected with EX_CMDRJE or EX_CMDIOE.



TrueCopy operations

CCI TrueCopy commands operate in conjunction with the software on the UNIX/PC servers and the TrueCopy functions of the RAID storage systems. The CCI software provides failover and other functions such as backup

commands to allow mutual hot standby in cooperation with the failover product on the UNIX/PC server (for example, MC/ServiceGuard, FirstWatch, HACMP).

Note: For proper maintenance of TrueCopy operations, it is important to determine if there are any faults in paired volumes, recover the volumes from the failures as soon as possible, and continue operation in the original system.

Note: For information about the operational requirements and specifications for TrueCopy, please see the *Hitachi TrueCopy® User Guide* for your storage system.

TrueCopy takeover commands

Figure 6-5 Server failover system configuration on page 6-10 illustrates a high-availability (HA) environment. When a server software error or a node error is detected, the HA failover software causes the cluster manager (CM) to monitor server programs and causes the CM of the standby node to automatically activate the HA control script of the corresponding server program. The HA control script usually contains database recovery procedures, server program activation procedures, and other related recovery procedures. The TrueCopy CCI takeover commands are also activated by the HA control script.

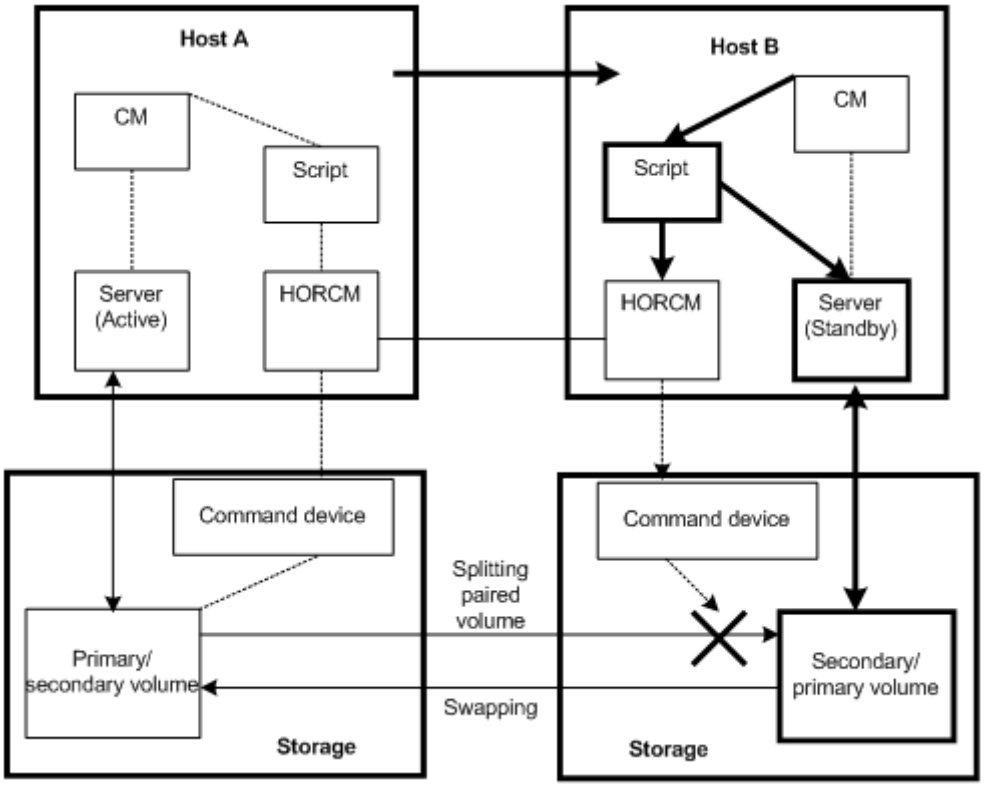


Figure 6-5 Server failover system configuration

Legend

- CM (Cluster Manager) : Demon process that keeps the consistency of the cluster by monitoring the node and server program in the cluster.

- Script : Shell script that automatically performs takeover process when CM detects the server failure.

In an HA environment, a package is a group of applications that are scripted to run on the secondary host in the event of a primary host failure. When using the HA software (for example, MC/ServiceGuard), the package can be transferred to the standby node as an operation executed by the system administrator (see Figure 6-6 Package transfer on high availability (HA) software on page 6-11).

Note: If the operation is performed when CCI and TrueCopy are being used, the volume is switched from primary to secondary as if an error had occurred, even though data consistency is assured. When restoral of the original node occurs along with its original package (group of applications), it is necessary to copy the data on the secondary volume onto the primary volume; this operation can take as much time as the initial copy operation for the pair. In actual operation, no package can be transferred when TrueCopy is being used. The secondary package is switched to the primary package, and vice versa, when the primary volume is switched to the secondary volume. Therefore, the primary and secondary TrueCopy volumes should be switched depending on the package state.

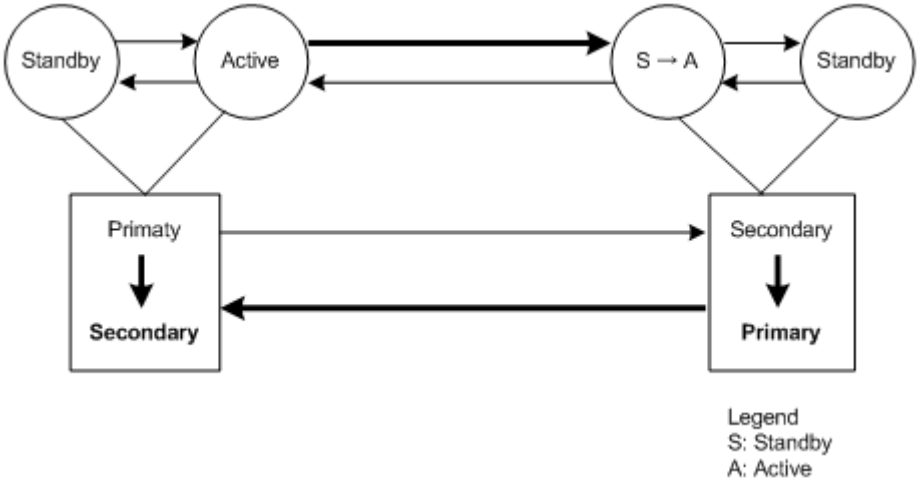


Figure 6-6 Package transfer on high availability (HA) software

The swap option of the takeover command allows swapping of the primary and secondary volume designations, so if the primary and secondary volume are switched due to a server error or package transfer, pair operation can be continued using the reversed volumes. When control is handed back over to the original node, swapping the volume designations again eliminates the need of copying them. In addition, the takeover command has the option to allow the secondary volume to be logically separated (for the purpose of recovery from a disaster at the original operating site). The takeover command has four functions designed for HA software operation: Takeoverswitch, swap-takeover, SVOL-takeover, and PVOL-takeover. This command is not available for ShadowImage

Takeover-switch function

The control scripts activated by HA software are used by all nodes of a cluster in exactly the same manner so they have no discrimination between primary and secondary pair volumes (they just know the near and far disk in a pair). Thus, the takeover command, when activated by a control script, must check the combination of attributes of volumes possessed by the local and remote nodes and determine the proper takeover action. The table below shows the takeover actions.

Table 6-1 Near/Local and Far/Remote Volume Attributes and Takeover Actions

Local node (Takeover node)		Remote node		Takeover action
Volume attribute	Fence and status	Volume attribute	P-VOL status	
SMPL	-	SMPL	-	Reject
		P-VOL	-	Nop-takeover[1]
		S-VOL	-	Unconformable
		Unknown	-	Reject
P-VOL (primary)	Fence == Data or Status && pair status == PSUE or PDUB or MINAP == 0	SMPL	-	Reject
		P-VOL	-	Unconformable
		S-VOL	-	PVOL-Takeover[2]
		Unknown	-	PVOL-Takeover[2]
	Others	SMPL	-	Reject
		P-VOL	-	Unconformable
		S-VOL	-	Nop-takeover[1]
		Unknown	-	Nop-takeover[1]
S-VOL (secondary)	Status == SSWS (After SVOL_SSUStakeover)	-	-	Nop-takeover[1]
	Other than SSWS	SMPL	-	Unconformable
		P-VOL	PAIR or PFUL	Swap-takeover[2]
			Others	SVOL-takeover[2]
		S-VOL	-	Unconformable
		Unknown	-	SVOL-takeover[2]

Notes:

1. No action needed to allow local writes.
2. Required to allow local writes.

Nop-takeover: No operation is done to allow local writes, though the takeover command is accepted. Personality swaps must be accomplished in another way.

Unconformable: A pair of volumes are not conformable to each other as a pair (that is, one P-VOL, one S-VOL). The takeover command execution terminates abnormally.

Reject: The takeover command is rejected, and the operation terminates abnormally.

Unknown: The attribute of the remote node is unknown and cannot be identified. This means that the remote node system has gone down or cannot communicate over the LAN.

SSWS: Since the SSWS state is referring to a Suspend for Swapping with S-VOL Side only, the SSWS state is displayed as SSUS (SVOL_PSUS) by all commands except the -fc option of the pairdisplay command.

Swap-takeover function

The P-VOL status at the remote node is PAIR or PFUL (TrueCopy Async and over HWM) and the S-VOL has mirroring consistency. In such a state, it is possible to swap the primary and secondary volume designations to continue operation. The takeover command internally executes the operating commands (explained later) step by step, to swap the primary and secondary volume designations. Swapping can be specified at the granularity of volume pair, CT group, or volume group.

The swap-takeover function does not use Simplex and No Copy mode for Swapping in order to guarantee mirror consistence more surely, and it is included as a function of SVOL-takeover.

1. As the preliminary step of swap-takeover, the command orders a Suspend for Swapping (SSWS) for the local volume (S-VOL). If this step fails, the swap-takeover function is disabled and it will be returned at an error.
2. The command orders a Resync for Swapping for switch to the primary volume that the local volume (S-VOL) is swapped as the NEW_PVOL and re-synchronizes the NEW_SVOL based on the NEW_PVOL. As for the number of simultaneous copy tracks, if the remote host is known then the command will use the value of P-VOL specified at paircreate time, else (remote host is Unknown) the command will use a default of 3 as the number of tracks for Resync for Swapping.

   If this step fails, the swap-takeover function will be returned at SVOLSSUS-takeover, and the local volume (S-VOL) is maintained in SSUS(PSUS) state which permits WRITE and maintaining delta data (BITMAP) for the secondary volume. Also this special state is displayed as SSWS state using -fc option of pairdisplay command.

TrueCopy Async/Universal Replicator specific behavior for swap-takeover: The S-VOL side CCI will issue a Suspend for Swapping to the S-VOL side storage system. Non-transmitted data which remains in the FIFO queue (sidefile) of the primary volume will be copied to the S-VOL side and a Resync for Swapping operation will be performed (after the copy process). The Swap operation is required to copy Nontransmitted P-VOL data within a given timeout value (specified by the -t <timeout> option).

SVOL-takeover function

The function makes it so the takeover node alone can use the secondary volume (except in COPY state) in SSUS(PSUS) state (i.e., reading and writing are enabled), on the assumption that the remote node (possessing the primary volume) cannot be used.

The data consistency of the secondary volume is judged by its status and fence level. If this check proves that data is not consistent, the SVOL-takeover function fails. If this check proves that data is consistent then this function will try to switch the S-VOL to a primary volume using a Resync for Swapping, and if it succeeds then this function will return Swap-takeover, else this function will return SVOL-SSUS-takeover as the return value of horctakeover command. In case of a Host failure, this function will be returned as Swap-takeover. In case of a FICON or P-VOL site failure, this function will be returned as SVOL-SSUS-takeover. A SVOL-takeover can be specified by the granularity of a paired logical volume, CT group or volume group. If a SVOL-takeover is specified for a volume group, a data consistency check is executed for all volumes in the group. Inconsistent volumes are picked out and displayed in the execution log file as shown below:

Example:

```
Group Pair vol Port targ# lun# LDEV#...Volstat Status Fence To
be...
oradb1 ora001 CL1-A 1 5 145...S-VOL PAIR NEVER Analyzed
oradb1 ora002 CL1-A 1 6 146...S-VOL PSUS STATUS Suspected
```

Even so, the SVOL-takeover function enables the secondary volume to be used (i.e., reading and writing are enabled) since it assumes that the remote node (possessing the primary volume) cannot be used.

TrueCopy Async/Universal Replicator specific behavior for svol-takeover: The S-VOL side CCI will issue a Suspend for Swapping to the S-VOL side storage system. Non-transmitted P-VOL data will be copied to the S-VOL and a Resync for Swapping operation will be performed (after the copy process).

In case of a Host failure, this data synchronize operation will be accomplished and the SVOL-takeover function will return as Swaptakeover after attempting a Resync for Swapping.

In case of a FICON or P-VOL site failure, this data synchronization operation may fail. Even so, the SVOL-takeover function will do Suspend for Swapping, and enable the secondary volume to be used.

As a result, this function will return as SVOL-SSUS-takeover. Through this behavior, you will be able to judge that non-transmitted data of the primary volume was not transmitted completely when a SVOL-takeover returns SVOL-SSUS-takeover.

Caution: The SVOL-takeover operation is required to copy Nontransmitted P-VOL data within a given timeout value (specified by the -t <timeout> option).

If the timeout occurs (before the SVOL-takeover operation has completed all S-VOL changes to a SSWS state), the horctakeover command will fail with EX_EWSTOT. If the horctakeover has failed due to a timeout then you need to try for a recovery as shown below.

- Wait until the S-VOL state becomes SSWS' via pairdisplay -g <group> -l -fc command, and try to the start-up again for the HA Control Script.
- Make an attempt to re-synchronize the original P-VOL based on the S-VOL using pairresync -g <group> -swaps -c <size> for a Fast Failback operation.

  If this operation fails with [EX_CMDRJE] or [EX_CMDIOE], this is due to a FICON link down or site failure. After a recovery from the failure, perform the operation again.

Therefore this timeout value should be a greater than (or equal) to the start-up timeout value for the MC & CC Control Script.

PVOL-takeover function

A PVOL-takeover relinquishes the pair state for a volume or group in order to make the P-VOL writable following some type of error (for example, link down with DATA fence). This function makes it so the takeover node alone can use the primary volume (that is, reading and writing are enabled), on the assumption that the remote node (possessing the secondary volume) cannot be used.

The PVOL-takeover function has two functions: PVOL-PSUE-takeover, and PVOL-SMPL-takeover. A PVOL-PSUE-takeover forces the primary volume to suspend (PSUE, PSUS) state which permits WRITEs to all primary volumes of the group (even if the fence level is data). Therefore PSUE and/or PSUS are intermingled in the volume group through the action of this PVOLPSUE_ Takeover. This intermingled pair status creates PSUE as the group status, therefore the pairvolchk command results give precedence to PSUE (PDUB) status over PSUS for the group.

This special state returns back to its original state by issuing the pairresync command. A PVOL-SMPL-Takeover forces the primary volume to simplex (SMPL) state so the pair is destroyed. At first, PVOL-takeover executes PVOL-PSUE-takeover. If PVOL-PSUE-takeover fails, it then executes PVOL-SMPLtakeover. PVOL-takeover can be specified per paired logical volume or per volume group.

TrueCopy Async/Universal Replicator specific behavior for pvol-takeover: PVOL-Takeover will not be executed. It will become a Nop-Takeover, since the Fence Level will be Async which is equal to Never so it is not needed to allow P-VOL writes.

TrueCopy remote commands

Figure 6-7 TrueCopy remote system configuration on page 6-17 illustrates a TrueCopy remote configuration. The CCI TrueCopy remote commands assist the system operation with volume backups among UNIX servers and their operating system management functions. The TrueCopy remote pair commands are also used to copy volumes in server failover configurations and to restore the volumes to their original state after a server failover has been recovered.

- Pair creation command: Creates a new volume pair. Volume pairs can be created in units of volume or group.
- Pair splitting command: Splits a volume pair and allows read and write access to the secondary volume.
- Pair resynchronization command: Resynchronizes a split volume pair based on the primary volume. The primary volume remains accessible during resynchronization.
  - Swaps(p) option (TrueCopy only). Swaps volume from the SVOL(PVOL) to the PVOL(SVOL) when the SVOL(PVOL) is in the suspended state and resynchronizes the NEW_SVOL based on the NEW_PVOL. At the result of this operation, the volume attributes of the host of reference (local host) are used as the attributes for the NEW_PVOL(SVOL).
- Event waiting command: Used to wait for the completion of volume pair creation or resynchronization and to check the pair status.
- Pair status display and configuration confirmation command: Displays the pair status and configuration of the volume pairs and is used for checking the completion of pair creation or pair resynchronization.

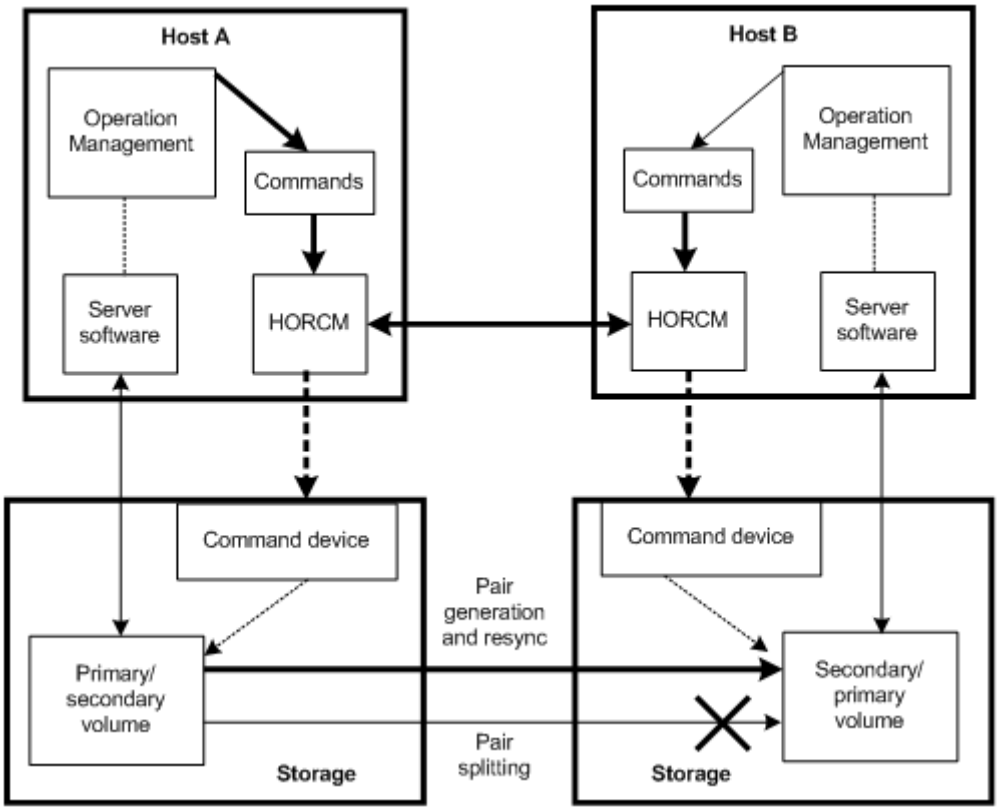


Figure 6-7 TrueCopy remote system configuration

Legend

- HORCM : The manager is a demon process, executes multiple commands, charges to a storage system through itself. Among the managers are connected by UDP, remotely execute a command among the servers mutually.
- Command : A command provisioned by CCI.

TrueCopy local commands

Figure 6-8 TrueCopy local system configuration on page 6-18 illustrates a TrueCopy local configuration. The CCI TrueCopy local commands assist the system operation with volume backups among UNIX servers and their operating system management functions. The TrueCopy local commands perform the same functions as the remote commands but within the same RAID storage system instead of between two RAID storage systems.

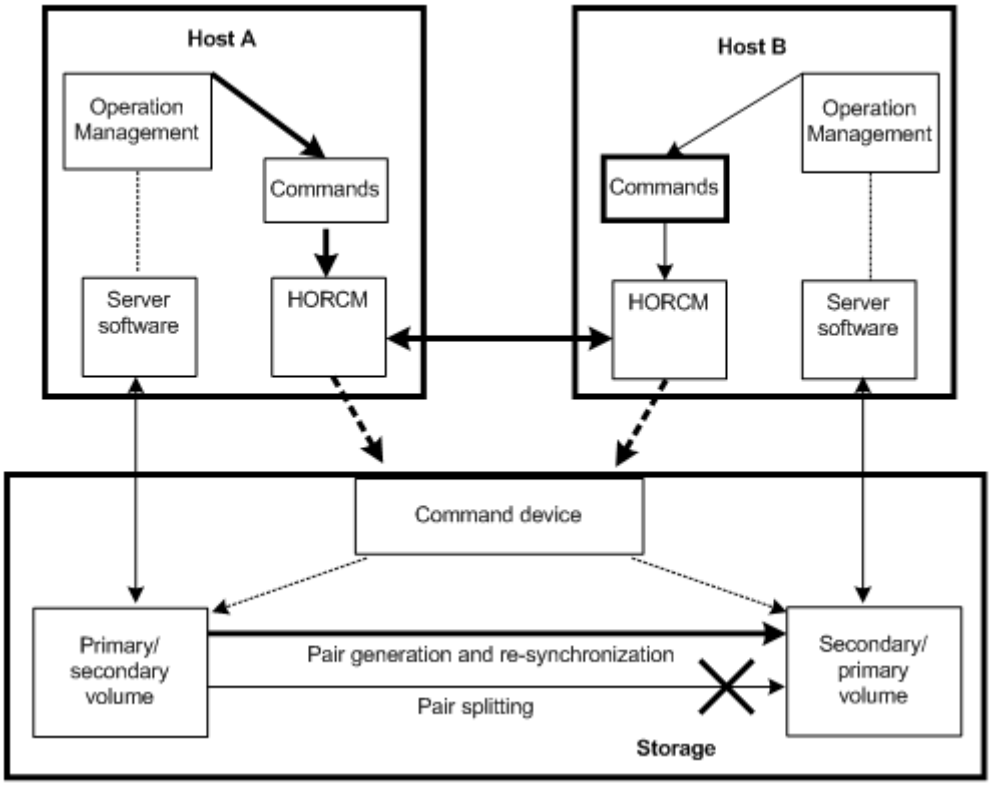


Figure 6-8 TrueCopy local system configuration

TrueCopy, ShadowImage, and Universal Replicator operations

TrueCopy/ShadowImage volumes

TrueCopy commands allow you to create volume pairs consisting of one primary volume (P-VOL) and one secondary volume (S-VOL). The TrueCopy P-VOL and S-VOL can be in different storage systems. TrueCopy provides synchronous and asynchronous copy modes. TrueCopy Async can only be used between separate storage systems (not within one storage system). For details on TrueCopy specifications, volumes and operations, please see the *Hitachi TrueCopy® User Guide* for your storage system.

ShadowImage commands allow you to create volume pairs consisting of one P-VOL and up to nine S-VOLs using the ShadowImage cascade function. ShadowImage pairs are contained within the same storage system and are maintained using asynchronous update copy operations. For details on ShadowImage specifications volumes and operations, please see the *Hitachi ShadowImage® User Guide* for your storage system.

Each volume pair that you want to create must be registered in the CCI configuration file. ShadowImage volume pairs must include a MU (mirrored unit) number assigned to the S-VOL. The MU number indicates that the pair is a ShadowImage pair and not a TrueCopy pair. Once the correspondence between the paired logical volumes has been defined in the HORCM_DEV

section of the configuration file, you can use the configuration file to group the paired volumes into volume groups that can be managed by the host operating system's LVM (logical volume manager).

The host's LVM allows you to manage the TrueCopy/ShadowImage volumes as individual volumes or by volume group. TrueCopy/ShadowImage commands can specify individual logical volumes or group names. For LUSE volumes, you must enter commands for each volume (LDEV) within the expanded LU. If you define volume groups and you want to issue commands to those volume groups, you must register the volume groups in the configuration file. For further information about the server LVM, see the user documentation for your corresponding operating system.

TrueCopy/ShadowImage/Universal Replicator pair status

Each TrueCopy pair consists of one P-VOL and one S-VOL, and each ShadowImage pair consists of one P-VOL and up to nine S-VOLs when the cascade function is used. Table 6-2 TrueCopy and ShadowImage pair status on page 6-19 lists and describes the TrueCopy and ShadowImage pair status terms. Table 6-3 Universal Replicator pair status on page 6-20 lists and describes the Universal Replicator pair status terms. The P-VOL controls the pair status for the primary and secondary volumes. The major pair statuses are SMPL, PAIR, PSUS/PSUE, and COPY/RCPY. Read and write requests from the host are accepted or rejected depending on the pair status of the volume.

The pair status can change when a CCI command is executed. The validity of the specified operation is checked according to the status of the volume (primary volume).

- Table 6-4 Pair status versus TrueCopy/Universal Replicator commands on page 6-22 shows the relationship between pair status and TrueCopy/Universal Replicator command acceptance.
- Table 6-5 Pair status versus ShadowImage commands on page 6-22 shows the relationship between pair status and ShadowImage command acceptance.
- Table 6-6 Pair status versus Copy-on-Write Snapshot commands on page 6-25 shows the relationship between pair status and Copy-on-Write Snapshot command acceptance.

For details on pair status of TrueCopy for Mainframe, ShadowImage for Mainframe, and Universal Replicator for Mainframe, see Pair operations with mainframe volumes on page 3-41.

Table 6-2 TrueCopy and ShadowImage pair status

Status	TrueCopy Pair Status	ShadowImage Pair Status	Primary	Secondary
SMPL	Unpaired volume	Unpaired volume	R/W enabled	R/W enabled
PAIR	Paired volume. Initial copy is complete. Updates are processed synchronously or asynchronously.	Paired volume. Initial copy is complete. Updates are processed asynchronously.	R/W enabled	R enabled

Status	TrueCopy Pair Status	ShadowImage Pair Status	Primary	Secondary
COPY	In paired state, but initial copy, pairsplit, or resync operation is not complete. Includes COPY(PD), COPY(SP), and COPY(RS) status.	In paired state, but initial copy, pairsplit, or resync operation is not complete. Includes COPY(PD), COPY(SP), and COPY(RS) status.	R/W enabled	R enabled
RCPY	Not used for TrueCopy	In paired state, but reverse resync operation is not complete. Includes COPY(RS-R) status.	R enabled	R enabled
PSUS (split) SSUS (split)	In paired state, but updates to the S-VOL data are suspended due to user-requested pairsplit. The RAID storage system keeps track of P-VOL and S-VOL updates while the pair is split.	In paired state, but updates to the S-VOL data are suspended due to user-requested pairsplit. The RAID storage system keeps track of P-VOL and S-VOL updates while the pair is split.	R/W enabled	R/W enabled when using write enable pairsplit option
PSUE (error) or PFUS	In paired state, but updates to the S-VOL data are suspended due to an error condition. (PSUE is PSUS due to internal error. PFUS is PSUS due to sidefile full.)	In paired state, but updates to the S-VOL volume data are suspended due to an error condition. When a PSUE pair is resynchronized, the RAID storage system copies the entire P-VOL to the S-VOL (same as initial copy).	R/W enabled if no error occurs in the primary volume	R enabled
PDUB	Used only for TrueCopy LUSE pairs. In paired state, but updates to one or more LDEVs within the LUSE pair are suspended due to an error condition.	Not used for ShadowImage	R/W enabled if no error occurs in the primary volume	R enabled

Table 6-3 Universal Replicator pair status

Status	Universal Replicator Pair Status	Primary	Secondary
SMPL	Unpaired volume	R/W enabled	R/W enabled
PAIR	The pair is synchronized. Updates to the P-VOL are duplicated on the S-VOL.	R/W enabled	R enabled
COPY	In paired state, but initial copy, pairsplit, or resync operation is not complete. Includes COPY(PD), COPY(SP), and COPY(RS) status.	R/W enabled	R enabled

Status	Universal Replicator Pair Status	Primary	Secondary
PSUS (split) SSUS (split)	The user has split the pair or released the pair; the pair is no longer synchronized. • The primary and secondary systems keep track of journal data discarded during the pairsplit operation. • When the operation is performed at the primary system, the status of both the P-VOL and S-VOL changes to PSUS. • When the operation is performed at the secondary system, the status of the S-VOL changes to PSUS; the primary system detects this (if path status is normal) and changes P-VOL status to PSUS. • When a pair is released from the secondary system, the secondary system changes the status of the S-VOL to SMPL. The primary system detects this (if path status is normal and changes P-VOL status to PSUS. (The pair must be released from the primary system to change P-VOL status to SMPL.)	R/W enabled	R/W enabled when using write enable pairsplit option
PSUE	The pair is suspended due to an error; the pair is not synchronized. • The primary and secondary systems keep track of any journal data that are discarded during the suspension operation. • The primary system keeps track of P-VOL tracks that are updated while the pair is suspended. • When a UR suspension condition is detected, the primary system changes P-VOL and S-VOL status to PSUE. If the secondary system detects the condition, it changes the S-VOL status to PSUE; the primary system detects this and changes P-VOL status to PSUS.	R/W enabled if no error occurs in the primary volume	R enabled
PFUS	If the Data Overflow Watch period is exceeded, pair status changes from PFUL to PFUS, and the pair is suspended. • The PFUS status is displayed by CCI and Storage Navigator as PSUS. • If a virtual volume of Dynamic Provisioning (DP-VOL) is used as a UR S-VOL, and the capacity of a pool-VOL is nearly full, UR status becomes PFUS and the pair is suspended.	R/W enabled	Read Only, unless write option is enabled.
SSWS	After Takeover, SSWS is the status of the S-VOL. With this status, data can be written to the S-VOL. • SSWS is displayed by CCI, from which the horctakover command is issued. • Storage Navigator displays this status as PSUS or PSUE.	R enabled	R/W enabled

Status	Universal Replicator Pair Status	Primary	Secondary
PFUL	If data in the journal volume exceeds 80-percent, pair status changes to PFUL. The write data that inflows then is monitored during the Data Overflow Watch. PFUL status is displayed by CCI. Storage Navigator displays this status as PAIR.	R/W enabled	R enabled

Table 6-4 Pair status versus TrueCopy/Universal Replicator commands

-		TrueCopy/Universal Replicator command					
		paircreate		pairsplit			pairresync
#	Status	Copy	Nocopy	-r or -rw option	-P option	-S option	Resync
1	SMPL	Accepted 2	Accepted 3	Rejected	Rejected	Acceptable	Rejected
2	COPY	Acceptable	Acceptable	Accepted 4	Rejected	Accepted 1	Acceptable
3	PAIR	Acceptable	Acceptable	Accepted 4	Accepted 4	Accepted 1	Acceptable
4	PSUS	Rejected	Rejected	Acceptable	Acceptable	Accepted 1	Accepted 2*
5	PSUE	Rejected	Rejected	Acceptable	Acceptable	Accepted 1	Accepted 2*
6	PDUB	Rejected	Rejected	Rejected	Rejected	Accepted 1	Accepted 2*

Legend:

Accepted = Accepted and executed. When the operation terminates normally, the status changes to the indicated number.

Acceptable = Accepted but no operation is executed.

Rejected = Rejected and operation terminates abnormally.

Pairsplit of a TrueCopy Async volume is returned after verification of state transition that waits until delta data is synchronized from P-VOL to S-VOL.

Note: In the case of the SSWS status after SVOL-SSUS-takeover execution, the **pairresync** command (from P-VOL to S-VOL) is rejected because the delta data for S-VOL becomes dominant, and its status is expected to be using the **-swaps(p)** option of **pairresync**. If the **pairresync** command (from P-VOL to S-VOL) is rejected, confirm this special status using the **-fc** option of the **pairdisplay** command.

The following table shows the relation of command acceptances for paired status and ShadowImage.

Table 6-5 Pair status versus ShadowImage commands

-		ShadowImage command					
		paircreate		pairsplit			pairresync
Pair Status		No -split	-split	-E option	-C option	-S option	Resync
1	SMPL	Accepted 2	Accepted 2 to 4	Rejected	Rejected	Acceptable	Rejected
2	COPY RCPY	Acceptable	Accepted [1] 2 to 4	Accepted 5	Accepted [1] 2 to 4	Accepted 1	Acceptable

-		ShadowImage command					
		paircreate		pairsplit			pairresync
Pair Status		No -split	-split	-E option	-C option	-S option	Resync
3	PAIR	Acceptable	Accepted [2] 2 to 4	Accepted 5	Accepted [2] 2 to 4	Accepted 1	Acceptable
4	PSUS	Rejected	Acceptable	Accepted 5	Acceptable	Accepted 1	Accepted 2
5	PSUE	Rejected	Acceptable	Acceptable	Acceptable	Accepted 1	Accepted 2

Legend:

Accepted = Accepted and executed. When the operation terminates normally, the status changes to the indicated number.

Acceptable = Accepted but no operation is executed.

Rejected = Rejected and operation terminates abnormally.

In the following descriptions, when the pair statuses of P-VOL and S-VOL are different, PVOL_ or SVOL_ are applied to show which volume is indicated.

Note: If the P-VOL does not have Write in the PAIR state, then data identical with an S-VOL is guaranteed. Therefore, when using the S-VOL with the SMPL state, after stopping Write to the P-VOL, generate a paired volume, and then split the paired volume after confirming that the paired volume has the PAIR status. In the PSUE state, ShadowImage does not manage differential data at the P-VOL or S-VOL. Therefore, **pairresync** issued to a pair in the PSUE state is all copy performance, but the copy progress rate returned by the **-**fc option of the **pairdisplay** command indicates "0%".

[1]**:** The (2 to 4) state change is effective for only the COPY state that is changed without specification of -split for **paircreate** command.

[2]**:** The (2 to 4) state change appears as P-VOL_PSUS & S-VOL_COPY (see example below), and reading and writing are enabled for S-VOL in SVOL_COPY state.

```
# pairsplit -g oradb

# pairdisplay -g oradb -fc

Group   PairVol(L/R) (Port#,TID,LU-M), Seq#, LDEV#.P/S, Status, %
, P-LDEV# M

oradb   oradev3(L)   (CL2-N , 3,  4-0) 8071   28..P-VOL PSUS,  100
29   W

oradb   oradev3(R)   (CL2-N , 3,  5-0) 8071   29..S-VOL COPY,   97
28   -
```

PVOL_PSUS & SVOL_COPY is the non-reflected PSUS state that data is still being copied from the P-VOL to the S-VOL, and this state has the following specific behavior.

- If you attempt to read non-reflected data on S-VOL in PVOL_PSUS & SVOL_COPY state, then ShadowImage copies non-reflected data from P-VOL to S-VOL, and returns the correct data after copied. This will bring the performance degradation (1/6 to 1/15 with IOPS) to read on the S-VOL.
- If you attempt to write non-reflected data on S-VOL in PVOL_PSUS & SVOL_COPY state, then ShadowImage copies non-reflected data from P-VOL to S-VOL, and writing data is managed as delta data for S-VOL after copied. This will bring the performance degradation(1/6 to 1/8 with IOPS) to write on the S-VOL.
- If you attempt to write to the data on P-VOL that does not still reflected the data to S-VOL, then ShadowImage copies non-reflected data from P-VOL to S-VOL, and writing data is managed as delta data for P-VOL. This will bring the performance degradation(1/6 to 1/8 with IOPS) to write on the P-VOL.
- The state changes for **pairsplit** are (WD = Write Disable, WE = Write Enable):

If P-VOL has non-reflected data in PAIR state:

Behavior of OLD **pairsplit** at T0	Behavior of first **pairsplit** at T0
T0 PVOL_PAIR from/to SVOL_PAIR(WD)	PVOL_PAIR from/to SVOL_PAIR(WD)
T1: PVOL_COPY from/to SVOL_COPY(WD)	PVOL_PSUS from/to SVOL_COPY(WE)
T2: PVOL_PSUS from/to SVOL_SSUS(WE)	PVOL_PSUS from/to SVOL_SSUS(WE)

If P-VOL has been reflected all data to S-VOL in PAIR state:

Behavior of OLD **pairsplit** at T0	Behavior of First **pairsplit** at T0
T0: PVOL_PAIR from/to SVOL_PAIR(WD)	PVOL_PAIR from/to SVOL_PAIR(WD)
T1: PVOL_PSUS from/to SVOL_SSUS(WE)	PVOL_PSUS from/to SVOL_SSUS(WE)

- The state changes for **paircreate -split** are:

Behavior of OLD **paircreate -split** at T0	Behavior of First **paircreate -split** at T0
T0: SMPL from/to SMPL	SMPL from/to SMPL
T1: PVOL_COPY from/to SVOL_COPY(WD)	PVOL_PSUS from/to SVOL_COPY(WE)
T2: PVOL_PSUS from/to SVOL_SSUS(WE)	PVOL_PSUS from/to SVOL_SSUS(WE)

- If you attempt the **pairevtwait -s psus** in PVOL_PSUS & SVOL_COPY state, then **pairevtwait** will return immediately even if the S-VOL is still in SVOL_COPY state because P-VOL is already in PVOL_PSUS state. If you want to wait the "SVOL_SSUS" state, and then you must check the status of the S-VOL becomes "SVOL_PSUS" via the return code using **pairvolchk -ss** command on S-VOL side or **pairvolchk -ss -c** command on P-VOL side. Or you can use **pairevtwait -ss ssus** on both P-VOL and S-VOL, **pairevtwait -ss ssus -l** on S-VOL locally.
- If you attempt the **pairresync -restore** or **pairsplit -S** in PVOL_PSUS & SVOL_COPY state, then ShadowImage will reject this command due to unable to perform. In this case, you need to wait until the S-VOL state becomes SVOL_SSUS.

Table 6-6 Pair status versus Copy-on-Write Snapshot commands

Pair Status		Copy-on-Write Snapshot Command					
		paircreate		pairsplit			pairresync
		No -split	-split	-E option	-C option	-S option	Resync
1	SMPL	Accepted 2	Rejected	Rejected	Rejected	Acceptable	Rejected
2	COPY RCPY	Acceptable	Rejected	Rejected	Rejected	Rejected	Acceptable
3	PAIR	Acceptable	Accepted* 4	Rejected	Accepted 4	Accepted 1	Acceptable
4	PSUS (PFUS)	Rejected	Acceptable	Rejected	Acceptable	Accepted 1	Accepted* 2
5	PSUE	Rejected	Rejected	Acceptable	Rejected	Accepted 1	Accepted* 2
Accepted*: A command is accepted and issued; whether this command is executed or not depends on the microcode version of the RAID storage system.							

Note:

- pairsplit ("simplex -S") of Copy-on-Write Snapshot volume is returned without verification of state transition that waits until SMPL state. **In SMPL state, the volume that was S-VOL becomes R/W disable and data is discarded.**
- In the "PSUE" state, Copy-on-Write Snapshot does not manage for differential data between the primary volume and secondary volume.

TrueCopy Async, TrueCopy, and Universal Replicator volumes

TrueCopy Async/Universal Replicator provides paired volumes that use asynchronous transfer to ensure the sequence of writing data between the primary volume and secondary volume. The sequence of writing data between the primary and secondary volumes is guaranteed within each consistency (CT) group (see Figure 6-9 TrueCopy Async consistency groups on page 6-26).

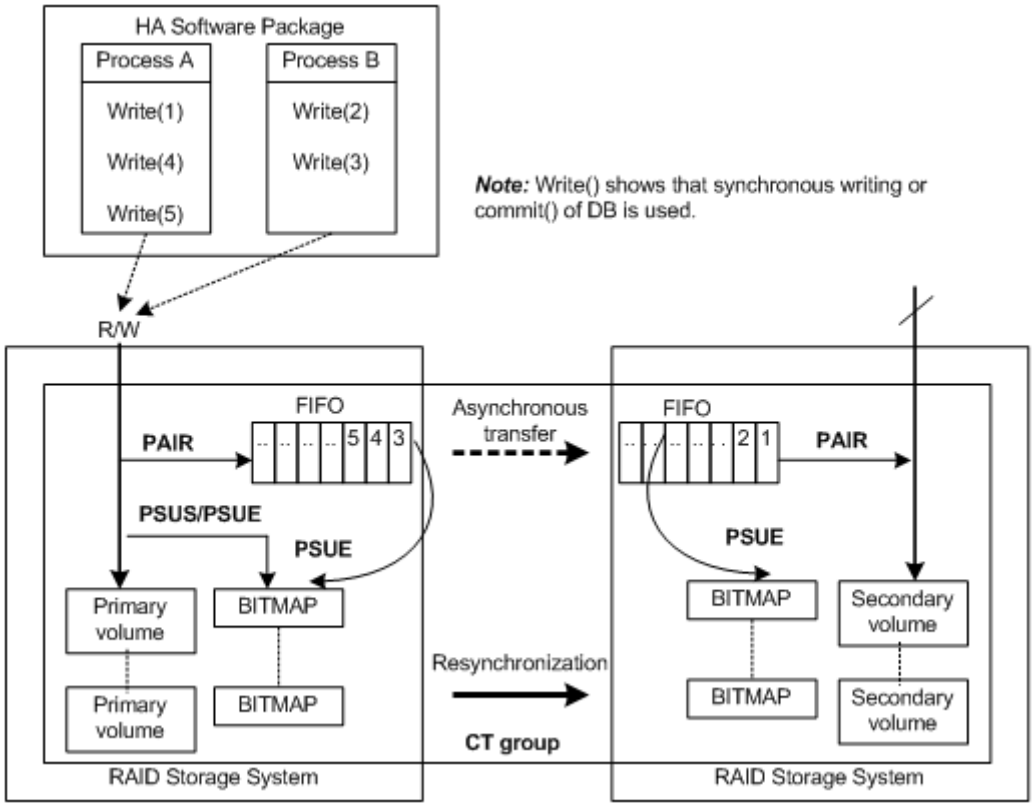


Figure 6-9 TrueCopy Async consistency groups

Restrictions

- Group definition of TrueCopy Async/Universal Replicator/TrueCopy volume: All volumes in a group must be contained within the same storage system. If two or more groups of CCI include the same CT group (CTGID), then pair operation of the group specification is handled in CT group entirety.
- Registration of CTGID number and limitations: CCI registers CTGID to RAID disk array automatically when paired volumes are created by **paircreate** command, and groups of configuration definition files are mapped to CTGID. The maximum number of CT groups is 256 for Virtual Storage Platform and USP V/VM (CTGID0 to CTGID255), 128 for TagmaStore USP/TagmaStore NSC (CTGID0 to CTGID127), 64 for Lightning 9900 V (CTGID0-CTGID63), and 16 for XP512/XP48 Disk Array (CTGID0 to CTGID15). TrueCopy Async/Universal Replicator pair command is terminated with EX_ENOCTG when the maximum number of CT groups is exceeded.
- **Relationships between CTGID and Journal ID:** CT group numbers 0-127 are used for TrueCopy Async, TrueCopy, and Universal Replicator. The rest of the CT group numbers 128-255 are used only for Universal Replicator, and are mapped to the journal.

Table 6-7 Assignment of consistency group IDs (CTGIDs)

CTGID	Assignment	
0 -127	TrueCopy Asynchronous TrueCopy	CTG 0-127
	Universal Replicator	CTG 0-127
128 - 255	Universal Replicator	CTG 128-255

- **At-time Split for TrueCopy:** The operation for making data consistency is only supported by the following option:

```
pairsplit -g <group>  ... [-r]
pairsplit -g <group>  ... -rw
```

TrueCopy Async and Universal Replicator volume characteristics

TrueCopy Async/Universal Replicator volumes have the following characteristics:

- PAIR state: A TrueCopy Async pair changes to the PAIR status as soon as all pending recordsets have been placed in the queue at the primary volume, without waiting for the updates to complete at the secondary volume.
- Pair splitting:When a TrueCopy Async pair is split or deleted, all pending recordsets at the primary volume are sent to the secondary volume, then the pair status changes to PSUS or SMPL. With the **`pairsplit`** command only, updates for the primary volume that occur during and after the pairsplit operation are marked on the bitmap of the primary volume.
- Pair resynchronization: The **`pairresync`** command resynchronizes the secondary volume based on the primary volume. This resynchronization does not guarantee the sequenced data transfer.
- Error suspending: Pending recordsets that have not yet been sent to the secondary volume are marked on the bitmap of the primary volume, then deleted from the queue, and then the pair status changes to PSUE.
- Group operations: TrueCopy Async automatically registers the CTGIDs with the storage system when paired volumes are created using the **`paircreate`** command, and groups in the configuration file are mapped to their corresponding CTGIDs. If more than one group, defined in the configuration definition file, is assigned to the same CTGID, then pair operations on the group specificity apply to the entire consistency group.

Sidefile cache for TrueCopy Async

The first-in-first-out (FIFO) queue of each CT group is placed in an area of cache called the sidefile. The sidefile is used for transferring TrueCopy Async recordsets to the RCU. The sidefile is not a fixed area in cache but has variable capacity for write I/Os for the primary volume. If the host write I/O rate is high and the MCU cannot transfer the TrueCopy Async recordsets to the RCU fast enough, then the sidefile capacity expands gradually. The sidefile has a threshold to control the quantity of data transfer of host side

write I/O. Host side write I/Os are controlled by delaying response when the sidefile exceeds the constant quantity limit on cache in the storage system (see Figure 6-10 Sidefile quantity limit on page 6-28).

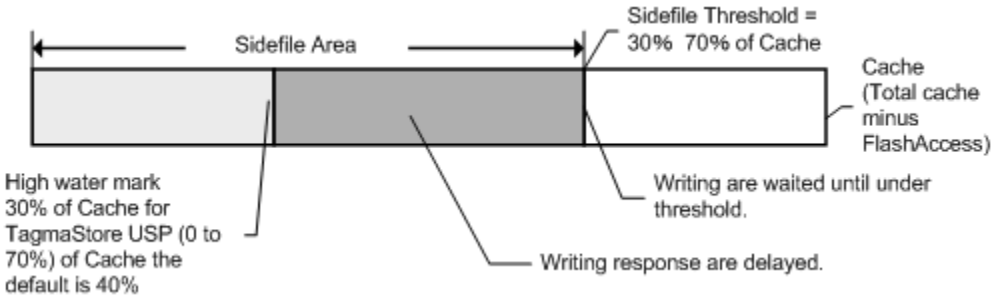


Figure 6-10 Sidefile quantity limit

Sidefile area: Sidefile area = 30% to 70% of cache as set on Storage Navigator (default sidefile = 50% for USP V/VM, 9900V; 40% for TagmaStore USP/TagmaStore NSC).

Write I/O control via the high-water mark (HWM): When the quantity of data in the sidefile reaches 30% of cache, the TrueCopy Async pair status is HWM of PAIR state, and the host write I/Os receive a delayed response in the range of 0.5 seconds to 4 seconds. Following is an arithmetic expression of the HWM at 100% of a sidefile space:

HWM(%) = High water mark(%) / Sidefile threshold (30 to 70) * 100

Write I/O control via the sidefile threshold: When the quantity of data in the sidefile occupies the maximum defined sidefile area, host write I/Os are delayed until there is enough sidefile space to store the next new write data. The copy pending timeout group option is defined using Storage Navigator and specifies the maximum delay between the M-VOL update and the corresponding R-VOL update. The range for the copy pending timeout option is 1-255 seconds (600 seconds for Universal Replicator), and default value is 90 seconds (60 seconds for UR). If the timeout occurs during this wait state, the pair status changes from PAIR to PSUS (sidefile full), and host write I/Os continue with updates being managed by the cylinder bitmap. **Important:** The copy pending timeout value should be less than the I/O timeout value of the host system.

TrueCopy Async transition states and sidefile control

TrueCopy Async volumes have special states for sidefile control during status transitions. Table 6-8 State table for TrueCopy vs. TrueCopy Async on page 6-29 shows the transition states for TrueCopy and TrueCopy Async volumes.

The suspending and deleting states are temporary internal states within the RAID storage system. CCI cannot detect these transition states, because these states are reported on the previous state of the storage system. These states are therefore concealed inside the **`pairsplit`** command. After the **`pairsplit`** command is accepted, host write I/Os for the P-VOL are managed by the cylinder bitmap (normal), non-transmitted data remaining

in the P-VOL's FIFO queue is transferred to the S-VOL's FIFO queue, and the pair status is then set to PSUS [SMPL] state when all data in the P-VOL's FIFO queue has been transmitted.

PFUL. If the quantity of data in sidefile cache exceeds 30% of cache storage, the internal status of the RAID storage system is PFUL, and host write I/Os receive delayed response in the range of 0.5 seconds (minimum) to 4 seconds (maximum).

PFUS. If the quantity of data in sidefile cache exceeds the user-defined sidefile area (30%-70%), then host write I/Os must wait for enough sidefile space to become available for storing the next new write data. If a copy pending timeout occurs during this waiting state, then the pair status changes from PAIR to PFUS, host write I/Os are accepted, and write data is managed by bitmap.

The CCI software can detect and report the PFUL and PFUS states as follows:

- As a return code of the **`pairvolchk`** command
- As the status code displayed to code item by the **`pairmon`** command
- As the paired status displayed to status item using -fc option of **`pairdisplay`** command

Table 6-8 State table for TrueCopy vs. TrueCopy Async

CCI state	Storage system internal state	Description			Writing control on TC async volume		Transfer data via ESCON
		TrueCopy Sync	TrueCopy Async		Writing data	Response	
SMPL	SMPL	SMPL	Same		Normal	Usual	None
COPY	COPY	COPY	Same		Via Sidefile	Usual*	**Sidefile & bitmap**
	Deleting	N/A	Deleting from COPY using [pairsplit -S]		Normal	Usual	Sidefile
	Suspending	N/A	Suspending from COPY by using [pairsplit]		**Via Bitmap**	Usual	Sidefile
PAIR	PAIR	Synchronized	Async sidefile in use	Less than HWM	Via Sidefile	Usual	Sidefile
	PFUL	N/A		**HWM to Threshold**	Via Sidefile	**Delayed**	Sidefile
				Over Threshold	Via Sidefile	**Wait until under threshold**	Sidefile
	Deleting	N/A	Deleting from PAIR using [pairsplit -S]		Normal	Usual	Sidefile
	Suspending	N/A	Suspending from PAIR	Using [pairsplit]	**Via Bitmap**	Usual	**Sidefile**
				Timeout of over threshold			

CCI state	Storage system internal state	Description		Writing control on TC async volume		Transfer data via ESCON
		TrueCopy Sync	TrueCopy Async	Writing data	Response	
PSUS	PSUS	PSUS	Same	Via Bitmap	Usual	None
	PFUS	None	**Timeout Over Threshold**	**Via Bitmap**	Usual	None
PSUE	PSUE	PSUE	Same (link down, etc)	Via Bitmap	Usual	None
PDUB	PDUB	PDUB	Same	Via Bitmap	Usual	None

* If the host has more write I/Os in COPY state, then host write I/Os are delayed until there is enough space in the sidefile.

Legend:

Bitmap: Host write data is managed via a cylinder BITMAP of delta data.

Normal: Host write data is not managed by BITMAP or sidefile.

Usual: Host side writing response is not delayed.

HWM (High Water Mark): Sidefile quantity is over 30% of cache storage.

TrueCopy Async/Universal Replicator error state

In the case of an ESCON or fibre-channel (FC) failure, the S-VOL FIFO queue is missing a data block that was transferred from the P-VOL FIFO queue. The RCU waits to store the next sequenced data block in the S-VOL FIFO queue until the TrueCopy Async copy pending timeout occurs (defined using TrueCopy). In addition, the timeout value can be specified at SVP. The default value is set to 5 minutes. If the timeout occurs during this waiting state, the pair status changes from PAIR to PSUE, and non-sequenced data blocks are managed by the S-VOL bitmap. The missing data block can be recovered using the **`pairresync`** command, which merges the S-VOL bitmap with the P-VOL bitmap. Figure 6-11 TrueCopy Async suspension condition on page 6-31 shows this situation on the secondary side.

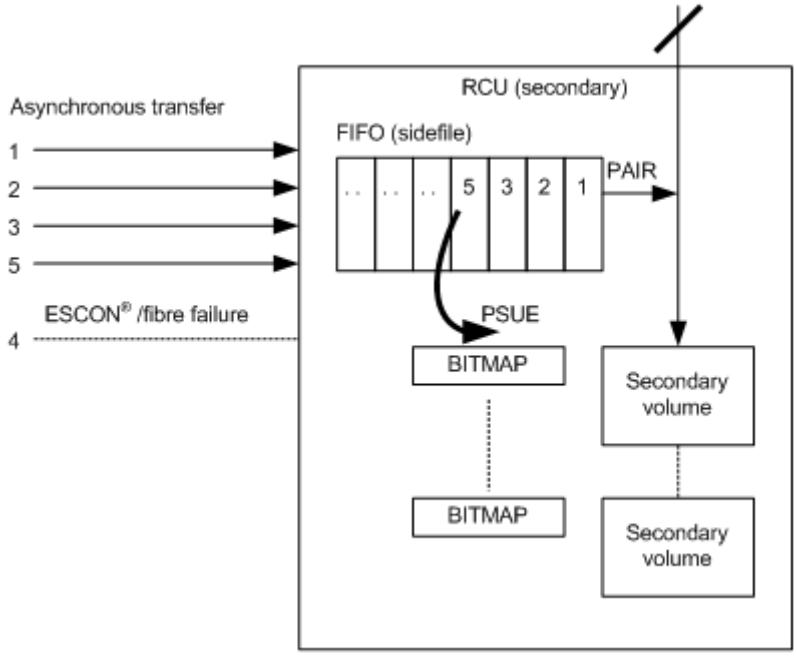


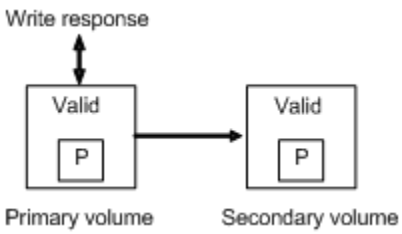
Figure 6-11 TrueCopy Async suspension condition

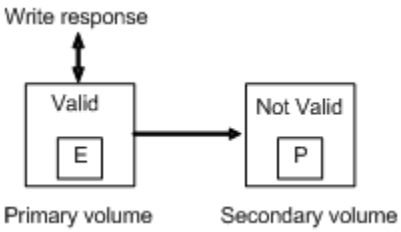
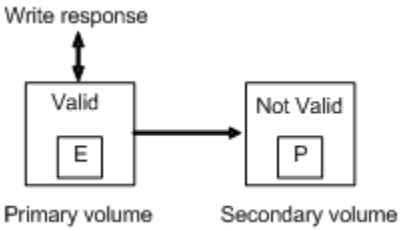
TrueCopy/TrueCopy Async and Universal Replicator fence level settings

TrueCopy volume pairs are assigned a fence level for write I/Os to ensure mirroring consistency of critical volumes. When the secondary volume takes over from the primary volume, the takeover action is determined according to the pair status and fence level of the corresponding secondary volume. Table 6-9 Relationship between TrueCopy pair statuses and fence levels on page 6-31 shows the relationship between TrueCopy pair statuses and fence levels.

- Mirror consistency = Identity and sequence of data is assured via error notification after an I/O completion.
- Data consistency = Sequence of data is assured in I/O order based on host.

Table 6-9 Relationship between TrueCopy pair statuses and fence levels

TrueCopy pair status of volume	Fence level and write response			
	Data [1]	Status [2]	Never [3]	Async [4]
	OK	OK	OK	OK
	Mirroring consistency assured	Mirroring consistency assured	Mirroring consistency assured	Data consistency assured

TrueCopy pair status of volume	Fence level and write response			
	Data [1]	Status [2]	Never [3]	Async [4]
	ERROR	OK	OK	OK
	Mirroring consistency assured	Mirroring consistency not assured	Mirroring consistency not assured	Data consistency assured
	ERROR	ERROR	OK	OK
	Mirroring consistency assured	Mirroring consistency assured	Mirroring consistency not assured	Data consistency assured

[1] When the fence level is data: Mirroring consistency is assured, since a write error is returned if mirror consistency with the remote S-VOL is lost. The secondary volume can continue operation, regardless of the status. Note: A P-VOL write that discovers a link down situation will, in addition to returning an error to the host, likely be recorded on [only] the P-VOL side.

[2] When the fence level is status: If there is a mirror consistency problem (that is, PSUE) and it is possible to set the S-VOL to PSUE, the P-VOL write completes OK. If the S-VOL cannot be set to PSUE for any reason, the P-VOL write completes with an error. The mirror consistency of the S-VOL depends on its status:

PSUE: The secondary volume is dubious.

PAIR: The secondary volume can continue operation.

[3] When the fence level is never: Writing to the P-VOL is still enabled in the state where mirror consistency to the S-VOL is lost, regardless of whether the secondary volume status is updated or not. Thus, the secondary could have these states:

PSUE: The secondary volume is dubious.

PAIR: The secondary volume is substantially dubious, since it can continue operation and is also dubious. The P-VOL status must be checked to confirm the mirroring consistency.

[4] When the fence level is async: TrueCopy Async/UR uses asynchronous transfers to ensure the sequence of write data between the P-VOL and S-VOL. Writing to the P-VOL is enabled, regardless of whether the S-VOL status is updated or not. Thus the mirror consistency of the secondary volume is dubious (similar to the "Never" fence):

- PSUE: The S-VOL mirroring consistency is not assured, but the PSUE suspended state ensures the sequence of data for the consistency group; thus, data consistency is also assured during a PSUE state. At a PSUE state, the P-VOL writes still complete and are also noted in a bitmap for future transfer. Due to the use of a bitmap in the suspend state, data consistency is not assured during a copy state resync.
- PAIR: If the P-VOL and S-VOL are both in a PAIR state, mirror consistency is not assured (may be behind) but data consistency is assured (what has reached the S-VOL is in the proper order).

Setting the fence level

Data fence level

Figure 6-12 Relationship between logs (journal) and data in paired status on page 6-33 shows the relationship between redo log files (journal) and data files. If the S-VOL takes over from the P-VOL in the status shown in Figure 6-12 Relationship between logs (journal) and data in paired status on page 6-33 (where two errors have occurred), the secondary host leaves data (V) unprocessed in the roll-back processing and cannot be recovered completely. Therefore, the fence level of a redo log file must be defined as data. Once the fence level is set to data, the P-VOL returns an error if data may possibly be inconsistent when a write request is issued by the host. Since writing to the data file is not executed due to a write error of the redo log file, the log file stays consistent with the data file. However, when the fence level is set to data, a write I/O error occurs even in the case where operation is suspended due to an error in the S-VOL. Accordingly, duplication becomes meaningless when the S-VOL takes over. Thus, applications using paired volumes with the data fence level should be able to handle write I/O errors properly. For example, the Oracle application creates multiple redo log files by itself (three by default). The fence level can be set to data in this case in which disk errors are permissible by creating multiple files.

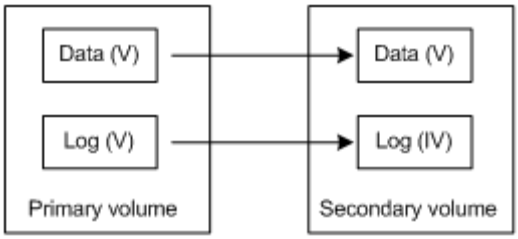


Figure 6-12 Relationship between logs (journal) and data in paired status

Never fence level

Because most UNIX file systems (excluding JFS and VxFS) have no journal files, the fence level should be defined as Never. When a takeover by the S-VOL occurs, fsck is executed on the volume and the file system is cleaned up, even if the S-VOL is undefined at the secondary host. The data that is lost depends on how much differential data is contained in the P-VOL when the S-VOL is suspended. During operation, error recovery should be performed when the suspended status (PSUE or PDUB) is detected (when one error occurs).

Copy-on-Write Snapshot operations

Copy-on-Write Snapshot normally creates virtual volumes for copying on write without specifying LUNs as S-VOLs. However, to use a Copy-on-Write Snapshot volume via the host, it is necessary to map the Copy-on-Write Snapshot S-VOL to a LUN. Therefore, CCI provides a combined command to enable the user or application to use the same CCI command in order to maintain ShadowImage compatibility.

Copy-on-Write Snapshot uses two techniques, one called "V-VOL mapping" (or virtual volume mapping) and the other is "Snapshot using copy on write" or "Copy-on-Write Snapshot." Copy-on-Write Snapshot volumes are also

put into pooling volumes called a "Snapshot pool," and a Snapshot pool is specified as a pool ID when a Snapshot is made. Copy-on-Write Snapshot and volume mapping is illustrated in Figure 6-13 Copy-on-Write Snapshot and volume mapping on page 6-34.

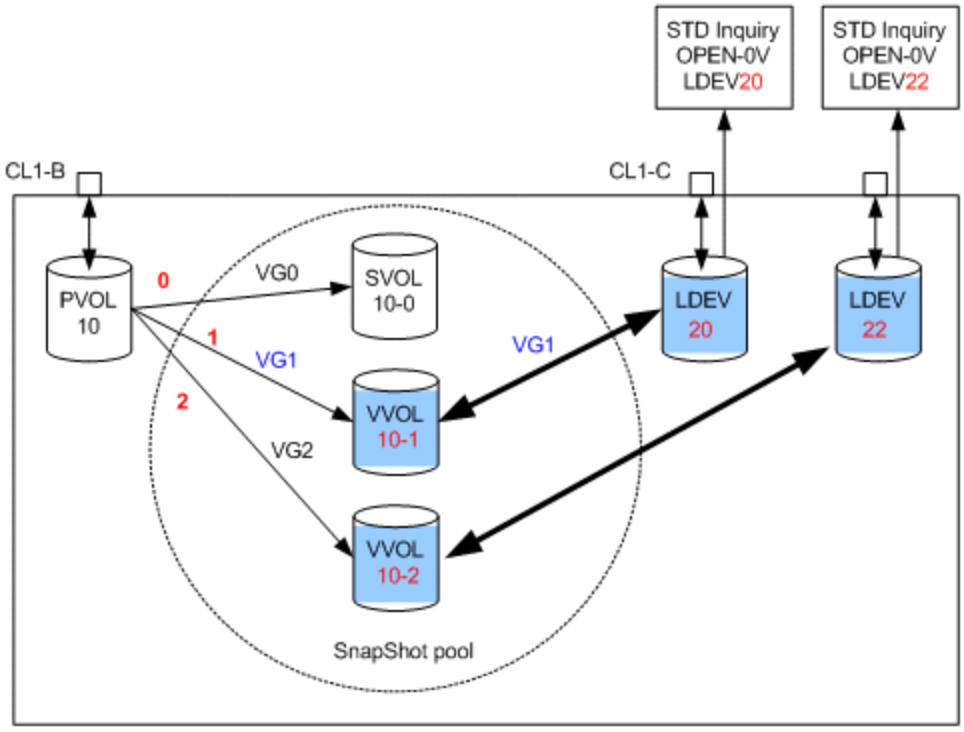


Figure 6-13 Copy-on-Write Snapshot and volume mapping

Copy-on-Write Snapshot volumes

The specifications for Copy-on-Write Snapshot volumes are:

- Allowable type of paired volume: The supported volume type is OPEN-V only for P VOL, and OPEN-0V for S VOL.
- Number of volumes (Copy-on-Write Snapshot) can be paired: This depends on P VOL capacity, Copy-on-Write Snapshot pool capacity, and shared memory capacity on the RAID storage system.
- Duplicated writing mode: Copying on write.
- Number of mirror volumes:
  - Thin Image: Up to 1,024 secondary volumes can be defined for each P VOL.
  - Copy-on-Write Snapshot: Up to 64 secondary volumes can be defined for each P VOL.

For details on Thin Image or Copy-on-Write Snapshot specifications such as maximum number of mirrored volumes, volumes and operations, please see the *Hitachi Thin Image User Guide* or *Hitachi Copy-on-Write Snapshot User Guide* for your storage system.

Creating a Copy-on-Write Snapshot pair

The CCI command for creating a Thin Image or Copy-on-Write Snapshot pair is the same as for ShadowImage. However, Thin Image pair can only operate up to 64 S-VOLs. Therefore, use raidcom command if you want to operate more than 64 S-VOLs.

The RAID storage system determines whether it is a ShadowImage pair or a Thin Image/Copy-on-Write Snapshot pair by the attribute of the S-VOL. The RAID storage system also determines whether it is a Thin Image pair or a Copy-on-Write Snapshot pair by the type of the pool to be used.

A Thin Image pair is generated in the following two cases:

- When a V-VOL (OPEN-0V) is specified as an S-VOL.
- When a pool for Thin Image is specified as the pool type.

A Copy-on-Write Snapshot pair is generated in the following two cases:

- When a V-VOL (OPEN-0V) is specified as an S-VOL.
- When a pool for Copy-on-Write Snapshot is specified as the pool type.

A V-VOL has the following characteristics:

- It appears as "OPEN-0V" to identify a V-VOL easily via the SCSI Inquiry or CCI.
- A V-VOL unmapped to the S-VOL of a Copy-on-Write Snapshot will reply to a SCSI Inquiry, but Reading and/or Writing is not allowed. LDEV will reply the capacity setting as an LU to SCSI Read Capacity.
- A V-VOL that has become the S-VOL of a Copy-on-Write Snapshot will reply to a SCSI Inquiry, and Reading and/or Writing is allowed.

Copy-on-Write Snapshot pair status

Each paired volume consists of a primary volume (P-VOL) and a secondary volume (S-VOL). Each volume has the status for controlling the pair state.

The P-VOL controls the pair state that is reflected on the status of the S-VOL. The major pair statuses are "SMPL", "PAIR", "PSUS", "COPY", and "RCPY". The status is changed when the CCI command is issued. A read or write request from the host is allowed or rejected according to the status.

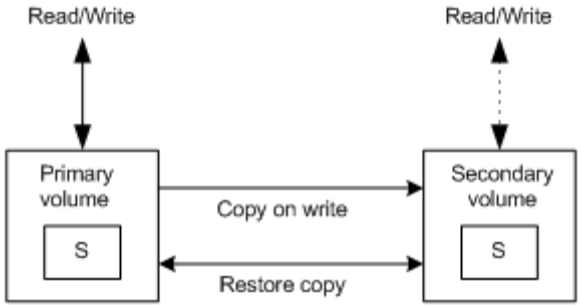


Table 6-10 Copy-on-Write Snapshot Pairing Status

P-VOL Status	Pairing Status	Primary	Secondary
SMPL	Unpaired (Copy-on-Write Snapshot) volume	R/W enabled	R/W disable[1]
PAIR (PFUL)	The Copy-on-Write Snapshot available state allocated the resource.	R/W enabled	R/W disable
COPY	The preparing state allocates the resource for the Copy-on-Write Snapshot.	R/W enabled	R/W disable
RCPY	The copying state from Copy-on-Write Snapshot to the primary volume by using restore option.	R/W enabled	R/W disable
PSUS (PFUS)	The differences of the updated data of the primary and secondary volume are controlled with copying on write.	R/W enabled	R/W enabled
PSUE (Error)	"PSUS" status due sto an internal failure. The differences of the updated data for the Copy-on-Write Snapshot volume are not controlled.	R/W enabled[2]	R/W disable

Notes:

1. V-VOL unmapped to the S-VOL of a Copy-on-Write Snapshot will reply to a SCSI Inquiry, but Reading and/or Writing is not allowed.
2. Reading and writing are enabled, as long as no failure occurs in the primary volume.

Pair status relationship to Copy-on-Write Snapshot commands

Table 6-11 Pair status relationship to Copy-on-Write Snapshot commands on page 6-36 applies to a Copy-on-Write Snapshot context. It explains 1) what a pair status may be prior to any CCI command execution, 2) what the result would be after giving a CCI command, and 3) what the pair status may be if the CCI command is Accepted.

Table 6-11 Pair status relationship to Copy-on-Write Snapshot commands

-		Copy-on-Write Snapshot Command					
		paircreate		pairsplit			pairresync
Pair Status		No -split	-split	-E option	-C option	-S option	Resync
1	SMPL	Accepted 2	Rejected	Rejected	Rejected	Acceptable	Rejected
2	COPY RCPY	Acceptable	Rejected	Rejected	Accepted*	Accepted 1	Acceptable
3	PAIR	Acceptable	Accepted*4	Rejected	Accepted*	Accepted 1	Acceptable
4	PSUS (PFUS)	Rejected	Acceptable	Rejected	Accepted*	Accepted 1	Accepted*2
5	PSUE	Rejected	Rejected	Rejected	Rejected	Accepted 1	Accepted*2

*A command is accepted and issued. Whether this command is executed or not depends on the microcode version of the RAID storage system.

Note:

- pairsplit -S of a Copy-on-Write Snapshot volume is returned without verification of the state transition that waits until SMPL state. **In a SMPL state, note that the volume that was an S-VOL becomes R/W disabled and data is discarded.**
- In the "PSUE" state, Copy-on-Write Snapshot does not manage differential data between the primary volume and secondary volume.

Controlling Volume Migration

Volume Migration, including external volumes, must be controlled using CLI in a Data Lifecycle Management (DLCM) solution. It is possible to support volume migration (Volume Migration function) and the external connection by operating the current ShadowImage and VDEV mapping of the external connection.

Also, it is important to consider the support of Volume Migration on the compatibility based on the current CLI interface, because CCI is supporting ShadowImage and the external connection. For this purpose, CCI makes the CLI interface that works by minimum compatible of the application by specifying the COPY mode for Volume Migration to the CLI of CCI.

Specifications for Volume Migration

CCI must be mapped to the port for pooling of RAID in order to control the volume of the external connection. Therefore, the external volume needs to be mapped previously to the RAID port without connecting to the host. Following is an execution example of the volume migration executed for LDEV#18.

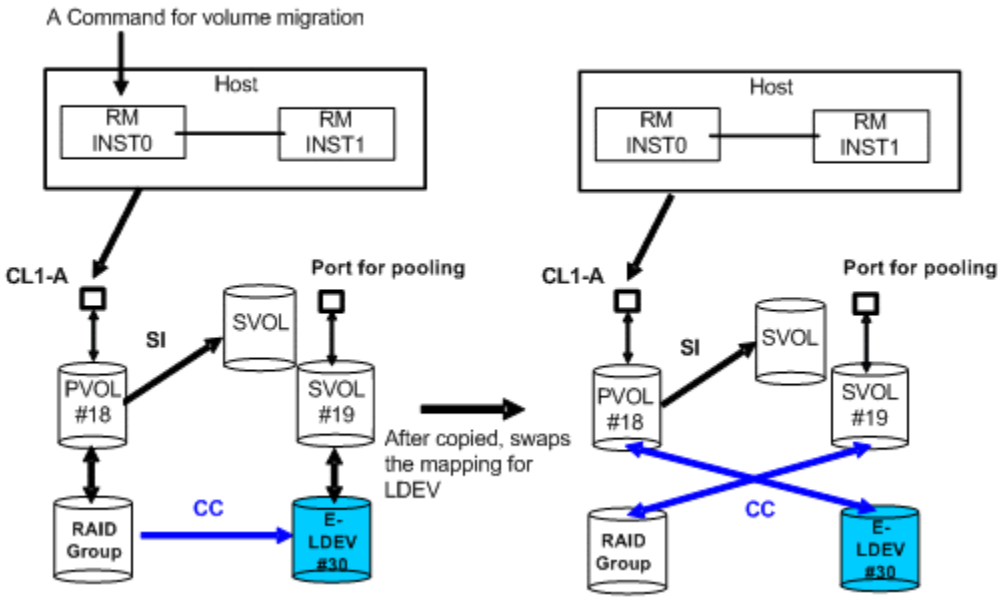


Figure 6-14 Volume Migration configurations

(1) Command specification

CCI operates the volume migration by specifying to the horcm*.conf as same SI and TC, because the volume migration using CCI is necessary to be defined the mapping for the target volume.

MU# (of SMPL as SI) that is not used because SI is used for Volume Migration operation.

An original volume for the migration is defined as P-VOL. A target volume for the migration is defined as S-VOL. In other words, an original volume is migrated from P-VOL to S-VOL, and the mapping between LDEV and VDEV is swapped after copied.

(2) Mapping specification

The mapping between LUN and LDEV is maintained for the replying of SCSI-Inquiry in order to make recognize as identical LUN through the host after mapping changes.

The way to know whether the mapping is changed or not is possible to use "-fe" option of **`pairdisplay`** and/or **`raidscan`** command that shows the connection for the external volumes.

Also LU of the external connection and LU of RAID Group intermingle on the port for pooling, but can confirm this with the above option of the **`raidscan`** command.

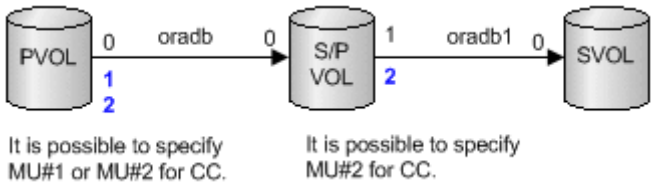
(3) Group operation

It is possible to execute the Volume Migration as a group by describing it to the horcm*.conf, however LU(LDEV), which was mapped to S-VOL after command execution, does not maintain the consistency of the group. In other words, you must consider the volume mapped to the S-VOL after execution as the discarded volume.

When HORCM demon is KILLed or the host has crash during group operation, the group aborting the execution of the command has LUN mixed with the external connection and RAID Group as the group. In this case, CCI skips the executed LU and issues the CC (Volume Migration) command to the un-executed LU, and an identical command is executed once again.

(4) Using MU#

CCI manages the status of TC/SI using MU#, so CCI uses the empty MU# that is managed for SI. Therefore, execute the command of the volume migration in the environment for SI having HORCC_MRCF environment variable. An example is shown below.



(5) HORCM instance

It is possible to describe the original and target volume for the volume migration to MU# as another group in horcm*.conf for HORCM instance of SI and /or TC. Also, it is possible to define the original and target volume for the volume migration in the horcm*.conf as HORCM instance independent from SI/TC.

Commands to control Volume Migration

(1) Command for Volume Migration

CCI supports the volume migration by adding an option (**-m cc**) to the **paircreate** command.

```
paircreate   -g <group> -d <pair vol> … -m <mode> -vl[r]  -c
<size>
```

`-m <mode>` `mode = cc` (can only be specified for ShadowImage)

This option is used to specify the Volume Migration mode.

Note: This option cannot be specified with "-split" option in the same command.

-vl[r]

The **-vl** option specifies "local", and copies from the local instance LU (P-VOL) to the remote instance LU (S-VOL), an original volume as the local instance LU is migrated from P-VOL to S-VOL, and the physical volume mapping between P-VOL and S-VOL is swapped after copied

The **-vr** option specifies "remote", and copies from the remote instance LU (P-VOL) to the local instance LU (S-VOL), an original volume as the remote instance LU is migrated from P-VOL to S-VOL, and the physical volume mapping between P-VOL and S-VOL is swapped after copied.

-c <size>

This option is used to specify a track size of the case that copies paired volume at 1-15 extents. In case of stopping Write to P-VOL and copying in a short time, the maximum value 15 is specified. When this option is omitted, it uses a default value of (3) is used for track size.

(2) Command for discovering an external volume

It is possible to discover the external volumes by using "-fe" option of the **raidscan** command.

raidscan -p <port> -fe

-fe

This option is used to display the serial# and LDEV# of the external LUNs only mapped to the LDEV.

If the external LUN mapped to the LDEV on a specified port does not exist, then this option will do nothing.Also if this option is specified, **-f[f][g][d]** option is not allowed.

Display example:

```
# raidscan -p cl1-a-0 -fe -CLI
PORT# /ALPA/C TID#  LU# Seq#   Num  LDEV# P/S  Status Fence  E-
Seq#  E-LDEV#
CL1-A-0  ef  0   0    8 62496     1    19 SMPL  -      -
30053      30
CL1-A-0  ef  0   0    9 62496     1    21 SMPL  -      -
30053      32
CL1-A-0  ef  0   0   10 62496     1    22 SMPL  -      -
30053      33
```

E-Seq#: Displays the production (serial) number of the external LUN. **E-LDEV#**: Displays the LDEV# of the external LUN.

(3) Command for confirming the status

It is possible to confirm the status for Volume Migration by using "-fe" option of the **pairdisplay** command.

pairdisplay -g <group> -fe

-fe

This option is used to display the serial# and LDEV# of the external LUNs mapped to the LDEV and additional information for the pair volume.

This option displays the information above by adding to last column, and then ignores the format of 80 column.

This option is invalid if the cascade options (-m all,-m cas) are specified.

Display example:

Before execution of Volume Migration command:

```
# pairdisplay -g horc0 -fe
Group ...  Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M CTG CM EM E-Seq#
E-LDEV#
horc0 ... 62496    18.SMPL  ---,-----    ---   -  -  -   -    -
-
horc0 ... 62496    19.SMPL  ---,-----    ---   -  -  -   H  30053
30
# paircreate -g horc0 -vl -m cc
```

During execution of Volume Migration command, the progress is displayed in the copy %:

```
# pairdisplay -g horc0 -fe
Group ...  Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M CTG CM EM E-Seq#
E-LDEV#
horc0 ... 62496    18.P VOL COPY,62496      19 -  -  C   -    -
-
horc0 ... 62496    19.S VOL COPY,-----      18 -  -  C   H  30053
30
```

After completion of Volume Migration command:

```
Group ...  Seq#,LDEV#.P/S,Status, Seq#,P-LDEV# M CTG CM EM E-Seq#
E-LDEV#

horc0 ... 62496    18.P VOL PSUS,62496      19 -   - C   V  30053
30

horc0 ... 62496    19.S VOL SSUS,-----      18 -   - C   -    -
-
```

CM: Displays the copy mode **N** : Non Snapshot **S** : Snapshot. For SMPL state, this shows that pair-volume will be created as Copy-on-Write Snapshot. **C** : **Volume Migration**

EM: Displays the external connection mode **H** : Mapped E-lun as hidden from the host. **V** : Mapped E-lun as visible to the host ' - ': Unmapped to the E-lun **BH** : Mapped E-lun as hidden from the host, but LDEV blockading. **BV** : Mapped E-lun as visible to the host, but LDEV blockading **B** : Unmapped to the E-lun, but LDEV blockading

E-Seq#: Displays the production (serial) number of the external LUN. Unknown is shown as '-'.

E-LDEV#: Displays the LDEV# of the external LUN. 'Unknown' is shown as '-'.

(4) Command for discovering an external volume via the device file

It is possible to discover the external volumes by using the **inqraid** command.

Example in Linux:

```
# ls /dev/sd* |./inqraid -CLI

DEVICE_FILE      PORT   SERIAL   LDEV  CTG   H/M/12   SSID
R:Group  PRODUCT_ID
sdh              CL2-G    63528  15360    -   s/s/ss   0100
5:01-09  OPEN-V
sdu              CL2-G    63528   2755    -   s/s/ss   000B
S:00001  OPEN-0V
sdv              CL2-G    63528   2768    -   s/s/ss   000B
U:00000  OPEN-0V
sdw              CL2-G    63528   2769    -   s/s/ss   000B
E:16384  OPEN-V
```

- **R:Group**: This displays the physical position of an LDEV according to mapping of LDEV in the RAID storage system.

LDEV mapping	R:	Group
RAID Group	RAID Level 1 : RAID1 5 : RAID5 6 : RAID6	RAID Group number - Sub number
Copy-on-Write Snapshot S-VOL	S	PoolID number
Unmapped	U	00000
External LUN	E	External Group number

Example in Linux:

```
# ls /dev/sd* |./inqraid
/dev/sdh -> CHNO =   0 TID =   1 LUN =   1
            [SQ] CL2-G Ser =   63528 LDEV =15360 [HITACHI ]
[OPEN-V          ]
            HORC = SMPL  HOMRCF[MU#0 = SMPL MU#1 = SMPL MU#2 =
SMPL]
            RAID5[Group  1- 9] SSID = 0x0100
/dev/sdu -> CHNO =   0 TID =   1 LUN =  14
            [SQ] CL2-G Ser =   63528 LDEV =2755 [HITACHI ]
[OPEN-V          ]
            HORC = SMPL  HOMRCF[MU#0 = SMPL MU#1 = SMPL MU#2 =
SMPL]
            E-LUN[Group 00001] SSID = 0x000B
            SNAPS[PoolID 0001] SSID = 0x000B
/dev/sdv -> CHNO =   0 TID =   1 LUN =  15
            [SQ] CL2-G Ser =   63528 LDEV =2768 [HITACHI ]
[OPEN-V          ]
            HORC = SMPL  HOMRCF[MU#0 = SMPL MU#1 = SMPL MU#2 =
SMPL]
            E-LUN[Group 08191] SSID = 0x000B
            UNMAP[Group 00000] SSID = 0x000B
/dev/sdw -> CHNO =   0 TID =   1 LUN =  16
            [SQ] CL2-G Ser =   63528 LDEV =2769 [HITACHI ]
[OPEN-V          ]
            HORC = SMPL  HOMRCF[MU#0 = SMPL MU#1 = SMPL MU#2 =
SMPL]
            E-LUN[Group 16384] SSID = 0x000B
            E-LUN[Group 16384] SSID = 0x000B
```

- **Group**: This item shows physical position of an LDEV according to mapping of LDEV in the RAID storage system.

LDEV Mapping	Display Formats
RAID Group	RAID1[Group Group number - Sub number] RAID5[Group Group number - Sub number] RAID6[Group Group number - Sub number]
Copy-on-Write Snapshot S-VOL	SNAPS[PoolID poolID number]
Unmapped	UNMAP[Group 00000]
External LUN	E-LUN[Group External Group number]

Relations between "cc" command issues and status

The migration volumes can be handled by issuing the CCI commands (pair creation and pair splitting commands). The validity of the specified operation is checked according to the status of the paired volume (primary volume).

Table 6-12 Command issues and pairing status transition on page 6-43 shows the relations between the migration volume statuses and command acceptances.

Table 6-12 Command issues and pairing status transition

Command:	Pair Creation	Pair Splitting
Pairing Status CC:	**-m cc**	**Simplex -S**
(1) SMPL	Accepted (2) to (3) (2) to (4)	Acceptable
(2) COPY	Acceptable	Accepted
(3) PSUS		Accepted (1)
(4) PSUE PDUB		Accepted (1)

Legend:

Accepted: A command is accepted and executed. When the command execution succeeds, the status changes to that of the shown number.

Accepted: A command is accepted and executed. When the command execution succeeds, the status changes to that of the shown number.

Acceptable: No operation is executed, though a command is accepted.

Blank: Command execution is rejected and the operation terminates abnormally.

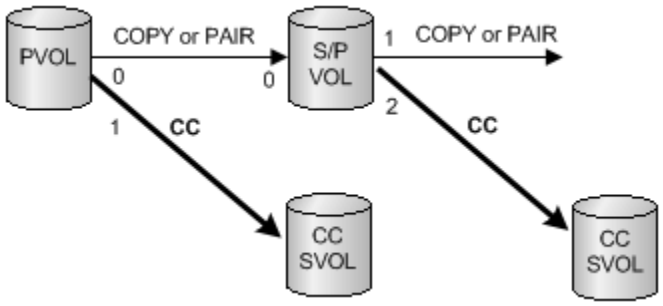
Other commands and options (for example, pairresync…) for operating a paired-volume are rejected.

The "-m cc" option cannot be specified with "-split" option in the same command.

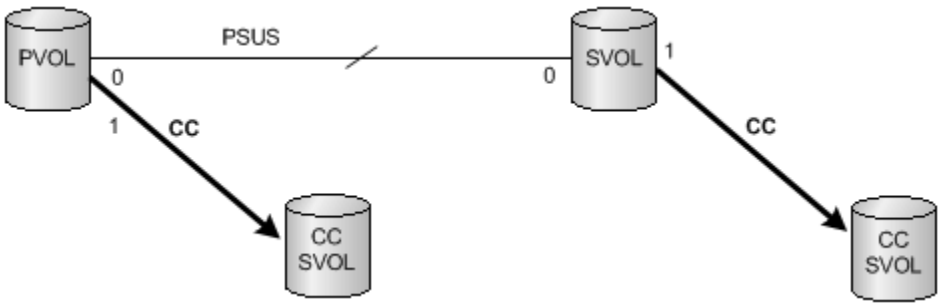
Restrictions for Volume Migration

Volume Migration must be used within the following restrictions:

- **ShadowImage (HOMRCF).** The operation for the volume migration must be operated at the "SMPL" or "PAIR" or "COPY" state. If not, **`paircreate -m cc`** command is rejected with EX_CMDRJE or EX_CMDIOE. Also ShadowImage cannot be operated to CC_SVOL moving in Volume Migration. In copying CC_SVOL, the copy operation for the volume migration is stopped, if the ShadowImage **`pairsplit`** command is executed.



- **TrueCopy (HORC).** The operation for the volume migration must be performed at the "SMPL" or "PSUS" state. If not, **`paircreate -m cc`** command is rejected with EX_CMDRJE or EX_CMDIOE. Also HORC cannot be operated to CC_SVOL copying in Volume Migration. On one hand, in copying CC_SVOL, the copy operation for the volume migration is stopped, if **`pairresync`** command for of HORC is executed.



- **LDEV type for Volume Migration.** The volume of the external connection for the volume migration must be mapped to an LDEV as OPEN-V.

Universal Replicator MxN configuration and control

Overview

Universal Replicator supports 4X4 by using sysplex timers on the mainframe. However, open systems do not have an equivalent of sysplex timers on the mainframe, because the SCSI protocol does not have timestamps.

If the open system (CCI) has the timestamp as an equivalent of sysplex timers, Universal Replicator supports 4X4 on the open system.

- CCI: delivers the timestamp(CTQ-Marker) to the consistency group
- Storage system (RCU): arbitrates the timestamp (CTQ-Marker) across multiple storage systems connected remote command devices, and then commits the journal data.

In this architecture, CCI needs to be running. If CCI has stopped, the storage system (RCU) function does not appear to exist. Therefore, the better architecture is to include the storage system (RCU) function into CCI.

CCI already supports the group control across multiple storage systems in the TC_Sync group. This means that CCI can support Universal Replicator MxN on the open system if CCI is capable of delivering the timestamps and committing the Journal data with a CTQ-Marker.

Thus, CCI supports UR MxN for open systems in the four ways described in Policy on page 6-44.

Policy

All data consistency of the CT group across multiple storage systems is maintained by CCI. The storage system supports only basic functions; there is no relation between storage systems in order to simplify testing and configurations.

CCI supports Universal Replicator MxN in the following ways.

(1) Delivering the timestamp (CTQ-Marker)

CCI (HORCM daemon process) makes a table for the groups registered to the horcm.conf as HORCM_CTQM with startup, and makes the threads for each group that delivers the same timestamp with an increment to the multiple storage systems configured in a group. The thread for a group delivers the same timestamp with increments, as far as a group configured Universal Replicator in the PAIR status.

The timestamp is delivered by using Freeze/Q-Marker & Run way as default. The timestamp is maintained in each storage system. CCI includes this timestamp with startup, and then delivers the same timestamp with increments to each storage system.

(2) Arbitrating/committing the journal data with CTQ-Marker

The thread for a group on HORCM compares the timestamp of S-JNL on each storage system (RCU) as far as a group configured Universal Replicator in PAIR state. Once HORCM detects a matching point of the timestamp (CTQ-Marker) on all storage systems (RCU), it issues an order to commit the Journal data with CTQ-Marker to each storage system (RCU).

(3) Propagating Error suspend

The thread for a group on HORCM delivers the same timestamp with increments as far as a group configured Universal Replicator in PAIR state. If the PSUE/PFUS state detects at least one storage system, then it notifies another storage system to suspend PSUS in order to keep the state consistent in the CT group. Then the thread stops to deliver the timestamp, and keeps monitoring its CT group with interval of HORCM_CTQM until it becomes PAIR state by next pair-resync.

(4) Committing the Journal data inside pairsplit command

The pairsplit command makes a suspending state on PAIR state, and inherits to compare the timestamp of S-JNL on each storage system (RCU). If it detects a matching point of the timestamp (CTQ-Marker) on all storage systems (RCUs), then it issues an order to commit the Journal data with Q-Marker to each storage system (RCU), and repeats it until it detects an EOM (End Of Marker) of CTQ-Marker with the pairsplit command.

horcm.conf

CCI supports TC_Sync group across multiple storage systems, but it does not allow TrueCopy Async (UR) group across multiple storage systems. Therefore, CCI needs to add the group definition (HORCM_CTQM) in order to allow making TrueCopy Async(UR) group across multiple storage systems. Then the HORCM daemon process delivers the timestamps (called the consistency Q-Marker), and commits S-VOL Journal data with Q-Marker to the defined group.

(1) Defining to control UR MxN

CCI supports a way to specify consistency Q-Marker to the specified group by adding "HORCM_CTQM" as a keyword in horcm.conf (see example below).

```
HORCM_CTQM
#groupinterval (10ms)mode(optional
oradb300
```

where

- **group** is to be allowed as a group across multiple storage systems.
- **interval** is the interval for the CTQ-Marker, recommended as a few second.
- **mode** is the run mode for the CTQ-Marker (timestamp). The default run mode is freeze/run. This does not normally need to be specified. If "run" is specified, then the timestamp is issued without freeze.

(2) Specifying different JID into CT group

In order to support the MxN configuration, it is necessary to specify a different journal ID (JID) into a CT group corresponding to a CCI group. Thus CCI adds an option to specify Journal ID in horcm.conf.

```
HORCM_LDEV
#dev_group    dev_name    Serial#    CU:LDEV(LDEV#) MU#
  oradb       dev1        30095:1    02:40
  oradb       dev2        30095:1    02:41
  oradb       dev3        30095:2    02:42
  oradb       dev4        30095:2    02:43
```

Note: The number at the end of the serial number (for example, :1 or :2) specifies the Journal ID.

If JID (Journal ID) is specified on horcm.conf as mentioned above, then the **paircreate** command need not specify Journal ID (-jp <jid> -js <jid>) option.

If JID (Journal ID) is not specified on horcm.conf, then Journal ID (-jp <jid> -js <jid>) option of the **paircreate** command is used.

Command specifications

CCI does not change the command options for supporting Universal Replicator MxN Open. However the output of the command is added so that the command can display the CT group and Q-Marker for each storage system, because the CT group and Q-Marker are managed on each storage system.

pairdisplay command

The output of **pairdisplay -v ctg** and **pairdisplay -v jnl[t]** are supported so that the option can display CT group information for each storage system. Following is an example for UR 2x2:

```
# pairdisplay -g ora -v ctg
CTG  P/S   Status AP U(%) Q-Marker QM-Cnt SF(%) Seq# IFC OT/s CT/m
RT/m
000  P-VOL PAIR    1   0  00000032       18   50     64034 ON   60
-    -
000  S-VOL PAIR    1   0  00000020        -   70     64035 -     -
-    -
000  P-VOL PAIR    1   0  00000031       15   50     64045 ON   60
-    -
000  S-VOL PAIR    1   0  00000022        -   70     64046 -     -
-    -

# pairdisplay -g ora -v jnl
JID MU CTG  JNLS  AP  U(%)   Q-Marker   Q-CNT  D-SZ(BLK)   Seq#
Num LDEV#
001  1   0  PJNN   1    0    00000049       2 1633672703  64034
2  5376
002  1   0  SJNN   1    0    00000047       0 1633672703  64035
2  5378
001  1   0  PJNN   1    0    00000049      20  211506164  64045
13 12388
002  1   0  SJNN   1    0    00000035      20  260319089  64046
16 12544

# pairdisplay -g ora -v jnlt
JID MU CTG  JNLS  AP  U(%)   Q-Marker   Q-CNT  D-SZ(BLK)   Seq#
DOW PBW APW
001  1   0  PJNN   1    0    00000c76      20 1633672703  64034
60 300  40
002  1   0  SJNN   1    0    00000c62      20 1633672703  64035
60 300  40
001  1   0  PJNN   1    0    00000c3a       7  211506164  64045
60 300  40
002  1   0  SJNN   1    0    00000c33       7  260319089  64046
60 300  40

# pairdisplay -g horc0 -v jnl -fe
JID MU CTG  JNLS  AP  U(%)   Q-Marker   Q-CNT  D-SZ(BLK)   Seq#
Num LDEV#     CTQM
016  2   0  PJSN   1    0    0000bb1b       0  198578688  64014
1 32768        -
018  2   0  SJSN   1    0    0000bb1b       0   99283968  64014
1 32770 0000187f
017  2   0  PJSN   1    0    00000011       0  198578688  64014
1 32769        -
019  2   0  SJSN   1    0    00000011       0   99283968  64014
1 32771 0000187f
```

Note: CTQM: Displays the last CTQ-Marker that was committed on S-VOL.

pairsplit command

The **pairsplit** command does not change the command options for supporting UR MxN Open. However, internal behavior is different from 1x1 UR or TrueCopy Async.

(1) pairsplit -r or -rw option

- Issues Freeze to CT group on each MCU
- Issues Suspend & Run to make a suspending state for CT group on each MCU

- Searches/commits a minimum matching point of the CTQ-Marker on RCU via MCU (in other words, do Journal Restore with CTQ-Marker)
- Repeats above until detecting an EOM (End Of Marker) marked on MCU on all RCU via MCU
- Issues End of Suspend to terminate a suspending state, after committed with EOM (End Of Marker) marked on MCU on all RCU

Exception: If an uncommitted state (that is, link failure) is detected while executing its operation, then the operation of committing is aborted on keeping current CTQ-Marker level, and a suspending state terminates without waiting for the EOM (End Of Marker).

(2) pairsplit -P option

- Issues Freeze to CT group on each MCU
- Issues Suspend & Run to make a suspending state for CT group on each MCU
- Searches/commits a minimum matching point of the CTQ-Marker on RCU via MCU (in other words, do Journal Restore with CTQ-Marker)
- Repeats above until detecting an EOM (End Of Marker) marked on MCU on all RCU via MCU
- Issues End of Suspend to terminate a suspending state

Exception: If an uncommitted state (that is, link failure) is detected while executing its operation, then the operation of committing is aborted on keeping current CTQ-Marker level, and a suspending state terminates without waiting for the EOM (End Of Marker).

(3) pairsplit -S option

- Issues Freeze to CT group on each MCU
- Issues Delete & Run to make a deleting state for CT group on each MCU
- Searches/commits a minimum matching point of the CTQ-Marker on RCU via MCU (in other words, do Journal Restore with CTQ-Marker)
- Repeats above until detecting an EOM (End Of Marker) marked on MCU on all RCU via MCU
- Issues End of Delete to terminate a deleting state, after committed with EOM (End Of Marker) on all RCU

Exception: If an uncommitted state(that is, link failure) is detected while executing its operation, then the operation of committing is aborted on keeping current CTQ-Marker level, and a deleting state terminates without waiting for an EOM (End Of Marker).

(4) pairsplit -RS option

In the case of PAIR state (NO failure):

- Issues SwapSuspend to make a suspending state for CT group on each RCU

- Searches/commits a minimum matching point of the CTQ-Marker on RCU via RCU (in other words, do Journal Restore with CTQ-Marker)
- Repeats above until detecting an EOM (End Of Marker) marked on MCU on all RCU via RCU
- Issues End of Suspend to terminate a suspending state, after committed with an EOM (End Of Marker) on all RCU

Exception: If an uncommitted state (that is, link failure) is detected while executing its operation, then the operation of committing is aborted on keeping current CTQ-Marker level, and a suspending state terminates with detecting at least one EOM (End Of Marker).

In the case of Failure (PSUE/PSUS):

- Issues SwapSuspend to make a suspending state for CT group on each RCU
- Searches/commits a minimum matching point of the CTQ-Marker on RCU via RCU (in other words, do Journal Restore with CTQ-Marker)
- Repeats above until detecting an EOM(End Of Marker) marked on all RCU via RCU
- Issues End of Suspend to terminate a suspending state

(5) pairsplit -R option

In the case of PAIR state (NO failure):

- Issues Delete to make a deleting state for CT group on each RCU
- Searches/commits a minimum matching point of the CTQ-Marker on RCU via RCU (in other words, do Journal Restore with CTQ-Marker)
- Repeats above until detecting an EOM (End Of Marker) marked on MCU on all RCU via RCU
- Issues End of Delete to terminate a deleting state, after committed with an EOM (End Of Marker) on all RCU

Exception: If an uncommitted state (that is, link failure) is detected while executing its operation, then the operation of committing is aborted on keeping current CTQ-Marker level, and a deleting state terminates with detecting at least one EOM (End Of Marker).

In the case of Failure(PSUE/PSUS):

- Issues Delete to make a deleting state for CT group on each RCU
- Searches/commits a minimum matching point of the CTQ-Marker on RCU via RCU (in other words, do Journal Restore with CTQ-Marker)
- Repeats above until detecting an EOM(End Of Marker) marked on all RCU via RCU
- Issues End of Delete to terminate a deleting state

Notice on system operation

CCI does not change the command options for supporting Universal Replicator MxN Open. However, the output of the command is added so that the command can display the CT group and Q-Marker for each storage system, because the CT group and Q-Marker are managed on each storage system.

(1) CT group ID and journal ID for UR

The CT group ID must be assigned/used as the unique identifier across multiple storage systems. Therefore, the paircreate command makes a group volume having the same CT group ID across multiple storage systems.

(2) Cascading operation

The "-FHORC" option for cascading operation does not perform with CTQ-Marker Mode. Hence the cascading volume must not be specified UR MxN volume when using the "-FHORC" option.

(3) Running HORCM daemon

HORCM daemon process delivers the timestamps (called the consistency Q-Marker) to the defined CT group. Therefore if HORCM daemon is stopped, then UR will stop to delta (commit) and will suspend because of Journal Full state.

Thus HORCM daemon must be running to keep the PAIR state.

(4) Separating a command device IO from application IO

The HORCM daemon process issues IOs to the command device in order to deliver the timestamps to the defined CT group. Therefore, it is recommended to separate the command device path from the application IO path.

(5) About waiting application IO

The HORCM daemon process delivers the timestamps to the defined CT group while freezing IO for each journal.

Waiting Rate = 0.5ms * Number of journal / / Interval (ms) * 100

(Note that 0.5 ms depends on the OS platform.)

Therefore it is recommended to limit within four journal per CT group and 8192 LDEVs per CT group. In the case of multiple CT groups per HORCM, it is recommended to limit within 256 LDEVs per CT group.

(6) HOST IO on pairsplit -RS, -R, horctakeover, pairresync -swapp(s)

The **pairsplit -RS, -R** operation cannot be frozen and Split HOST IO from RCU in Link Normal state. In other words this option does not support At-time Split, hence these operations are required to stop HOST IO in order to keep Data Consistency on S-VOL. This is the same restriction as TC_Sync.

(7) Suspending/deleting status

The suspending/deleting for committing S-VOL Journal data with CTQ-Marker is accomplished by the CCI commands. Therefore the storage system has nothing to do in that status (suspending/deleting).

If a CCI command is aborted for some reason (KILL, etc.) or EX_EWSTOT, the storage system keeps that status (suspending/deleting).

To terminate this status, re-execute the CCI command, then terminate suspending/deleting status after "JNL Consistency Restore".

(8) Detecting inconsistent CTQ-Marker

The **pairsplit** command checks data consistency with CTQ-Marker across multiple storage systems. If an inconsistent CTQ-Marker is detected, then it returns with EX_VOLCUR after changed to suspend status.

This error needs to confirm if CTQMs are the same on S-VOL on each storage system using the "pairdisplay -v jnl -fe" option.

```
# pairdisplay -g horc0 -v jnl -fe
JID MU CTG  JNLS  AP  U(%)   Q-Marker   Q-CNT  D-SZ(BLK)   Seq#
Num LDEV#     CTQM

016  2   0  PJSN   1    0    0000bb1b       0  198578688  64014
1 32768        -

018  2   0  SJSN   1    0    0000bb1b       0   99283968  64014
1 32770 0000187f

017  2   0  PJSN   1    0    00000011       0  198578688  64014
1 32769        -

019  2   0  SJSN   1    0    00000011       0   99283968  64014
1 32771 0000187f
```

(9) About pairsyncwait command

Using the Q-Marker with the **pairsyncwait** command is managed on each Journal including the target device. Therefore the **pairsyncwait** command must specify a target device (-g <group> -d <pair vol>, or -d <device file>, or -d <serial#> <ldev#>). For example:

```
# pairsyncwait -g horc0 -d dev-002 -t 500
UnitID  CTGID    Q-Marker  Status    Q-Num
     1      0  0000003de8  DONE          0
```

If group (-g <group>) is specified, then the first dev_name on the specified group is used.

Explanation of terms:

- JNL Consistency Restore: commits up as far as MAX CTQ-Marker.
- JNL Full Restore: commits up to EOM (End of marker for split).
- JNL Consistency Suspend: suspends after "JNL Consistency Restore"
- JNL Full Suspend: suspends after "JNL Full Restore"

Configuration examples

CCI does not change the command options for supporting Universal Replicator MxN Open. However the output of the command is added so that the command can display the CT group and Q-Marker for each storage system, because the CT group and Q-Marker are managed on each storage system.

(1) UR 2x2

```
#/******** HORCM0 on production *****/
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
NONE         horcm0      1000   3000

#/********** For HORCM_CMD ****************/
HORCM_CMD
#dev_name
#UnitID #0(Serial# 64034), #1(Serial# 64045)
\\.\CMD-64034:/dev/rdsk
\\.\CMD-64045:/dev/rdsk

#/********** For HORCM_LDEV ****************/
HORCM_LDEV
#dev_group  dev_name  Serial#  LDEV#  MU#
ora         data0     64034    400
ora         data1     64034    401
ora         data2     64045    400
ora         data3     64045    401

#/********** For HORCM_INST ****************/
HORCM_INST
#dev_group  ip_address    service
ora         RHOST         horcm0

#/******** For UR of multiple DKC *****/
HORCM_CTQM
#dev_group  interval(10ms)  mode
ora         300
```

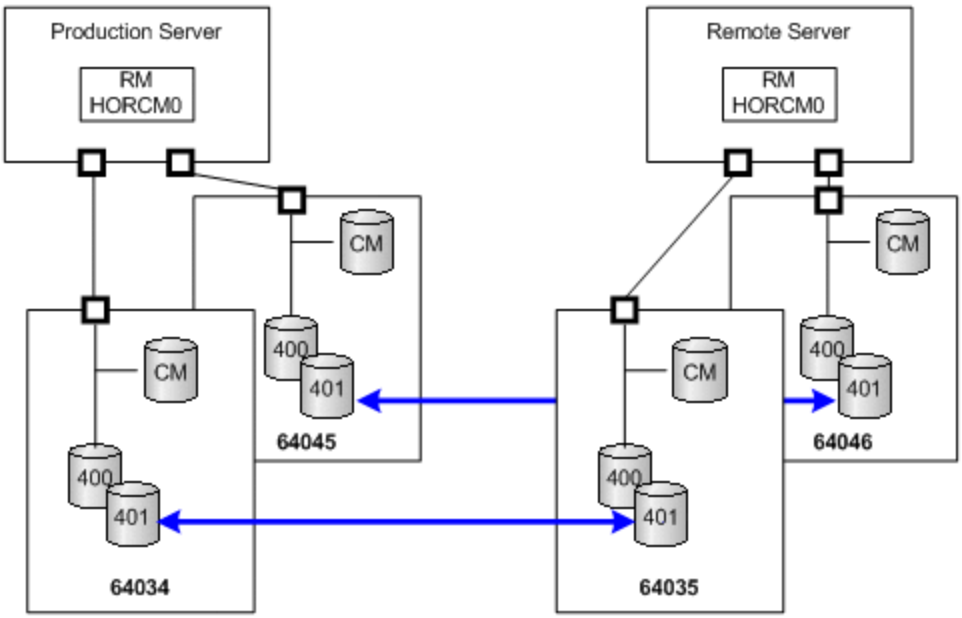
```
#/******** HORCM0 on Remote *****/
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
NONE         horcm0      1000   3000

#/********** For HORCM_CMD ****************/
HORCM_CMD
#dev_name
#UnitID #0(Serial# 64035), #1(Serial# 64046)
\\.\CMD-64035:/dev/rdsk
\\.\CMD-64046:/dev/rdsk

#/********** For HORCM_LDEV ****************/
HORCM_LDEV
#dev_group  dev_name  Serial#  LDEV#  MU#
ora         data0     64035    400
ora         data1     64035    401
ora         data2     64046    400
ora         data3     64046    401

#/********** For HORCM_INST ****************/
HORCM_INST
#dev_group  ip_address    service
ora         PHOST         horcm0

#/******** For UR of multiple DKC *****/
HORCM_CTQM
#dev_group  interval(10ms)  mode
ora         300
```



(2) UR 2x1

```
#/******** HORCM0 on production *****/
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
NONE        horcm0      1000   3000

#/********** For HORCM_CMD ****************/
HORCM_CMD
#dev_name
#UnitID #0(Serial# 64034), #1(Serial# 64045)
\\.\CMD-64034:/dev/rdsk
\\.\CMD-64045:/dev/rdsk

#/********** For HORCM_LDEV ****************/
HORCM_LDEV
#dev_group  dev_name  Serial#   LDEV#  MU#
ora         data0     64034:1   400
ora         data1     64034:1   401
ora         data2     64045:1   400
ora         data3     64045:1   401

#/********** For HORCM_INST ****************/
HORCM_INST
#dev_group  ip_address    service
ora         RHOST         horcm0

#/******** For UR of multiple DKC *****/
HORCM_CTQM
#dev_group   interval(10ms)   mode
ora          300
```

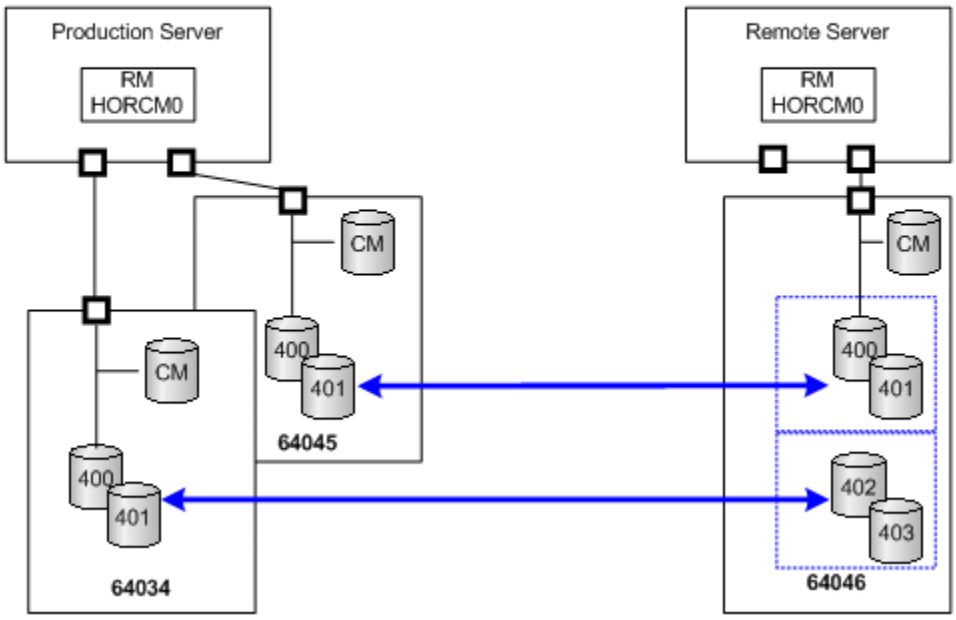
```
#/******** HORCM0 on Remote *****/
HORCM_MON
#ip_address service poll(10ms) timeout(10ms)
NONE        horcm0      1000   3000

#/********** For HORCM_CMD ****************/
HORCM_CMD
#dev_name
#UnitID #0(Serial# 64046)
\\.\CMD-64046:/dev/rdsk

#/********** For HORCM_LDEV ****************/
HORCM_LDEV
#dev_group  dev_name  Serial#   LDEV#  MU#
ora         data0     64046:1   400
ora         data1     64046:1   401
ora         data2     64046:2   402
ora         data3     64046:2   403

#/********** For HORCM_INST ****************/
HORCM_INST
#dev_group  ip_address    service
ora         PHOST         horcm0

#/******** For UR of multiple DKC *****/
HORCM_CTQM
#dev_group   interval(10ms)   mode
ora          300
```



Remote volume discovery

In the configuration separating "Storage admin server (CCI server)" and each production server, it is difficult to verify/check the volumes on the production servers and the volumes described to the horcm.conf on CCI server.

In this configuration, you cannot use the following CCI capabilities:

- Command device security
- **pairdisplay -fd** option that displays the device file on the production host view
- **raidscan -find verify**

To solve this configuration problem, CCI supports a way to discover volumes on the remote server by adding the -export option to the **`inqraid`** command, and by importing its output via the **`raidscan -find`** command.

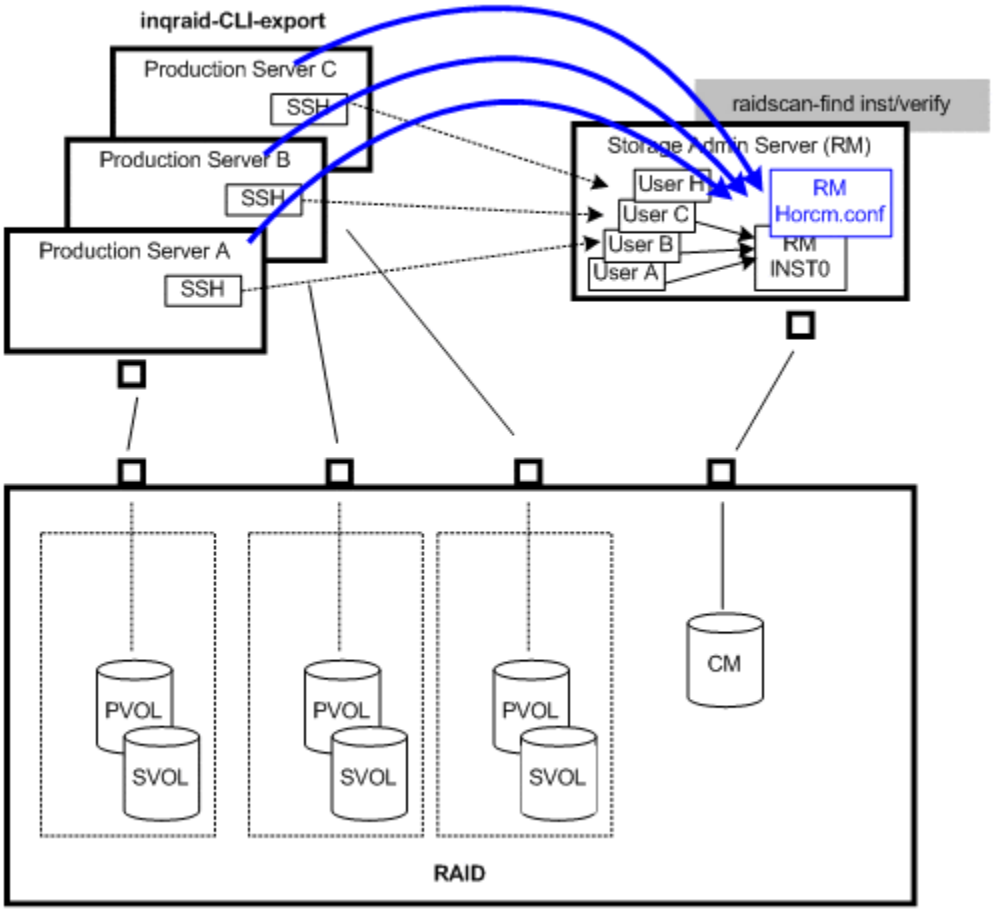


Figure 6-15 Volume discovery

Discovering a remote volume

The **inqraid** command exports the device information discovered on the production servers. The device information includes "Keyword, Serial#, Ldev#, Device file name..". The **raidscan -find inst** command on CCI server imports the device information, and registers it into the HORCM daemon.

The inqraid command is needed only for discovering LUNs on the production server.

(1) inqraid format

The **inqraid** command adds the "-export" option with -CLI for exporting the results of the volume discovery on the remote server.

Example from UNIX (Solaris):

```
# ls /dev/rdsk/c1t* | inqraid -CLI -export
INQRAID:@CL4-G@64015@0@124@OPEN-V-CM@/dev/rdsk/c1t0d0s2
INQRAID:@CL4-G@64015@1@124@OPEN-V-CM@/dev/rdsk/c1t0d1s2
INQRAID:@CL4-G@64015@2@95@OPEN-V@/dev/rdsk/c1t0d2s2
INQRAID:@CL4-G@64015@3@95@OPEN-V@/dev/rdsk/c1t0d3s2
INQRAID:@CL4-G@64015@4@95@OPEN-V@/dev/rdsk/c1t0d4s2
INQRAID:@CL4-G@64015@5@95@OPEN-V@/dev/rdsk/c1t0d5s2
INQRAID:@CL4-G@64015@7@95@OPEN-V@/dev/rdsk/c1t0d7s2
```

(2) A way to export/import using pipe & SSH

Example for exporting from UNIX (Solaris) to CCI host:

```
# ls /dev/rdsk/c1t* | inqraid -CLI -export | ssh
<CCI host> raidscan -find inst
DEVICE_FILE             Group    PairVol     PORT   TARG  LUN M
SERIAL  LDEV
/dev/rdsk/c1t0d2s2      G1       G1-000      CL4-G-1  57    2 0
64015     2
/dev/rdsk/c1t0d2s2      G1       G1-000      CL4-G-1  57    2 -
64015     2
/dev/rdsk/c1t0d3s2      G1       G1-001      CL4-G-1  57    3 0
64015     3
```

Example for Verifying from UNIX (Solaris) to CCI host:

```
# ls /dev/rdsk/c1t* | inqraid -CLI -export | ssh <CCI
host> raidscan -find verify
DEVICE_FILE             Group    PairVol     PORT   TARG  LUN M
SERIAL  LDEV
/dev/rdsk/c1t0d0s2      -        -           -         -    - -
64015     0
/dev/rdsk/c1t0d1s2      -        -           -         -    - -
64015     1
/dev/rdsk/c1t0d2s2      G1       G1-000      CL4-G-1  57    2 -
64015     2
/dev/rdsk/c1t0d3s2      G1       G1-001      CL4-G-1  57    3 -
64015     3
/dev/rdsk/c1t0d4s2      -        -           -         -    - -
64015     4
/dev/rdsk/c1t0d5s2      -        -           -         -    - -
64015     5
/dev/rdsk/c1t0d7s2      -        -           -         -    - -
64015     7
```

(3) A way to import with horcmstart.sh on CCI host

Example 1 for exporting:

```
# ls /dev/rdsk/c1t* | inqraid -CLI -export | ssh <CCI
host> cat > /etc/horcmperm*.conf
```

OR

Example 2 for exporting:

```
# ls /dev/rdsk/c1t* | inqraid -CLI -export > /tmp/inqraid.ex
```

ftp "/tmp/inqraid.ex" to "/etc/horcmperm*.conf" on CCI host

This example for importing on CCI host executes horcmstart.sh * on the CCI host, where * is the instance number.

Display example for verifying on CCI host:

```
# cat /etc/horcmperm*.conf | raidscan -find verify
DEVICE_FILE             Group    PairVol     PORT   TARG  LUN M
SERIAL  LDEV
/dev/rdsk/c1t0d0s2      -        -           -         -    - -
64015     0
/dev/rdsk/c1t0d1s2      -        -           -         -    - -
64015     1
/dev/rdsk/c1t0d2s2      G1       G1-000      CL4-G-1  57    2 -
64015     2
/dev/rdsk/c1t0d3s2      G1       G1-001      CL4-G-1  57    3 -
64015     3
/dev/rdsk/c1t0d4s2      -        -           -         -    - -
64015     4
/dev/rdsk/c1t0d5s2      -        -           -         -    - -
64015     5
/dev/rdsk/c1t0d7s2      -        -           -         -    - -
64015     7
# pairdisplay -g G1 -fd -l
Group   PairVol(L/R) Device_File    ,Seq#,LDEV#.P/
S,Status,Fence,Seq#,P-LDEV# M
G1      G1-000(L)    c1t0d2s2       64015     2.SMPL  ---- ------
,----- ----- -
G1      G1-001(L)    c1t0d3s2       64015     3.SMPL  ---- ------
,----- ----- -
```

7

Data protection operations with CCI

This chapter describes data protection operations using CCI.

Data protection operations

User data files are normally placed on a disk through a software layer such as a file system, LVM, disk driver, SCSI protocol driver, bus adapter, and SAN switching fabric. Data corruption can happen due to software layer bugs or human error. CCI Data Protection Facility does not prevent these types of errors. On the other hand, the purpose of data protection is to prevent writing to volumes that the RAID storage system is guarding.

Data protection functions include:

- Data Retention Utility
- Volume Retention Manager
- Volume Security
- Encryption License Key
- Database Validator

Data Retention Utility

The purpose of the Data Retention Utility is to prevent writing to volumes that the RAID storage system is guarding. Data Retention Utility is similar to the command that supports Database Validator, setting a protection attribute for the specified LU.

- **Hide from Inquiry command.** The RAID storage system conceals the target volumes from the SCSI Inquiry command by responding "unpopulated volume" (0x7F) to the device type.
- **SIZE 0 volume.** The RAID storage system replies with "SIZE 0" to the target volumes through the SCSI Read capacity command.
- **Read protection.** The RAID storage system protects reading from the target volumes by responding with the "Illegal function" check condition (SenseKey = 0x05, SenseCode = 0x2200).
- **Write protection.** The RAID storage system replies with "Write Protect" in the mode sense header, and protects from writing the target volumes by responding with the "Write Protect" check condition (SenseKey=0x07, SenseCode=0x2700).
- **SVOL disabling.**

  The RAID storage system rejects the command execution of the copy series program product for not to be overwritten the target volume by the copy process of copy series program product (TrueCopy/Universal Replicator/ShadowImage/Copy-on-Write Snapshot), and protects the target volume. This option can be used with the other Data Retention Utility options in parallel. For example, if you want to protect from the writing by the both copy series program product and the host accessing, set the both write protection option and this option. Only the setting of write protection option cannot protect the target volume from the writing executed by the copy processing of the copy series program product.

Restrictions on Data Retention Utility volumes

- **File systems using Data Retention Utility**
  - When setting DRU to the UNIX file system volumes, the volumes must be mounted with the Read Only option after the volumes are unmounted. If DRU is set to the volumes as they are in the mounted status, unexpected behavior may occur in the system.
  - When using a file system for Write Protect Mode set disk on Windows Server 2003/Windows Server 2008/Windows Server 2012, use the "-x mount" and "-x umount" CCI command options with the above mentioned procedures.
  - Data Retention Utility volumes set to Write Protect Mode (Read ONLY) cannot be used for the Windows NT/Windows 2000 file system (NTFS, FAT).
- **LVM(VxVM) on Data Retention Utility**
  - If changing LVM configuration including Data Retention Utility, use the raidvchset -vg command for setting the status of the target volume checking prohibited temporarily. Also, after the completion of LVM configuration change, set again the status as checking.
- **Data Retention Utility in HA Cluster Server**
  - If HA Cluster software writes to the metadata at regular intervals to confirm whether its disks are available or not, then Data Retention Utility should not be used in HA environments.
- **Dynamic disk on Windows systems**
  - Data Retention Utility volumes cannot be used for the dynamic disk, because the dynamic disk does not handle the volumes set to Write Protect Mode (Read ONLY). Data Retention Utility volumes must be used for basic disks only.
- LUN#0
  - Some operating systems cannot recognize LUNs over LUN#1 if LUN#0 has the Data Retention Utility "inv" attribute set. This is because some HBA drivers do not scan all LUNs on a port if LUN#0 is invisible.

Database Validator

Database Validator prevents data corruption in an Oracle database by checking Oracle data validation before an Oracle data block is written on a disk.

- Data Block corruption: This occurs when Oracle data is corrupted by some intervening software layer and/or hardware components. The RAID storage system can check the validity of the data block before the Oracle data block is written to disk.
- Data block address corruption: The OS (file system, LVM, Disk driver) may write blocks to the wrong location. The RAID storage system can check the validity of the data block address to verify that the Oracle data block is written to the correct location on disk.

- Protection of Oracle volume: Oracle data files might be overwritten by a non-Oracle application or by human operation using a command. The RAID storage system can protect volumes storing Oracle files by preventing the volumes from being modified by another application or by human error.

Restrictions on Database Validator

- **Oracle® tablespace location**
  - File system-based Oracle files are not supported by Database Validator. All Oracle database files must be placed on raw volumes (including LVM raw volumes) directly.
  - If host-based striping is used on raw volumes, then the stripe size must be an exact multiple of the Oracle block size.
  - Oracle redo log files (including archive logs) must be on separate volumes with respect to the data files (including control files). In other words, Oracle redo log files and the data files must not be mixed on the same LU.
- **Restoring Oracle® files**
  - Before restoring Oracle data files from a backup, data validation may need to be temporarily turned off for those data files that were backed up prior to the Oracle checksum being enabled.

Old blocks may exist on disk without checksum information in them if the database was running without checksum enabled in the past.

- **Oracle® on LVM(VxVM)**
  - LVM block size must be a multiple of the Oracle block size. The Oracle block size must be less than or equal to the minimum of the LVM stripe size and the largest block size at which LVM will not fracture (known as "Logical Track Group" in LVM), which is 256 KB in LVM.
  - When adding new physical volumes (PVs) to a logical volume (LV) to be used as an Oracle data file, control file, or online log, the data validation should be re-enabled in order to have HARD checking take effect on those new PVs.

    Similarly, in order to have HARD checking no longer performed on PVs that have been removed from an LV that had previously been used by Oracle, HARD checking should be explicitly disabled on the device corresponding to the PV.
  - If host-based mirroring is used such as LVM mirroring, all component PV mirrors must be HARD-enabled, otherwise the entire logical volume (LV) is exposed. That is, if a user takes an unmirrored HARD-enabled LV, then makes it mirrored on the fly without HARD-enabling all sides of the mirror, that entire LV is exposed to data corruption.
  - LVM bad block relocation is not allowed on PVs that are HARD-enabled.
- **Oracle® and LVM (VxVM) on HA Cluster Server**

- If HA Cluster software writes to LVM metadata at regular intervals to confirm whether its disks are available or not, change the check area which is set for the target LU (except management area) by using the "-vs <bsize> SLBA ELBA" option.

Protection parameters and operations

The RAID storage systems have protection checking parameters for each LU, and these parameters are set through CCI and its command device. CCI supports the following commands to set and verify the parameters for protection checking for each LU:

- **raidvchkset:** Sets the protection checking parameter for the specified volumes.
- **raidvchkdsp:** Shows the protection checking parameter for the specified volumes based on the CCI configuration definition file.
- **raidvchkscan:** This command has three different uses depending on the options used with the command.
  - Shows the fibre port, target ID, LDEV, and validation checking parameters for the specified volumes based on the **`raidscan`** command.
  - Shows the journal volume list setting and information for the journal volume.
  - Shows the Copy-on-Write Snapshot pool setting and information for the Copy-on-Write Snapshot pool.

Data Protection facility

The Data Protection Facility permits main operations to volumes that you can see on the host, and prevents wrong operations. CCI controls protected volumes at the result of recognition of protection. CCI recognizes only volumes that the host shows. For that purpose LUN Security is provided for the CCI environment.

The Data Protection Facility ON/OFF is controlled by the security setting for the command device, as shown in the following table.

Table 7-1 Security setting for command device

Command device setting			Security to be set
Security	**User authentication**	**Group information acquisition**	
0	0	0	No security
0	0	1	Only HORCM_DEV allowed
0	1	0	User authentication required
0	1	1	User authentication required Only HORCM_DEV allowed
1	0	0	CMD security

Command device setting			Security to be set
Security	User authentication	Group information acquisition	
1	0	1	CMD security Only HORCM_DEV allowed
1	1	0	CMD security User authentication required
1	1	1	CMD security User authentication required Only HORCM_DEV allowed

Notes:

- Only HORCM_DEV allowed : means to be able to perform the operation for only paired logical volumes described at HORCM_DEV.
- User authentication required: means that only the commands issued by the authorized users can be executed.
- CMD security: means that only the devices recognizable from the host can be operated.

The Data Protection Facility uses an enhanced command device that you define using the LUN Manager software (or SNMP). When you define the command device, the DataProtection Facility is turned ON or OFF to each command device, which has an attributes to enable the Data Protection Facility. CCI distinguishes the ON from OFF attribute when CCI recognizes the command device. Figure 7-1 Definition of the protection volumes on page 7-6 shows the definition of protected volumes.

Note: If the command device is set to enable protection mode, there is no impact on CCI operations. CCI controls pairs under current specification. For details about the command operations when the Data Protection Facility is turned ON, see Target commands for protection on page 7-9.

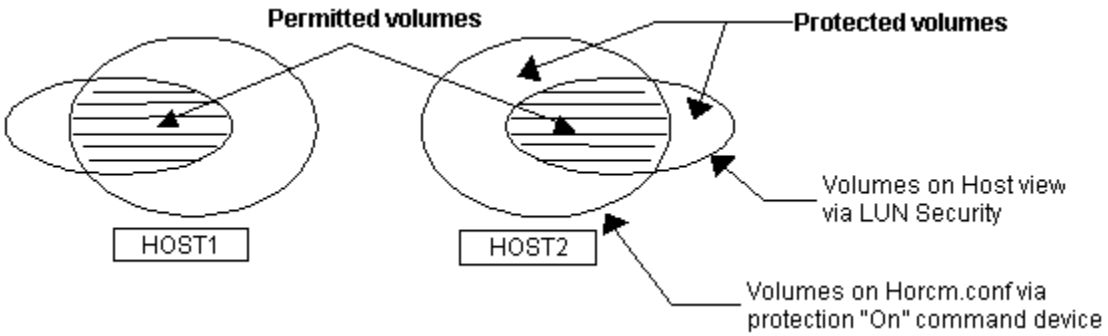


Figure 7-1 Definition of the protection volumes

Data Protection Facility specifications

Only the permitted volumes can be registered in `horcm.conf`. When creating the `horcm.conf` file, describe volumes only from the view that the host shows. CCI manages mirror descriptors (TrueCopy, ShadowImage/ MU#0/1/2) as a unit. The Data Protection Facility has two specifications:

one must be a volume that you can see from the host such as the Inquiry tool, and the other must be a mirror descriptor volume that was registered in `horcm.conf`. The following table shows the registration for the mirror descriptor.

Table 7-2 Registration for the mirror descriptor

Volumes in horcm.conf	Mirror Descriptor in horcm.conf							
	TrueCopy		ShadowImage					
			MU#0		MU#1		MU#2	
	E	none	E	none	E	none	E	none
Unknown	-	-	-	-	-	-	-	-
/dev/rdsk/c0t0d0	permitted volumes	-	permitted volumes	-	permitted volumes	-	permitted volumes	-
Unknown	-	-	-	-	-	-	-	-

Legend:

E: Mirror descriptor volume to be registered in `horcm.conf`.

Unknown: Volumes that own host cannot recognize, even though volumes were registered in `horcm.conf`.

- CCI permits operation after the **`permission`** command at startup of HORCM. The target is volume that was registered in the `horcm.conf` file.
- The **`permission`** command is necessary to permit the protected volume at first. The **`permission`** command compares an identification for volumes of `horcm.conf` to all of own host volumes, and the result is registered within HORCM. And HORCM makes tables for protected volume and permitted volumes from `horcm.conf` and Inquiry result. Inquiry result is based on configuration of Data Retention Utility. When controlling pair volumes, requests to protected volumes are rejected with error code EX_ENPERM.
- The Data Protection Facility is based on the host side view at the result of Data Retention Utility. You need to configure Data Retention Utility before CCI operation. CCI checks Data Retention Utility by Inquiry within CCI.
- The Data Protection Facility can be enabled separately for each command device. If you want to use protection and non-protection modes in the same storage system at the same time, you can define two (or more) command devices: one with protection ON, one with protection OFF. Protection mode is enabled for the host that has Data Retention Utility and ON command device.

Examples for configuration and protected volumes

Case (1): Two Hosts (Figure 7-2 Example for the two-host configuration on page 7-8). In protect mode Ora2 are rejected to operate the paired volume, because of Unknown for Grp4 on HOST2.

Case (2): One Host (Figure 7-3 Example for the one-host configuration on page 7-8). In protect mode Ora1 and Ora2 are rejected to operate the paired volume, because of Unknown for Grp2 and Grp4 on HOST1. If HOST1 has a protection OFF command device, then Ora1 and Ora2 are permitted to operate the paired volume.

Note: The Data Protection Facility is implemented by only CCI. CCI needs to know the protection attribute for the command device whether should be permitted the operation for paired volume. If HORCM has protection ON command device at its time, then HORCM checks a permission for a paired volume.

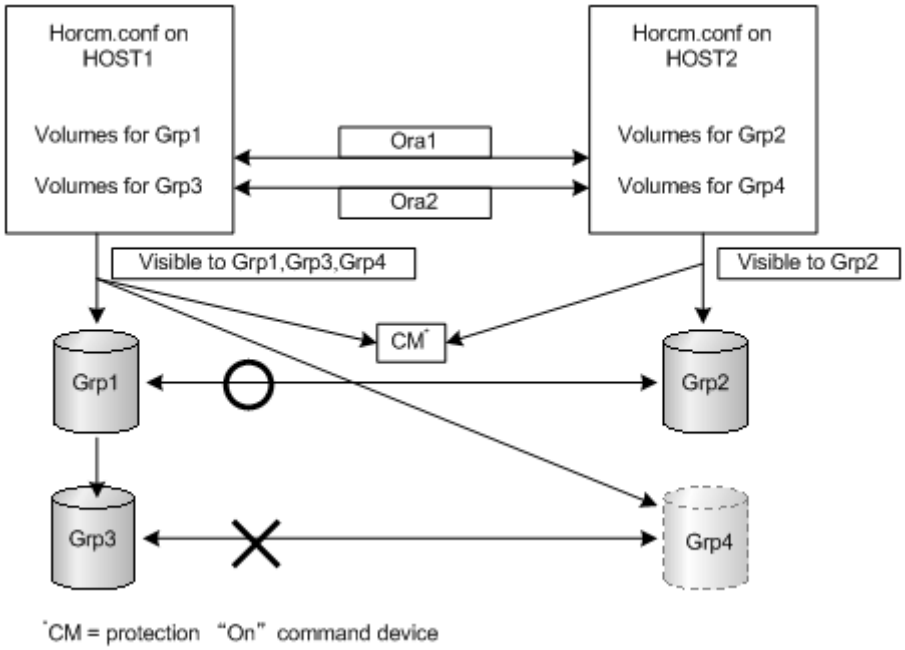


Figure 7-2 Example for the two-host configuration

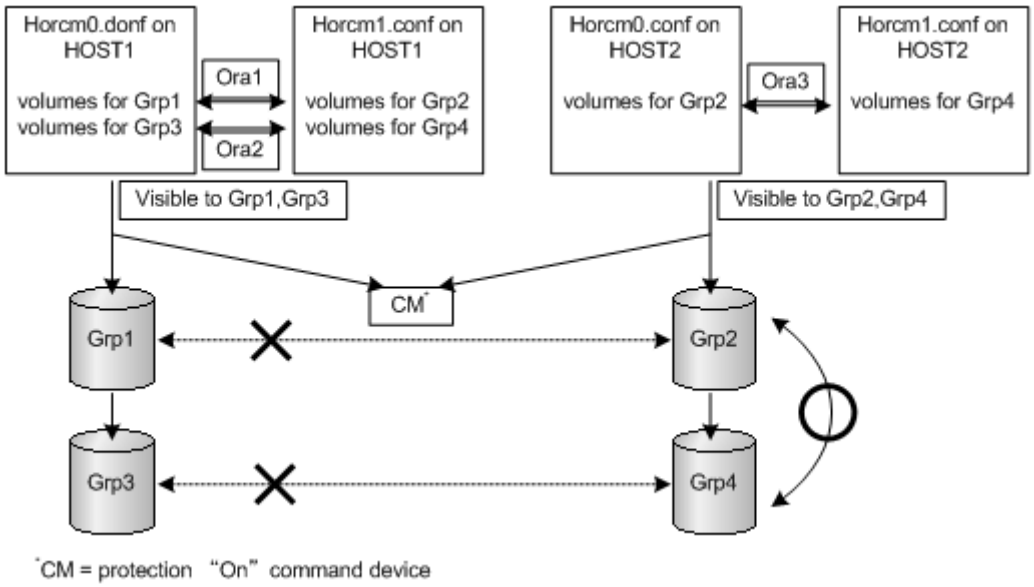


Figure 7-3 Example for the one-host configuration

Operation authority with CMD security enabled

If the CMD security is enabled, you have the operation authority for the LU which meets both of the following requirements.

- The connection to the host has been recognized when you start CCI.
- The LU is the target of the pair operation specified with MU# which is defined in the configuration definition file.

For the volumes that you do not have the operation authority, "****" is displayed as the LDEV#, and "----" is displayed as the status. If you perform the pair operations, CCI rejects the request with the error code "EX_ENPERM" (pairdisplay is not included).

If you specify 0, 1 2... for the MU#, your operation authority is limited on the LUs for the local copy program products (ShadowImage, ShadowImage for Mainframe and Copy-on-Write Snapshot). If you specify h0, h1 or h2 for the MU#, your operation authority is limited on the LUs for the remote copy (TrueCopy, TrueCopy for Mainframe, TrueCopy Async, Universal Replicator and Universal Replicator for Mainframe) operations. If you specify nothing for the MU#, you have the operation authority on MU#0 for the local copy and the remote copy operations.

Target commands for protection

The following commands are controlled by the Data Protection Facility: **horctakeover**, **paircurchk**, **paircreate**, **pairsplit**, **pairresync**, **pairvolchk**, **pairevtwait**, **pairsyncwait**, **raidvchkset**, **raidvchkdsp**, **pairdisplay**. When the command is issued to non-permitted volumes, RAID Manager rejects the request with error code "EX_ENPERM" (pairdisplay is not included).

- The **pairdisplay** command shows all volumes, so that you can confirm non-permitted volumes. Non-permitted volumes are shown without LDEV# information. As shown below, the LDEV# information is " **** " (-CLI is "–").

  ```
  # pairdisplay -g oradb
  Group   PairVol(L/R) (Port#,TID,LU-M),Seq#, LDEV#.P/S,Status,
  Seq#,P-LDEV# M
  oradb   oradev1(L)  (CL1-D , 3,  0-0) 35013 ****..-  -,-   -
  oradb   oradev1(R)  (CL1-D , 3,  1-0) 35013 ****..-  -,-   -
  ```

- The **raidscan** command shows all volumes same as current specification, because it does not need HORCM_DEV and HORCM_INST on `horcm.conf`. If you want to know permitted volumes at **raidscan**, use **raidscan -find**. The -find option shows device file name and storage system information by using internal Inquiry result. You can use **raidscan -find** to make `horcm.conf`, because only permitted volumes are shown with host side view. Following is an example for HP-UX systems:

  ```
  # ioscan  -fun | grep rdsk | raidscan -find
  DEVICE_FILE          UID  S/F PORT   TARG  LUN    SERIAL  LDEV
  PRODUCT_ID
  /dev/rdsk/c0t3d0      0    F  CL1-D     3    0     35013    17
  ```

```
OPEN-3
/dev/rdsk/c0t3d1      0     F   CL1-D      3     1      35013     18
OPEN-3
```

permission command

CCI recognizes permitted volumes at the result of the **permission** command. The **permission** command is the -find inst option of **raidscan**. This option issues an inquiry to a specified device file to get Ser# and LDEV# from the RAID storage system, and checks an identification for volumes of `horcm.conf` to all of own host volumes, then stores the result within HORCM of the instance. This **permission** command is started by /etc/horcmgr automatically.

The following example shows the relation between the device file and `horcm.conf` for a manual operation on an HP-UX system. All volumes of ioscan are permitted.

```
# ioscan  -fun | grep rdsk | raidscan -find inst
DEVICE_FILE             Group    PairVol     PORT   TARG  LUN M
SERIAL  LDEV
/dev/rdsk/c0t3d0        oradb    oradev1     CL1-D     3    0 -
35013    17
/dev/rdsk/c0t3d0        oradb    oradev1     CL1-D     3    0 0
35013    17
```

New options for security

raidscan -find inst

This option registers the device file name to all mirror descriptors of the LDEV map table for CCI and permits the matching volumes on `horcm.conf` in protection mode. It is started from /etc/horcmgr automatically. You will not normally need to use this option. This option issues an Inquiry to a device file from the result of STDIN. Then CCI gets Ser# and LDEV# from the RAID storage system. Subsequently, CCI compares the Inquiry result to the contents of `horcm.conf`, and the result is stored within HORCM for the instance. At the same time CCI shows the result of this option about the relation. This option will also be terminated to avoid wasteful scanning after registration based on `horcm.conf`, because HORCM does not need the registration any more.

```
# ioscan  -fun | grep rdsk | raidscan -find inst
DEVICE_FILE             Group    PairVol     PORT   TARG  LUN M
SERIAL  LDEV
/dev/rdsk/c0t3d0        oradb    oradev1     CL1-D     3    0 -
35013    17
/dev/rdsk/c0t3d0        oradb    oradev1     CL1-D     3    0 0
35013    17
```

Note: When multiple device files share the same LDEV, the first device file is registered to the LDEV map table.

raidscan -find verify [MU#]

This option shows the relation between group on `horcm.conf` and Device_File registered to the LDEV map tables from DEVICE_FILE of STDIN.

```
# ioscan  -fun | grep rdsk | raidscan -find verify -fd
DEVICE_FILE             Group    PairVol     Device_File      M
SERIAL   LDEV
/dev/rdsk/c0t3d0        oradb    oradev1     c0t3d0           0
35013    17
/dev/rdsk/c0t3d1        oradb    oradev2     Unknowm          0
35013    18
/dev/rdsk/c0t3d2        -        -           -                0
35013    19
```

Note: It shows shared LDEV among multiple device files, if there is a difference between DEVICE_FILE and Device_File. You can also use this option to the command device that specified non-protection mode. It is used for the purpose to see the relation between DEVICE_FILE and the group of `horcm.conf`.

raidscan -f[d]

This option shows the Device_File that was registered on the group of HORCM, based on the LDEV (as defined in the local instance configuration definition file).

```
# raidscan -p  cl1-d  -fd
Port# ,TargetID#,Lun#..Num(LDEV#....)...P/S,
Status,Fence,LDEV#,Device_File
CL1-D ,       3,   0...1(17).............SMPL  -   - -,c0t3d0
CL1-D ,       3,   1...1(18).............SMPL  -   - -,c0t3d1
```

pairdisplay -f[d]

This option shows the relation between the Device_File and the paired volumes (protected volumes and permitted volumes), based on the group, even though this option does not have any relation with protection mode.

```
# pairdisplay -g oradb -fd
Group   PairVol(L/R) Device_File    M ,Seq#,LDEV#.P/S,Status,
Seq#,P-LDEV# M
oradb   oradev1(L)   c0t3d0         0 35013   17..P-VOL COPY,
35013    18  -
oradb   oradev1(R)   c0t3d1         0 35013   18..S-VOL COPY,
35013    17  -
```

If either the local or the remote host (instance) has not been shown the Device_File, then pair operations are rejected (except the local option such as "-l") in protection mode because of Unknown volume, as shown in the following example.

```
# pairdisplay -g oradb -fd
Group   PairVol(L/R) Device_File    M ,Seq#,LDEV#.P/S,Status,
Seq#,P-LDEV# M
oradb   oradev1(L)   c0t3d0         0 35013   17..P-VOL COPY,
35013    18  -
oradb   oradev1(R)   Unknown        0 35013 ****..-  -, -  -  -
```

Permitting protected volumes

Protection mode needs recognition step to check accessible volumes and the `horcm.conf` at the startup of HORCM on protection mode. The protected volumes must be registered to enable the Data Protection Facility at each startup of HORCM, so that this registration process is executed automatically by /etc/horcmgr.

With a $HORCMPERM file

The following is executed for registration of permitted volume file ($HORCMPERM file), if $HORCMPERM file exists and there are permitted volumes. To permit only the volumes specified, then the volume list must be defined in the $HORCMPERM file.

Naming of $HORCMPERM file on UNIX systems

$HORCMPERM is /etc/horcmperm.conf or /etc/horcmperm*.conf (* = instance number) by default. For example, on HP-UX systems:

```
cat $HORCMPERM | /HORCM/usr/bin/raidscan -find inst
# The following are an example to permit the LVM Volume groups.
# For MU# 0
vg00  /dev/rdsk/c0t3d0  /dev/rdsk/c0t3d1
vg00  /dev/rdsk/c0t3d2  /dev/rdsk/c0t3d3
# For MU# 1
vg01  /dev/rdsk/c0t3d0  /dev/rdsk/c0t3d1
vg01  /dev/rdsk/c0t3d2  /dev/rdsk/c0t3d3
```

Verifying a group for vg01. The following are examples how to verify whether a LVM volume group is mapped to group (MU#1 for ShadowImage) in the `horcm.conf` file correctly.

```
# export HORCC_MRCF=1
# cat /etc/horcmperm.conf | grep vg01 | raidscan -find verify 1 -
fd
```

OR

```
# vgdisplay -v /dev/vg01|grep dsk|sed 's/\/*\/dsk\//\/rdsk\//
g'|raidscan -find verify 1 -fd
DEVICE_FILE             Group    PairVol     Device_File      M
SERIAL  LDEV
/dev/rdsk/c0t3d0        oradb1   oradev1     c0t3d0           1
35013    17
/dev/rdsk/c0t3d1        oradb1   oradev2     c0t3d1           1
35013    18
/dev/rdsk/c0t3d2        oradb    oradev3     c0t3d2           1
35013    19
/dev/rdsk/c0t3d3        -        -           -                1
35013    20
```

Naming of $HORCMPERM file on Windows systems

$HORCMPERM is %windir%\horcmperm.conf or %windir%\horcmperm*.conf (* = instance number) by default.

```
type $HORCMPERM | x:\HORCM\etc\raidscan.exe -find inst
# The following are an example to permit the DB Volumes.
# Note: a numerical value is interpreted as Harddisk#.
# DB0 For MU# 0
Hd0-10
harddisk12  harddisk13  harddisk17
# DB1 For MU# 1
hd20-23
```

Verifying a group for DB1. The following is an example of how to verify whether a DB volume group is mapped to a group (MU#1 for ShadowImage) in the `horcm.conf` file correctly.

```
D:\HORCM\etc> set HORCC_MRCF=1
D:\HORCM\etc> echo hd20-23 | raidscan -find verify 1 -fd
DEVICE_FILE          Group    PairVol     Device_File      M
SERIAL  LDEV
Harddisk20           oradb1   oradev1     Harddisk20       1
35013    17
Harddisk21           oradb1   oradev2     Harddisk21       1
35013    18
Harddisk22           oradb    oradev3     Harddisk22       1
35013    19
Harddisk23           -        -           -                1
35013    20
```

Without a $HORCMPERM file: Commands to run on different operating systems

If NO $HORCMPERM file exists, run a command on the host to permit all volumes on the host. Table 7-3 Without a $HORCMPERM file: Commands to run on different operating systems on page 7-13 shows the command to run on each operating system.

Table 7-3 Without a $HORCMPERM file: Commands to run on different operating systems

System	Command
HP-UX	echo /dev/rdsk/* /dev/rdisk/* /dev/rcdisk/* | /HORCM/usr/bin/raidscan -find inst
Linux	ls /dev/sd* | /HORCM/usr/bin/raidscan -find inst
zLinux	ls /dev/sd* /dev/dasd*| /HORCM/usr/bin/raidscan -find inst
Solaris	ls /dev/rdsk/* | /HORCM/usr/bin/raidscan -find inst
AIX	lsdev -C -c disk | grep hdisk | /HORCM/usr/bin/raidscan -find inst
Tru64 UNIX	ls /dev/rdisk/dsk* | /HORCM/usr/bin/raidscan -find inst
Digital UNIX	ls /dev/rrz* | /HORCM/usr/bin/raidscan -find inst
DYNIX/ptx	/etc/dumpconf -d | grep sd | /HORCM/usr/bin/raidscan -find inst
IRIX64	ls /dev/rdsk/*vol /dev/rdsk/*/*vol/* | /HORCM/usr/bin/raidscan -find inst
OpenVMS	/HORCM/usr/bin/raidscan -pi '1DGA0-10000 DKA0-10000 DGA0-10000' -find inst
Windows	X:\HORCM\etc\raidscan.exe -pi $PhysicalDrive -find inst

Note: This registration process has risk because it is executed automatically by **/etc/horcmgr** without judgment for protection mode in order to validate the -fd option. This registration brings a degradation in **horcmstart.sh**, but HORCM daemon has been running as usual, and it will depend on how many devices a host has. To start faster at HORCM faster in non-protection mode, create the $HORCMPERM file of "SIZE 0 byte" as a dummy file or to set HORCMPERM=MGRNOINST. At this time, the **-fd** option shows Device_File name as Unknown, and after you can use **`raidscan -find inst`** to validate the **-fd** option.

Environment variables

$HORCMPROMOD

This environment variable turns protection mode ON as specified in the following table. If your command device is set for non-protection mode, this parameter sets it to protection mode.

Table 7-4 Relation between HORCMPROMOD and command device

Command Device	HORCMPROMOD	Mode
Protection mode	Don't care	Protection mode
Non-protection mode	Not specified	Non-protection mode
	Specified	Protection mode

$HORCMPERM

This variable is used to specify the HORCM permission file name. If no file name is specified, /etc/horcmperm.conf or /etc/horcmperm*.conf (* = instance number) is the default.

- If a HORCM permission file exists, then /etc/horcmgr executes the following command to permit the volumes specified.

Example for UNIX systems:

```
cat $HORCMPERM | /HORCM/usr/bin/raidscan -find inst
```

Example for Windows systems:

```
type $HORCMPERM | x:\HORCM\etc\raidscan.exe -find inst
```

- If no HORCM permission file exists, then /etc/horcmgr executes a built-in command to permit all volumes of a host. See Without a $HORCMPERM file: Commands to run on different operating systems on page 7-13 for examples of commands run on an operating basis.
- /etc/horcmgr does not execute the built-in command if the following is defined for $HORCMPERM. This is used to execute a system command to permit the volumes specified from a user's shell script.

```
HORCMPERM=MGRNOINST.
```

Determining the protection mode command device

The inquiry page is not changed for a command device with protection mode ON. Therefore, CCI provides how to find the protection mode command device. To determine the currently used command device, use the **horcctl -D** command. This command shows the protection mode command device by adding an asterisk (*) to the device file name.

Example for HP-UX systems:

```
# horcctl -D
Current control device = /dev/rdsk/c0t0d0*
- * indicates protection ON.
```

8

Examples of using CCI commands

This chapter provides examples of typical tasks performed using CCI commands.

- ☐ Group version control for mixed storage system configurations
- ☐ LDM volume discovery and flushing for Windows
- ☐ Special facilities for Windows systems
- ☐ Host group control
- ☐ Using CCI SLPR security

Group version control for mixed storage system configurations

Before executing each option of a command, CCI checks the facility version of the storage system internally to verify that the same version is installed on mixed storage system configuration. If the configuration includes older storage systems (for example, 9900V), this method may not meet the requirements for the mixed storage system environment, because the older storage system limits the availability enhancements in later facility versions. If the facility versions of the storage systems are different, you cannot use TagmaStore USP/TagmaStore NSC-specific facility, because CCI applies the minimum version to all storage systems. To expand the capability for mixed storage system configurations and avoid problems such as this, CCI supports the following group version control to manage a version for each group.

- CCI (HORCM daemon) makes a facility version for each group based on a configuration file at the startup of HORCM.
- In a mixed storage system configuration, if the facility version of the storage systems (for example, USP V/VM and TagmaStore USP/ TagmaStore NSC) is different on a group, CCI will apply the minimum version for each group (see the following figure).

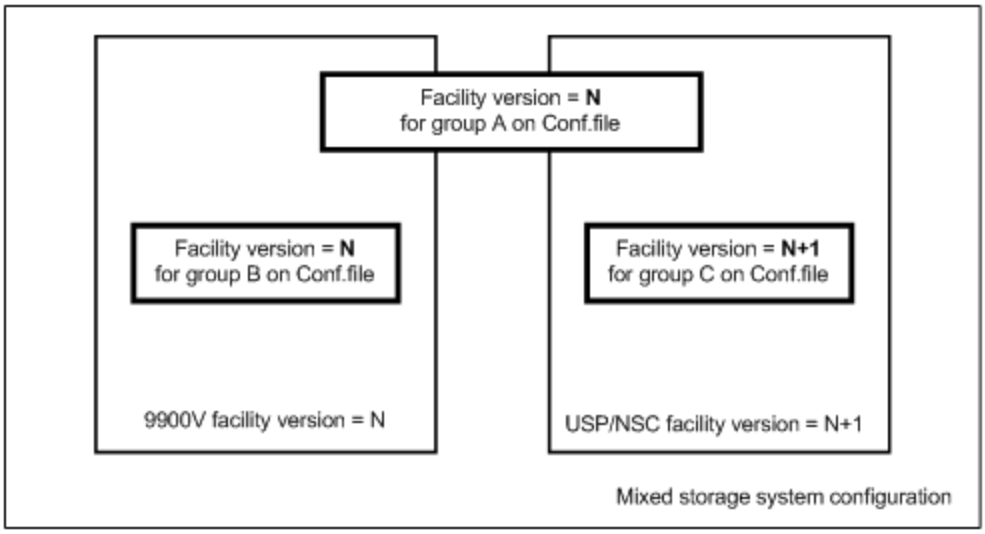


Figure 8-1 Definition of the group version

LDM volume discovery and flushing for Windows

Windows systems support the Logical Disk Manager (LDM) (such as VxVM), and a logical drive letter is typically associated with an LDM volume (\Device\HarddiskVolumeX). Therefore, you cannot know the relationship between LDM volumes and the physical volumes of the RAID storage system. Therefore, you need to create the CCI configuration file, and you need to know the relationship that is illustrated in Figure 8-2 LDM volume configuration on page 8-3.

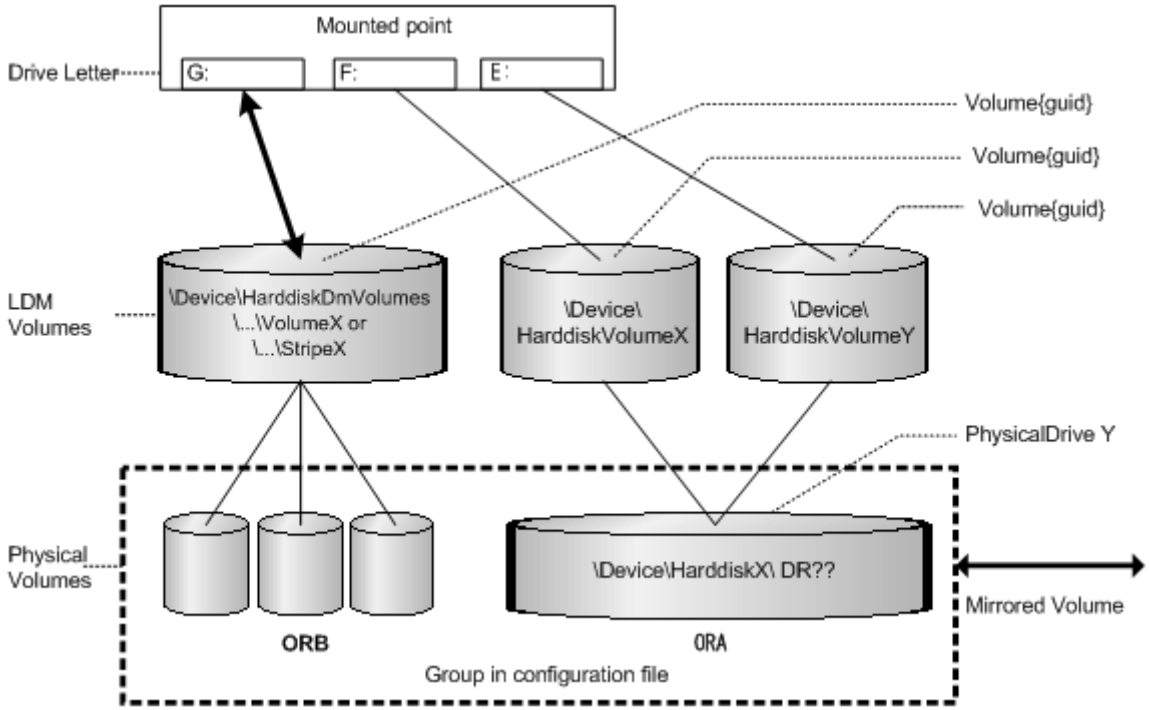


Figure 8-2 LDM volume configuration

Volume discovery function

CCI supports the volume discovery function on three levels showing the relationship between LDM volumes and the physical volumes.

- **Physical level.** CCI shows the relationship between PhysicalDrive and LDEV by giving **$Physical** as a KEY WORD for the discovery.
- **LDM volume level.** CCI shows the relationship between [LDM volume and PhysicalDrives] and LDEV by given **$Volume** as KEY WORD for the discovery.
- **Drive letter level.** CCI shows the relationship between [Drive letter and LDM volume and PhysicalDrives] and LDEV by given **$LETALL** as KEY WORD for the discovery.

The KEY WORD (**`$Physical, $Volume, $LETALL`**)can be used with **`raidscan -find`**, **`inqraid`**, **`mkconf`** commands.

In Windows, DOS devices (for example, C:, Volume{}) are linked to a Device Object Name (\Device\...). CCI indicates as the following by abbreviating a long Device Object Name.

- Device Object Name of the LDM for Windows:

\Device\HarddiskVolumeX for Partition : **\VolX\DskY**

DskY shows that VolX are configured through HarddiskY.

- Device Object Name of the LDM for Windows 2003/2000:

\Device\HarddiskDmVolumes\ ... \VolumeX for spanned volume : **\DmsX\DskYs**

\Device\HarddiskDmVolumes\ ... \StripeX for striped volume : **\DmtX\DskYs**

\Device\HarddiskDmVolumes\ ... \RaidX for Raid-5 volume : **\DmrX\DskYs**

DskYs shows that DmsX(DmtX,Dmr) volumes are configured through bundling multiple HarddiskY1 Y2….

- Device Object Name of the PhysicalDrive for Windows:

\Device\HarddiskX\DR?? : **HarddiskX**

You can determine the relationship between LDM volumes and LDEV by given a KEY WORD to the **inqraid** command.

```
inqraid $LETALL -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
D:\Vol2\Dsk4    -            -     -   -       -     -       -
DDRS-34560D
E:\Vol44\Dsk0   CL2-K    61456   194   -  s/s/ss  0004 1:01-10
OPEN-3
F:\Vol45\Dsk0   CL2-K    61456   194   -  s/s/ss  0004 1:01-10
OPEN-3
G:\Dmt1\Dsk1    CL2-K    61456   256   -  s/s/ss  0005 1:01-11
OPEN-3
G:\Dmt1\Dsk2    CL2-K    61456   257   -  s/s/ss  0005 1:01-11
OPEN-3
G:\Dmt1\Dsk3    CL2-K    61456   258   -  s/s/ss  0005 1:01-11
OPEN-3

inqraid $Volume -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
\Vol2\Dsk4      -            -     -   -       -     -       -
DDRS-34560D
\Vol44\Dsk0     CL2-K    61456   194   -  s/s/ss  0004 1:01-10
OPEN-3
\Vol45\Dsk0     CL2-K    61456   194   -  s/s/ss  0004 1:01-10
OPEN-3
\Dmt1\Dsk1      CL2-K    61456   256   -  s/s/ss  0005 1:01-11
OPEN-3
\Dmt1\Dsk2      CL2-K    61456   257   -  s/s/ss  0005 1:01-11
OPEN-3
\Dmt1\Dsk3      CL2-K    61456   258   -  s/s/ss  0005 1:01-11
OPEN-3

inqraid $Phy -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
Harddisk0       CL2-K    61456   194   -  s/s/ss  0004 1:01-10
OPEN-3
Harddisk1       CL2-K    61456   256   -  s/s/ss  0005 1:01-11
OPEN-3
Harddisk2       CL2-K    61456   257   -  s/s/ss  0005 1:01-11
OPEN-3
Harddisk3       CL2-K    61456   258   -  s/s/ss  0005 1:01-11
OPEN-3
Harddisk4       -            -     -   -       -     -       -
DDRS-34560D
```

- Device Object Name of the Partition for Windows NT
  - \Device\HarddiskX\PartitionY : **\DskX\pY**
- Device Object Name of the PhysicalDrive for Windows NT

- \Device\HarddiskX\Partition0 : **HarddiskX**

```
inqraid $LETALL -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
D:\Dsk0\p1      -            -     -   -       -     -       -
DDRS-34560D
E:\Dsk1\p1      CL2-K    61456   194   -  s/s/ss  0004 1:01-10
OPEN-3
F:\Dsk1\p2      CL2-K    61456   194   -  s/s/ss  0004 1:01-10
OPEN-3

inqraid $Phy -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
Harddisk0       -            -     -   -       -     -       -
DDRS-34560D
Harddisk1       CL2-K    61456   194   -  s/s/ss  0005 1:01-11
OPEN-3
```

You want to know the relationship between LDM volumes and a group of the configuration files, and then find a group of the configuration file by giving a KEY WORD to **raidscan -find verify** command.

```
raidscan -pi $LETALL -find verify
DEVICE_FILE             Group    PairVol     PORT   TARG  LUN M
SERIAL  LDEV
E:\Vol44\Dsk0           ORA      ORA_000     CL2-K     7    2 -
61456   194
F:\Vol45\Dsk0           ORA      ORA_000     CL2-K     7    2 -
61456   194
G:\Dmt1\Dsk1            ORB      ORB_000     CL2-K     7    4 -
61456   256
G:\Dmt1\Dsk2            ORB      ORB_001     CL2-K     7    5 -
61456   257
G:\Dmt1\Dsk3            ORB      ORB_002     CL2-K     7    6 -
61456   258

raidscan -pi $LETALL -find
DEVICE_FILE         UID  S/F PORT   TARG  LUN    SERIAL  LDEV
PRODUCT_ID
E:\Vol44\Dsk0         0   F  CL2-K     7    2     61456   194
OPEN-3
F:\Vol45\Dsk0         0   F  CL2-K     7    2     61456   194
OPEN-3
G:\Dmt1\Dsk1          0   F  CL2-K     7    4     61456   256
OPEN-3
G:\Dmt1\Dsk2          0   F  CL2-K     7    5     61456   257
OPEN-3
G:\Dmt1\Dsk3          0   F  CL2-K     7    5     61456   258
OPEN-3
```

Mountvol attached to Windows 2012/2008/2003/2000 systems

Pay attention to the **mountvol /D** command attached to a Windows system, such that it does not flush the system buffer associated with the specified logical drive. The **mountvol** command shows the volume mounted as **Volume{guid}** as follows:

```
mountvol
Creates, deletes, or lists a volume mount point.
.
.
MOUNTVOL [drive:]path VolumeName
MOUNTVOL [drive:]path /D
```

```
MOUNTVOL [drive:]path /L
    \\?\Volume{56e4954a-28d5-4824-a408-3ff9a6521e5d}\
        G:\
    \\?\Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e}\
        F:\
```

You can determine what **\\?\Volume{guid}** is configured, as follows:

```
inqraid $Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e} -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
\Vol46\Dsk1     CL2-K    61456   193   -  S/s/ss  0004 1:01-10
OPEN-3
raidscan -pi $Volume{bf48a395-0ef6-11d5-8d69-00c00d003b1e} -find
DEVICE_FILE         UID  S/F PORT   TARG  LUN    SERIAL  LDEV
PRODUCT_ID
\Vol46\Dsk1           0   F  CL2-K     7    1     61456   193
OPEN-3
```

System buffer flushing function

The logical drive to be flushed can be specified by the following two methods. One method is that the logical drive (for example, G:\hd1 drive, as below) is specified immediately, but this method must know about the logical drive corresponding to a group before executing the **sync** command. Also the volume is mounting by a directory and this method requires finding its volume name. To solve such a complication, CCI supports a method that flushes the system buffer associated with a logical drive through finding a volume{guid} corresponding to a group of the configuration file. This method does not depend on mounted point, so that it is possible to flush the volume mounted by a directory. This method is supported to be specified a group to the **raidscan -find sync** command.

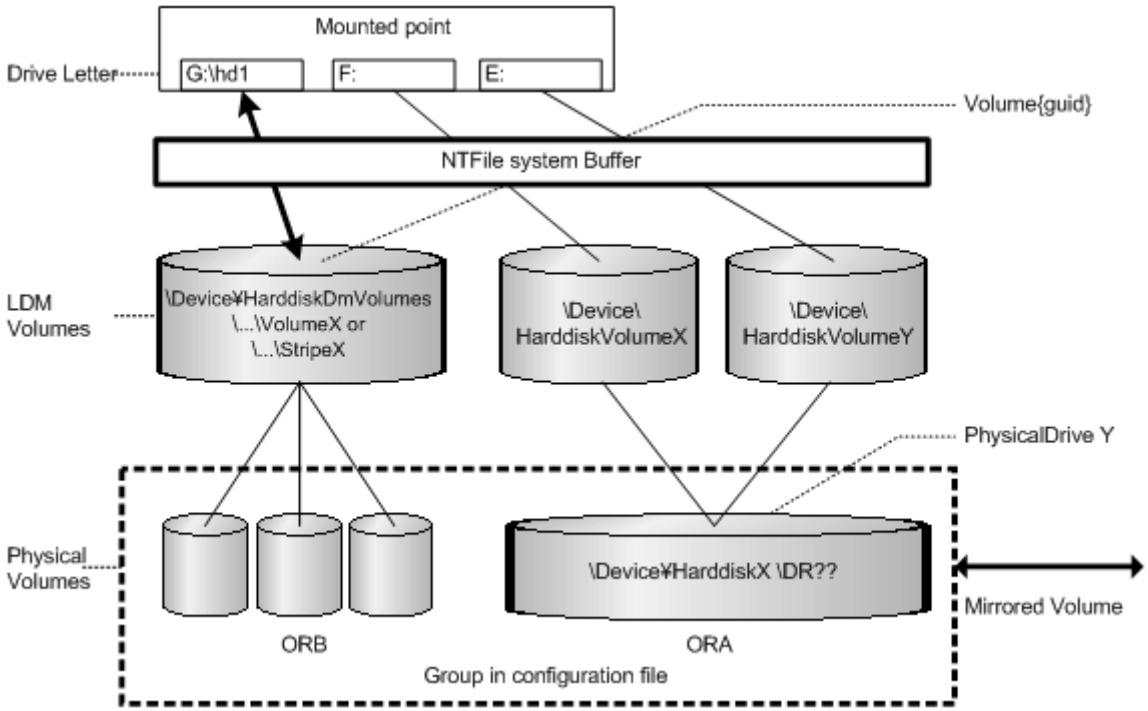


Figure 8-3 LDM volume flushing

The following example flushes the system buffer associated with the ORB group through **$Volume**.

```
raidscan -pi $Volume -find sync -g ORB
[SYNC] : ORB ORB_000[-] -> \Dmt1\Dsk1 : Volume{bf48a395-0ef6-11d5
8d69-00c00d003b1e}
[SYNC] : ORB ORB_001[-] -> \Dmt1\Dsk2 : Volume{bf48a395-0ef6-11d5
8d69-00c00d003b1e}
[SYNC] : ORB ORB_002[-] -> \Dmt1\Dsk3 : Volume{bf48a395-0ef6-11d5
8d69-00c00d003b1e}
```

The following example flushes the system buffer associated with all groups for the local instance.

```
raidscan -pi $Volume -find sync
[SYNC] : ORA ORA_000[-] -> \Vol44\Dsk0 : Volume{56e4954a-28d5
4824-a408-3ff9a6521e5d}
[SYNC] : ORA ORA_000[-] -> \Vol45\Dsk0 : Volume{56e4954a-28d5
4824-a408-3ff9a6521e5e}
[SYNC] : ORB ORB_000[-] -> \Dmt1\Dsk1  : Volume{bf48a395-0ef6
11d5-8d69-00c00d003b1e}
[SYNC] : ORB ORB_001[-] -> \Dmt1\Dsk2  : Volume{bf48a395-0ef6
11d5-8d69-00c00d003b1e}
[SYNC] : ORB ORB_002[-] -> \Dmt1\Dsk3  : Volume{bf48a395-0ef6
11d5-8d69-00c00d003b1e}
```

Note: Windows NT does not support the LDM volume, so specify **$LETALL** instead of **$Volume**.

Offline backup using `raidscan-find sync` for Windows file system:

The **`raidscan-find sync`** command flushes the system buffer associated with a logical drive through finding a Volume{guid} corresponding to a group of the configuration file, without using the **`-x mount`** and **`-x umount`** commands. The following examples are for group ORB.

P-VOL Side	S-VOL Side
Close all logical drives on the P-VOL by application. • **Flush** the system buffer for P-VOL using raidscan -pi **$Volume** -find sync -g ORB. • Split the paired volume using pairsplit -g ORB with r/w mode. • Open all logical drives on the P-VOL by application. • Resynchronize the paired volume using pairresync -g ORB.	• **Flush** the system buffer for NEW S-VOL data using raidscan -pi **$Volume** -find sync -g ORB. • Back up the S-VOL data. • **Flush** the system buffer for S-VOL updates using raidscan -pi **$Volume** -find sync -g ORB when the backup is finished.

Online backup using `raidscan-find sync` for Windows file system:

The **`raidscan-find sync`** command flushes the system buffer associated with a logical drive through finding a Volume{guid} corresponding to a group of the configuration file, without using the **`-x mount`** and **`-x umount`** commands. The following examples are for group ORB.

P-VOL Side	S-VOL Side
Freeze DB on opening P-VOL by application. • **Flush** the system buffer for P-VOL using raidscan -pi **$Volume** -find sync -g ORB . • Splits the paired volume using pairsplit -g ORB with r/w mode. • Unfreeze DB on opening P-VOL by application. • Resynchronize the paired volume using pairresync -g ORB.	• **Flush** the system buffer for NEW S-VOL data using raidscan -pi **$Volume** -find sync -g ORB . • Back up the S-VOL data. • **Flush** the system buffer for S-VOL updates using raidscan -pi **$Volume** -find sync -g ORB when the backup is finished.

Offline backup using raidscan-find sync for Windows NT file system:

The **`raidscan-find sync`** command flushes the system buffer through finding a logical drive corresponding to a group of the configuration file, without using the **`-x mount`** and **`-x umount`** commands. The following examples are for group ORB.

P-VOL Side	S-VOL Side
Close all logical drives on the P-VOL by application. • **Flush** the system buffer for P-VOL using raidscan -pi **$LETALL** -find sync -g ORB. • Split the paired volume using pairsplit -g ORB with r/w mode. • Open all logical drives on the P-VOL by application. • Resynchronize the paired volume using pairresync -g ORB.	• Back up the S-VOL data. • **Flush** the system buffer for S-VOL updates using raidscan -pi **$LETALL** -find sync -g ORB when the backup is finished.

Online backup using `raidscan-find sync` for Windows NT file system:

The **`raidscan-find sync`** command flushes the system buffer through finding a logical drive corresponding to a group of the configuration file, without using the **`-x mount`** and **`-x umount`** commands. The following examples are for group ORB.

P-VOL Side	S-VOL Side
Freeze DB on opening P-VOL by application. • **Flush** the system buffer for P-VOL using the raidscan -pi **$LETALL** -find sync -g ORB. • Splits the paired volume using pairsplit -g ORB with r/w mode. • Unfreeze DB on opening P-VOL by application. • Resynchronize the paired volume using pairresync -g ORB.	• Back up the S-VOL data. • **Flush** the system buffer for S-VOL updates using raidscan -pi **$LETALL** -find sync -g ORB when the backup is finished.

Note:

- **P-VOL side** must stop the WRITE IO to the logical drive corresponding to a [-g name] before issuing the **`raidscan -find sync`** command.
- **S-VOL side** must close the logical drive corresponding to a [-g name] before issuing the **`raidscan -find sync`** command.

Special facilities for Windows systems

CCI provides the following special facilities for Windows systems:

- Signature changing facility for Windows systems on page 8-9
- GPT disk for Windows on page 8-11

Signature changing facility for Windows systems

Consider the following Microsoft Cluster Server (MSCS) configuration in which a MSCS P-VOL is shared from MSCS Node1 and Node2, and the copied volume of S-VOL is used for backup on Node2. If the Node2 has reboot on standby state, then MSCS of Node2 has a problem to assign drive letter of S-VOL with previous P-VOL drive letter. This problem will happen on Node2 on MSCS environment as shown in the following figure. The conditions are:

- Node1 is active.
- Node2 is standby state where P-VOL on Node2 is hidden by MSCS, and reboots the Node2.

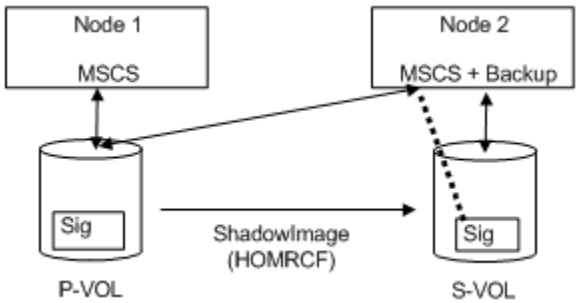


Figure 8-4 Configurations with MSCS and ShadowImage (HOMRCF)

MSCS on Node2 will misunderstand the S-VOL as MSCS cluster resource, because the signature of S-VOL and P-VOL is the same due to copied. The reason is that MSCS cluster resources are managed with the signature only. Therefore S-VOL of Node2 will unable to backup so that MSCS of Node2 carry away the S-VOL. This is a problem of MSCS service because Windows system does change the signature through reboot if the same signature is detected on NO MSCS service. MSCS will not accommodate LUNs with duplicate signatures and partition layout. The best way to avoid such problems is to transport to another host outside the cluster, but this enforces to set up a backup server, so CCI supports a facility to put back the signature as a second way.

The signature can be changed by using the **dumpcfg.exe** command attached to Windows resource kits, but if the S-VOL is created with the Noread option and the system is rebooted, then the **dumpcfg.exe** command will fail to change the signature, because the system does not know the signature and volume layout information for S-VOL.

CCI adopts the following way with this point in view:

- You must save the signature and volume layout information to the system disk by using the **inqraid -gvinf** command, after an S-VOL has set the signature and new partition by the Windows disk management.
- You can put back the signature by setting the signature and volume layout information to an S-VOL that was saved to the system disk by using the **inqraid -svinf** command, after splitting the S-VOL. If the S-VOL is created with the Noread option and the system is rebooted, then the system cannot create a device object (\Device\HarddiskVolume#) and Volume{guid} for S-VOL, but the -svinf option will create a Device object (\Device\HarddiskVolume#) and Volume{guid} without using the Windows disk management.

Note: The Cluster Disk Driver does not allow using the Noread volume as [Device is not ready] at the boot time, since the Cluster Disk Driver is a Non-Plug and Play Driver. Verify this situation using the **inqraid** command as follows:

```
inqraid $Phy -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
Harddisk0       -          -     -    -      -      -      -    -
Harddisk1       -          -     -    -      -      -      -    -
```

In this case, do the following to disable the Cluster Disk Driver:

1. In the **Computer Management** window, double-click **System Tools**, and then click **Device Manager**.
2. On the **View** menu, click **Show Hidden Devices**. Non-Plug and Play Drivers appear in the list in the right pane.
3. Open Non-Plug and Play Drivers, right-click **Cluster Dis**k, and then click **Disable**. When prompted to confirm whether to disable the cluster disk, click Yes. When prompted to restart the computer, click Yes.
4. Verify that you can see the Noread volume using **inqraid** command as follows.

```
inqraid $Phy -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
Harddisk0       CL2-K    61456   194   -  s/S/ss  0004 1:01-10
OPEN-3
Harddisk1       CL2-K    61456   256   -  s/S/ss  0005 1:01-11
OPEN-3
```

5. After starting up CCI and splitting the S-VOL, put back the signature by using the **`inqraid -svinf`** command.
6. Again, in the Computer Management window, enable the Cluster Disk Driver, and restart the computer.

GPT disk for Windows

Windows supports the basic disk called GPT disk using GUID partition instead of the Signature. The GPT disk also can be used as an S-VOL of the BC. Therefore, CCI supports saving/restoring the GUID DiskId of the GPT Basic disk to the **`inqraid`** command.

- gvinfex option (Windows 2012 only)

  This option retrieves the LUN signature and volume layout information by way of a raw device file provided via STDIN or arguments, and saves it in a system disk file with the following format:

  ```
  \WindowsDirectory\VOLssss_llll.ini
  ```

  where

  ```
  ssss = serial#
  ```

  ```
  llll = LDEV#
  ```

  Normally, this option is used to save the Disk signature/ GUID DiskId and volume layout information once, after it has been written on a potential (and before its paircreate). You do not need to directly view these host files.

  For example, saves the volume information for all physical drives:

  ```
  D:\HORCM\etc>inqraid $Phys -gvinfex -CLI
  \\.\PhysicalDrive10:
  # Harddisk10  -> [VOL61459_448_DA7C0D91] [OPEN-V          ]
  \\.\PhysicalDrive11:
  # Harddisk11   -> [VOL61459_449_D4CB5F17-2ADC-4FEE-8650
  D3628379E8F5] [OPEN-V          ]
  \\.\PhysicalDrive12:
  # Harddisk12   -> [VOL61459_450_9ABDCB73-3BA1-4048-9E94
  22E3798C3B61] [OPEN-V          ]
  ```

- -svinfex[=PTN] option (Windows 2003 only)

  This option writes LUN signature/GUID DiskId and volume layout information (that had previously been saved in a system disk file) by way of a raw device file provided via STDIN or arguments.

  This option gets the serial# and LDEV# of the RAID storage system for the target device using SCSI Inquiry, and writes the signature/GUID DiskId and volume layout information from the **VOLssss_llll.ini** file to the target device.

This option will work correctly (even if Harddisk# changes due to configuration changes) because the signature/GUID DiskId and volume layout information is associated the array serial# and LDEV# (not Harddisk#).

- **[=PTN]**

  This option specifies a string pattern usable to select only the pertinent output lines being provide from STDIN. If used as shown, only the pairdisplay output lines containing Harddisk would be used to cause signature writing.

```
D:\HORCM\etc>pairdisplay -l -fd -g URA | inqraid -
svinfex=Harddisk
[VOL61459_448_DA7C0D91] -> Harddisk10        [OPEN-V          ]
[VOL61459_449_D4CB5F17-2ADC-4FEE-8650-D3628379E8F5] ->
Harddisk11     [OPEN-V          ]
[VOL61459_450_9ABDCB73-3BA1-4048-9E94-22E3798C3B61] ->
Harddisk12      [OPEN-V          ]
```

- -gplbaex option (Windows 2012/2008 Only)

  This option is used for displaying usable LBA on a Physical drive in units of 512 bytes, and is used to specify [slba] [elba] options for **raidvchkset** command.

```
C:\HORCM\Tool>inqraid -CLI -gplbaex hd10,13
Harddisk10    : SLBA = 0x0000003f ELBA = 0x013fe5d9 PCNT = 1
[OPEN-V          ]
Harddisk11    : SLBA = 0x00000022 ELBA = 0x013fffdf PCNT = 2
[OPEN-V          ]
Harddisk12    : SLBA = 0x00000022 ELBA = 0x013fffdf PCNT = 3
[OPEN-V          ]
```

  SLBA: displays usable starting LBA in units of 512 bytes

  ELBA: displays usable ending LBA (ELBA -1) in units of 512 bytes

  PCNT: displays the number of partitions

Directory mount facility for Windows systems

The attached **mountvol** command into Windows supports the directory mount, but it does not support the directory mount function that flushes the system buffer associated to a logical drive such as in UNIX systems. The directory mount structure on Windows is only symbolical link between a directory and Volume{guid}, illustrated in Figure 8-5 Directory mount structure on page 8-13 below. As such, CCI supports the function to discover the mounted volumes by a directory, and supports the operation to mount/unmount with the subcommand option.

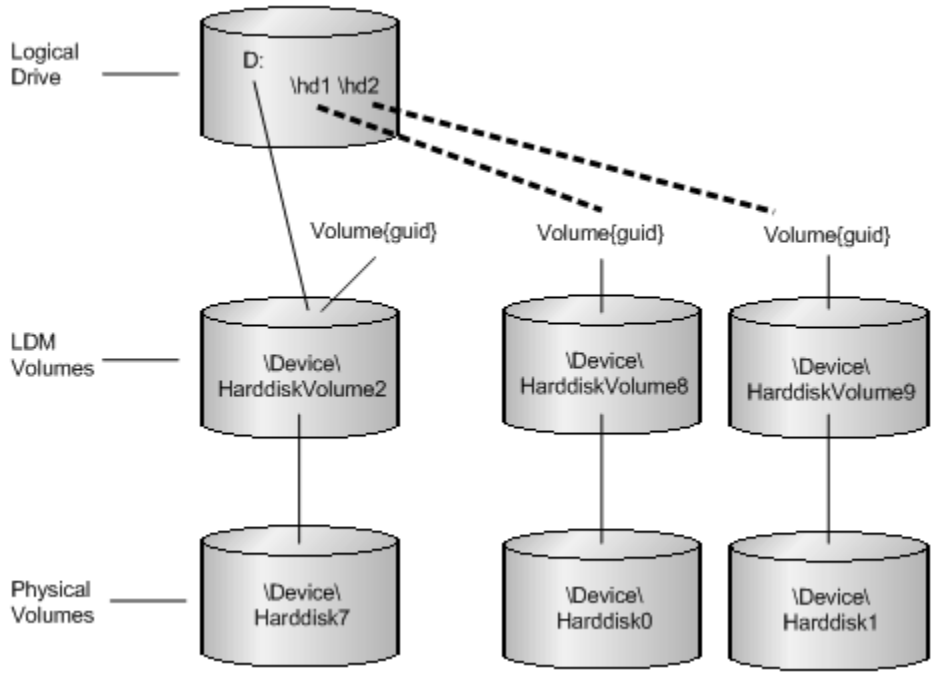


Figure 8-5 Directory mount structure

Volume discovery for directory mounted volume: CCI can discover the directory mounted volume by using **$LETALL** that shows the relationship between logical drive and the physical volumes. The KEY WORD (**$LETALL**)can also be used with the **raidscan -find** and **mkconf** commands.

```
D:\HORCM\etc>inqraid $LETALL -CLI
DEVICE_FILE     PORT    SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
D:\Vol2\Dsk7    -            -     -   -       -     -       -
DDRS-34560D
D:\hd1\Vol8\Dsk0 CL2-F    61459   448   -  s/s/ss  0005 1:01-01
OPEN-3
D:\hd2\Vol9\Dsk1 CL2-F    61459   449   -  s/s/ss  0005 1:01-01
OPEN-3
G:\Dms1\Dsk2     CL2-K    61456   256   -  s/s/ss  0005 1:01-11
OPEN-3
G:\Dms1\Dsk3     CL2-K    61456   257   -  s/s/ss  0005 1:01-11
OPEN-3
G:\Dms1\Dsk4     CL2-K    61456   258   -  s/s/ss  0005 1:01-11
OPEN-3
```

Subcommand for directory mounted volume: CCI supports the directory mount with the -x mount,-x unmount,-x sync option so that the directory mount can be used to mount/unmount the S-VOL.

Mount and Sync used Volume{GUID} for Windows: CCI supports the **mount**command option specified in the device object name, such as \Device\Harddiskvolume X. Windows changes the device number for the device object name after recovering from a failure of the PhysicalDrive. As a result, the **mount**command specified in the device object name may fail. Therefore, CCI supports a **mount**command option that specifies a Volume{GUID} as well as the device object name.

- **Mount**
  - The **mount**command option specifies a Volume{GUID} as well as the device object name.
  - If a Volume{GUID} is specified, then it is executed by converting a Volume{GUID} to a device object name.
  - Discover the Volume{GUID}s by using **inqraid $Volu -fv** command option.

Examples:

```
C:\HORCM\etc>inqraid -CLI $Vol -fv
DEVICE_FILE                                          PORT    SERIAL  LDEV
CTG  H/M/12  SSID R:Group PRODUCT_ID
Volume{cec25efe-d3b8-11d4-aead-00c00d003b1e}\Vol3\Dsk0     CL2-D
62496   256   -       -     -       - OPEN-3-CVS-CM
```

[Mount used DefineDosDevice()]

Note: This may forcibly dismount the mounted volume due to LOG-OFF of Windows. For example:

```
C:\HORCM\etc>raidscan -x mount E: Volume{cec25efe-d3b8-11d4-aead-
00c00d003b1e}
E: <+> HarddiskVolume3
```

[Mount used Directory mount]

Note: This prevents the forcible removal of a volume due to LOG-OFF of Windows. For example:

```
C:\HORCM\etc>raidscan -x mount E:\ Volume{cec25efe-d3b8-11d4-aead-
00c00d003b1e}
E:\ <+> HarddiskVolume3
```

- **sync**
  - The **sync**command option will also be able to specify a Volume{GUID} as well as the device object name.
  - If a Volume{GUID} is specified, then it is executed by converting a Volume{GUID} to a device object name.

Example:

```
C:\HORCM\etc>raidscan -x sync Volume{cec25efe-d3b8-11d4-aead-
00c00d003b1e}
[SYNC] Volume{cec25efe-d3b8-11d4-aead-00c00d003b1e}
```

Host group control

The RAID storage systems have the defined host group in the port and can allocate a host LU for every host group. CCI does not use this host LU, and specifies an absolute LUN in the port. To eliminate confusion that LUN of the CCI notation does not correspond to LUN on the host view and Storage Navigator, CCI supports specifying a host group and LUN on the host view.

Specifying a host group

(1) Defining the formats

The addition of arguments for the host group to the **raidscan** command and the configuration file means that it is not compatible with conventional CLI. Therefore, CCI provides a way to support CLI by specifying a host group in the port strings as follows.

- CL1-A-**GRP#** (GRP# can be up to 127)

Specifying the host group for the **raidscan** command:

```
raidscan -p CL1-A-5
```

Specifying the host group for the configuration file:

```
#dev_group     dev_name      port#        TargetID      LU#    MU#
ORA            ORA_000       CL2-D-1             4         1      0
ORA            ORA_001       CL2-D-1             4         2      0
```

If the port including a host group is specified to the port name, then a maximum of 255 LUNs can be specified.

(2) Specifiable port strings

As a result, CCI supports four kinds of forms for the port name.

- Specifying the port name without a host group

CL1-A

CL1-A**n** where **n**: unit ID for multiple RAID

- Specifying the port name with a host group

CL1-A-**g** where **g**: host group

CL1-A**n**-**g** where **n**-**g**: host group=**g** on CL1-A in unit ID=**n**

Commands and options including a host group

(1) Specifiable command for host group

The following commands can specify a host group with the port strings:

- **raidscan -p <port>**, **raidar -p <port>**, **raidvchkscan -p <port>**

```
# raidscan -p CL2-D-1
PORT# /ALPA/C,TID#,LU#.Num(LDEV#....)...P/S,
Status,Fence,LDEV#,P-Seq#,P-LDEV#
CL2-D-1 /da/ 0,  4,  0.1(256)...........SMPL  ----  ------ ----
, -----  ----
CL2-D-1 /da/ 0,  4,  1.1(257)...........SMPL  ----  ------ ----
, -----  ----
CL2-D-1 /da/ 0,  4,  2.1(258)...........SMPL  ----  ------ ----
, -----  ----
```

(2) Command option including a host group

CCI supports new option for the following commands in order to show a LUN on the host view by finding a host group via the specified device.

- **raidscan -pdg <device>**, **raidar -pdg <device>**, **raidvchkscan -pdg <device>**

```
# raidscan -pdg /dev/rdsk/c57t4d1
PORT# /ALPA/C,TID#,LU#.Num(LDEV#....)...P/S,
Status,Fence,LDEV#,P-Seq#,P-LDEV#
```

```
CL2-D-1 /da/ 0,  4,  0.1(256).....SMPL  ----  ------ ----
, -----  ----
CL2-D-1 /da/ 0,  4,  1.1(257).....SMPL  ----  ------ ----
, -----  ----
CL2-D-1 /da/ 0,  4,  2.1(258).....SMPL  ----  ------ ----
, -----  ----
Specified device(hgrp=1) is LDEV# 0257
```

- **raidscan -findg**

```
# ls /dev/rdsk/c57* | raidscan -findg
DEVICE_FILE         UID  S/F PORT   TARG  LUN    SERIAL  LDEV
PRODUCT_ID
/dev/rdsk/c57t4d0    0    F  CL2-D-1   4    0     62500   256
OPEN3-CVS-CM
/dev/rdsk/c57t4d1    0    F  CL2-D-1   4    1     62500   257
OPEN3-CVS
/dev/rdsk/c57t4d2    0    F  CL2-D-1   4    2     62500   258
OPEN3-CVS
```

- **raidscan -findg conf, mkconf -gg**

```
# ls /dev/rdsk/c57* | raidscan -findg conf 0 -g ORA
HORCM_DEV
#dev_group         dev_name        port#     TargetID     LU#
MU#
# /dev/rdsk/c57t4d1    SER =    62500  LDEV =  257 [ FIBRE
FCTBL = 4 ]
ORA               ORA_000         CL2-D-1          4       1
0
# /dev/rdsk/c57t4d2    SER =    62500  LDEV =  258 [ FIBRE
FCTBL = 4 ]
ORA               ORA_001         CL2-D-1          4       2
0
```

- **inqraid -fg**

```
# ls /dev/rdsk/c57* | ./inqraid -CLI -fg
DEVICE_FILE     PORT     SERIAL  LDEV CTG  H/M/12  SSID R:Group
PRODUCT_ID
c57t4d0         CL2-D-1  62500   256   -       -     -       -
OPEN-3-CVS-CM
c57t4d1         CL2-D-1  62500   257   -  s/P/ss  0005 1:01-02
OPEN-3-CVS
c57t4d2         CL2-D-1  62500   258   -  s/P/ss  0005 1:01-02
OPEN-3-CVS
```

Using CCI SLPR security

The Virtual Partition Manager feature of the RAID storage systems (USP V/VM and TagmaStore USP/TagmaStore NSC) supports storage logical partitioning (SLPR), a feature that partitions the ports and volumes of the RAID storage system. If CCI does not have SLPR security, then it can operate the target volumes crossing SLPR through the command device. The purpose of CCI SLPR security is to prevent CCI from operating the volumes on another SLPR (SLPR#N) through the command device from the SLPR (SLPR#M) that is assigned to its Host. You can use CCI SLPR Security by defining the command device through the Virtual Partition Manager feature, so that CCI can protect the target volume.

The following example represents the SLPR protection facility.

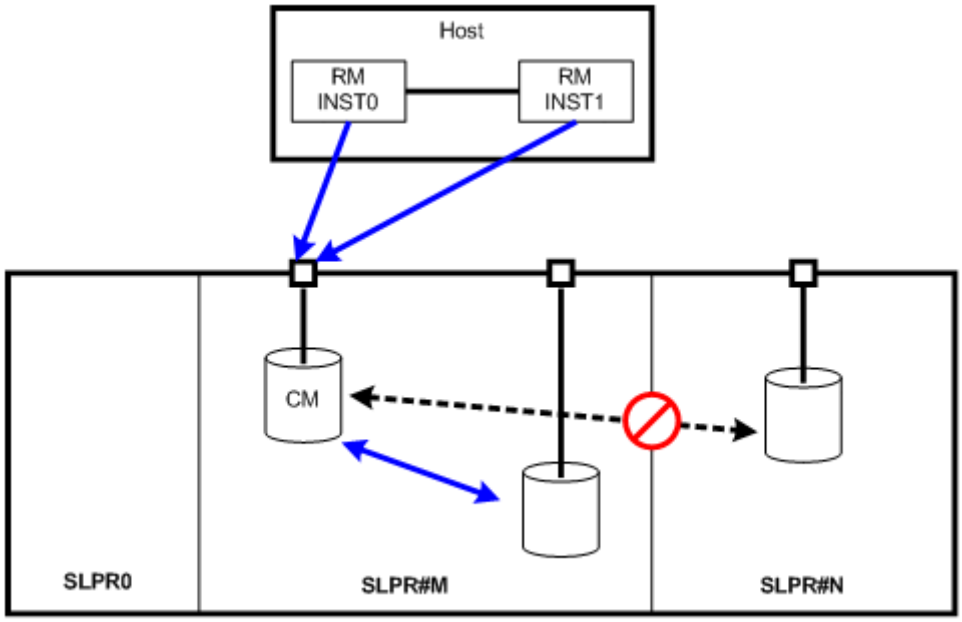


Figure 8-6 Protection of the command device that has the SLPR attribute

Legend

- SLPR : split of storage
- SLPR#M : split number M of storage

Specifying the SLPR Protection Facility

When you want to access certain SLPRs on a single Host, use the CCI protection facility so that the Host can access multiple SLPRs through a single command device. The following outline reviews the setup tasks for the SLPR protection facility.

1. **Setting SLPR on the command device**: The command device has an SLPR number and an associated bitmap so you can set multiple SLPRs. You accomplish this by sharing a command device (using ports connected to different SLPRs) by setting the command device through SLPR#0 (called Storage Administrator) on Storage Navigator.

   For example, if the command device is shared with the port on SLPR#1 and SLPR#2, then the command device will automatically set the bitmap corresponding to SLPR#1 and SLPR#2.

2. **Testing SLPR**: CCI verifies whether or not the command device can access a target within SLPR. So, if the command device belongs to SLPR#0, or CCI has no SLPR function, then the SLPR protection is ignored.

   However, if the command device is shared with the port on SLPR#1 and SLPR#2, CCI allows you to operate the volume on SLPR#1 and SLPR#2.

3. **Rejecting commands**: If access is denied on the specified port (or target volume), CCI rejects the following commands and outputs an error code, EX_ESPERM:

- **horctakeover**, **paircurchk**, **paircreate**, **pairsplit**, **pairresync**, **pairvolchk**, **pairevtwait**, pairsyncwait
- **raidscan** (except **-find verify**, **-find inst**), **raidar**, **pairdisplay**
- **raidvchkset**, **raidvchkscan** (except **-v jnl**), **raidvchkdsp**

```
[EX_ESPERM]       Permission  denied with the SLPR
[Cause ] : A specified command device does not have a
permission to access other SLPR.
[Action] : Please make the SLPR so that the target port and
the command device belongs to the same SLPR.
```

SLPR configuration examples

Single host

Figure 8-7 SLPR configuration on a single host on page 8-18 provides an example of when control is denied to the **paircreate** and **raidscan** commands in the following cases:

- The volume described on RMINST1 is different from the SLPR of the command device, so the **paircreate** command cannot control the paired volume.
- The specified port is different from the SLPR of the command device, so the **raidscan -p CL3-A** command cannot scan any ports that are defined as SLPR#N.

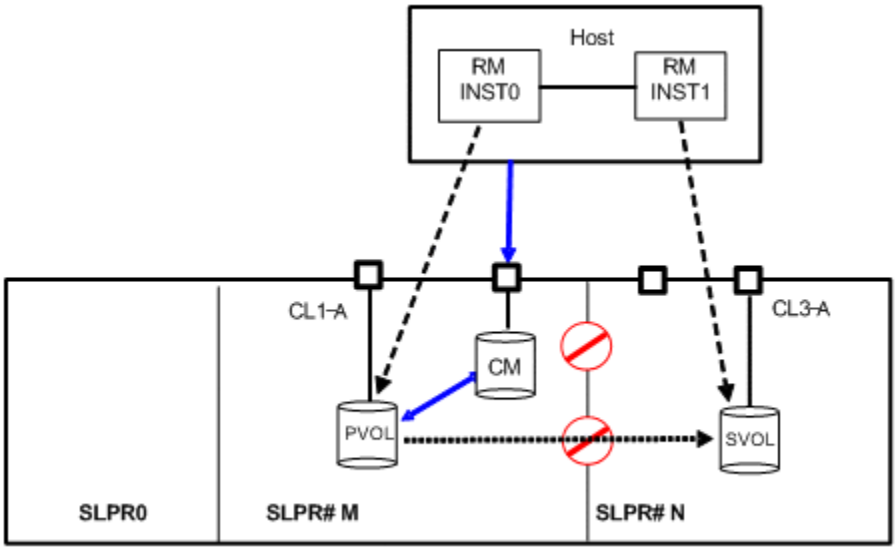


Figure 8-7 SLPR configuration on a single host

To operate SLPR#N, assign the command device. If RMINST1 has been assigned to a command device for SLPR#N, the **paircreate** command is permitted. However, the **raidscan -p CL3-A** command (via RMINST0) is unable to scan a port, because the specified port is different than the SLPR of the command device. In this case, -p CL3-A must be operated via RMINST1, as shown in the following example.

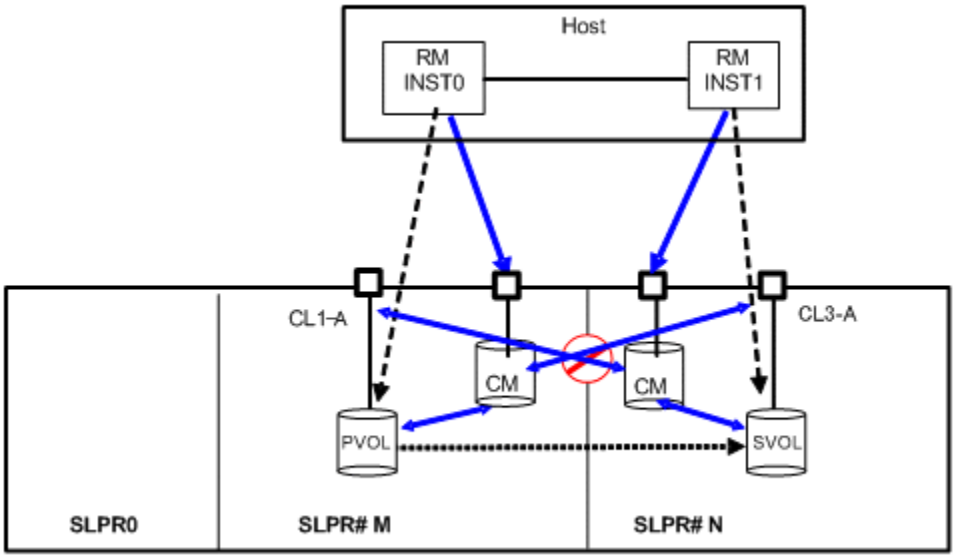


Figure 8-8 Operation across SLPRs using two command devices on a single host

To operate SLPR#N, share the command device. If RMINST1 has a shared command device for SLPR#N, the **`paircreate`** command is permitted. Additionally, the **`raidscan -p CL3-A`** command (via RMINST0), is permitted to scan a port, because the shared command device has the Bitmap settings SLPR#M and SLPR#N.

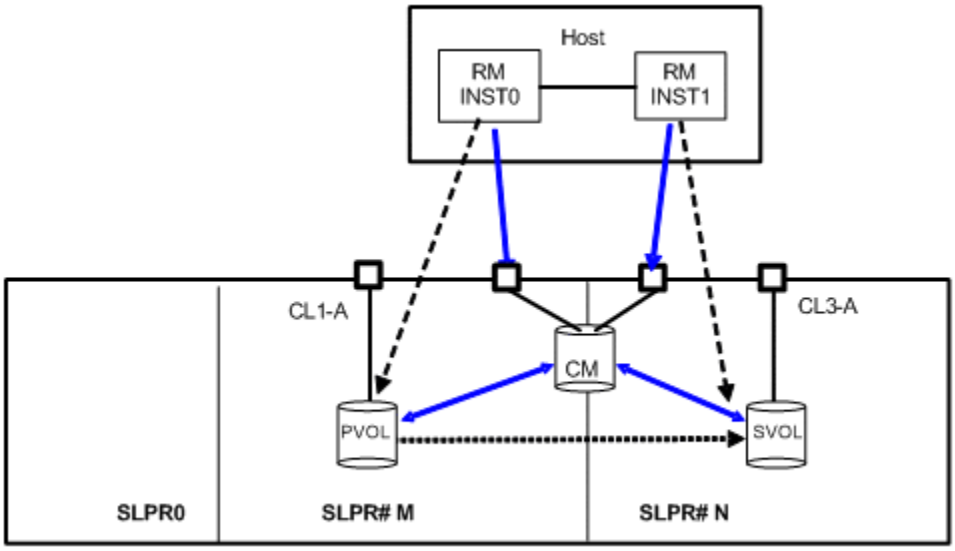


Figure 8-9 Operation across SLPRs using a shared command device on a single host

Dual Hosts

In the following example, the **paircreate** command is unable to operate the paired volume because the volume described on HostB is different than the SLPR of the command device. Also, the **raidscan -p CL3-A** command (via both Hosts), is unable to scan a port because the specified port is different than the SLPR of the command device.

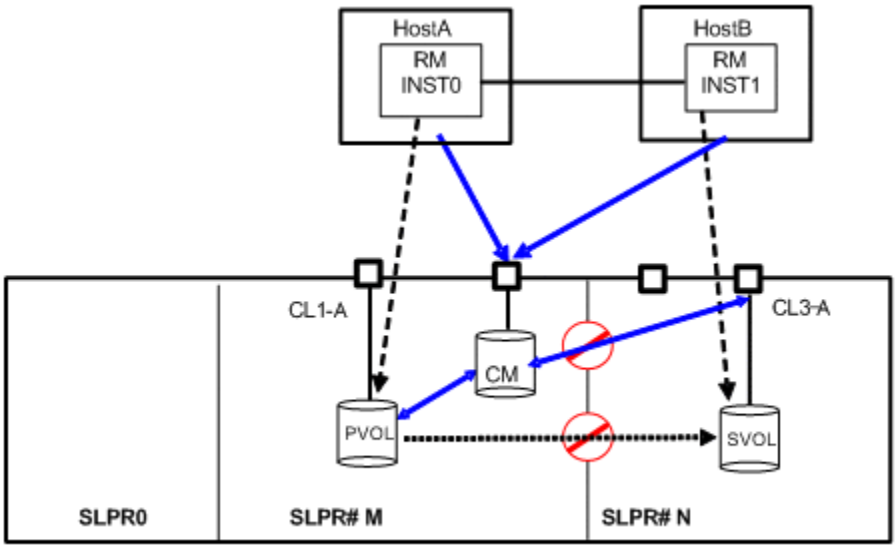


Figure 8-10 SLPR configuration on dual hosts

To operate SLPR#N, assign the command device. If HostB has a command device for SLPR#N, the **paircreate** command is permitted. However, the **raidscan -p CL3-A** command via HostA is unable to scan a port because the specified port is different than the SLPR of the command device. In this case, **raidscan -p CL3-A** command must be operated via HostB.

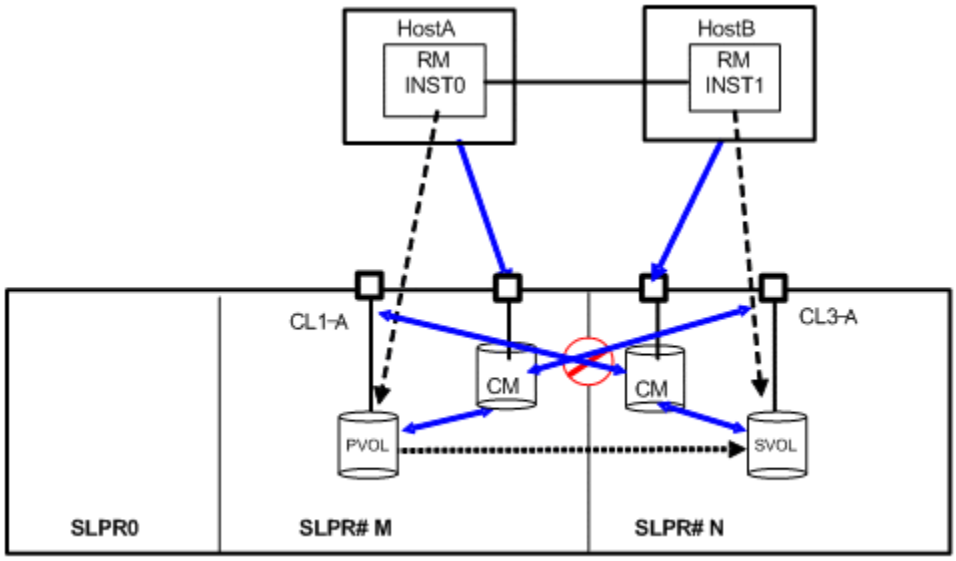


Figure 8-11 Operation across SLPRs using two command devices on dual hosts

To operate SLPR#N, share the command device. If HostB has a shared command device for SLPR#N, the **paircreate** command is permitted. Also, the **raidscan -p CL3-A** command (via HostA), is allowed to scan a port because the shared command device has the Bitmap settings SLPR#M and SLPR#N.

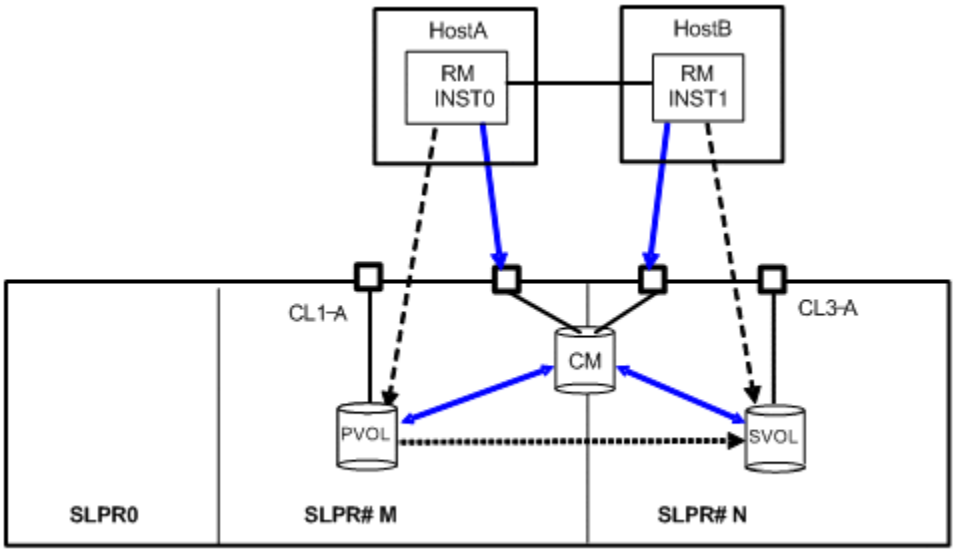


Figure 8-12 Operating SLPR#N by sharing the command device

TrueCopy using dual hosts

In the following example, the **pair-operation** command (except the -l option) determines whether the operation for paired volumes should be permitted at a remote site. The result is that the **paircreate** command is not allowed to operate the paired volume, because the volume described on HostB differs from the SLPR of the command device. Also, the **raidscan -p CL3-A** command (on HostB) is not allowed to scan a port.

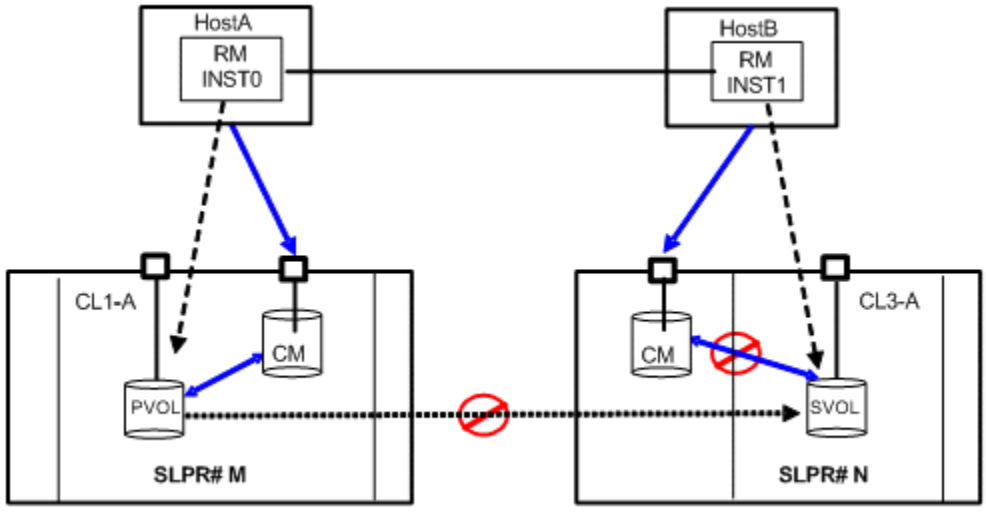


Figure 8-13 TrueCopy operation using SLPR

9

Troubleshooting

This chapter provides troubleshooting information for CCI.

- ☐ General troubleshooting
- ☐ Operational notes and restrictions for CCI operations
- ☐ Error messages and error codes
- ☐ Calling the HDS Support Center

General troubleshooting

If you have a problem with the CCI software, first make sure that the problem is not being caused by the UNIX/PC server hardware or software, and try restarting the server.

Problem	Recommended action

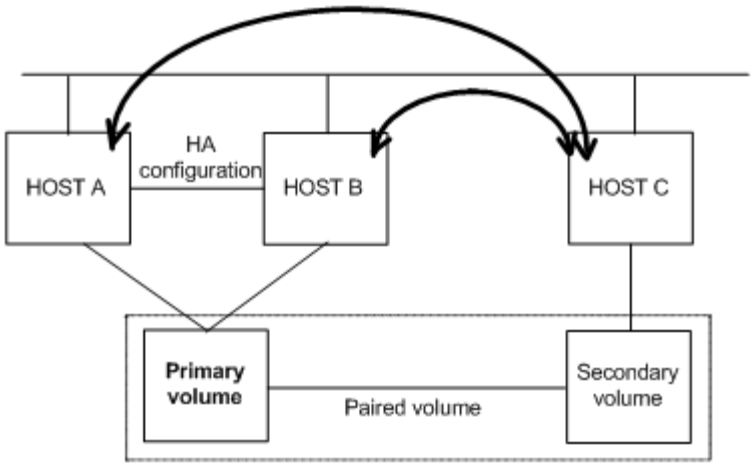
Deprecated SCSI ioctl
The following message is output to syslog file(/var/log/messages) with every ioctl():
`program horcmgr is using a deprecated SCSI ioctl, please convert it to SG_IO`
	CCI currently uses the ioctl(SCSI_IOCTL_SEND_COMMAND) for sending the control command to the command device. However, in RHEL 4.0 using kernel 2.6.9.XX, the following message is output to syslog file(/var/log/messages) with every ioctl():
	`program horcmgr is using a deprecated SCSI ioctl, please convert it to SG_IO`
	This may originate from the following kernel code in drivers/scsi/scsi_ioctl.c as way of warning that ioctl(SCSI_IOCTL_…) of kernel 2.6.9.XX does not properly handle an error of the HBA driver.
	`----------`
	`/* Check for deprecated ioctls ... all the ioctls that do not follow`
	`the new unique numbering scheme are deprecated */`
	`switch (cmd) {`
	`case SCSI_IOCTL_SEND_COMMAND:`
	`case SCSI_IOCTL_TEST_UNIT_READY:`
	`case SCSI_IOCTL_BENCHMARK_COMMAND:`
	`case SCSI_IOCTL_SYNC:`
	`case SCSI_IOCTL_START_UNIT:`
	`case SCSI_IOCTL_STOP_UNIT:`
	`printk(KERN_WARNING "program %s is using a deprecated SCSI "`
	`"ioctl, please convert it to SG_IO\n", current->comm);`
	`---------`
	Thus, CCI supports a way to change to the ioctl(SG_IO) automatically, if Linux kernel supports the ioctl(SG_IO) for horcmgr and **inqraid** command. However, CCI may encounter Linux kernel that does not support the ioctl(SG_IO) fully, so CCI also supports by defining either following environment variable or "/HORCM/etc/USE_OLD_IOCTL" file(size=0) that uses the ioctl(SCSI_IOCTL_SEND_COMMAND) forcibly. For example:
	`export USE_OLD_IOCTL=1`
	`horcmstart.sh 10`
	`HORCM/etc:`
	`-rw-r--r--  1 root root      0 Nov 11 11:12 USE_OLD_IOCTL`
	`-r--r--r--  1 root sys   32651 Nov 10 20:02 horcm.conf`
	`-r-xr--r--  1 root sys  282713 Nov 10 20:02 horcmgr`

CCI cannot be started because horcmstart command fails	If you have changed the configuration definition file settings: make sure that the configuration definition file you changed is correct. If you have changed the settings of the storage system: make sure that the settings you changed are correct, and if necessary, change the configuration definition file settings. Even if there are no problems in these files and settings, but if you cannot run CCI, get all log files under the specified directory by HORCM_LOG (the default setting: /horcm/log/), and then contact the Hitachi Data Systems Support Center.

Operational notes and restrictions for CCI operations

For maintenance of volumes used by CCI and the HDS features it supports, if a volume failure occurs, it is important to find the failure in the paired volumes, recover the volumes, and continue operation on the original system. When a CCI (HORCM) or HDS feature failure is detected, please collect the data in the error log file and trace data (all files in HORCM_LOG directory), and report the failure to your HDS representative.

Items	Notes and restrictions
Startup/shutdown restrictions	When the server starts up, the secondary volume may be updated by the primary volume's server. The secondary volume must not be mounted automatically in the startup sequence. If the secondary volume is used by the LVM, the volume group of the LVM must be deactivated. The secondary volume must be mounted in the split state or in the simplex mode. When the server starts up, the secondary volume can be activated without confirming, when can be guaranteed that the secondary volume has been PSUS (R/W enable) or in the SMPL state by server shutdown sequence.
Hot standby operations	TrueCopy commands cannot execute hot standby operations between the primary and secondary volumes. Use the takeover command intended for the HA configuration to execute the hot standby operation. In hot standby operation, two servers are used, and the active (primary) and standby (secondary) server programs are run alternately in each server in case of a failure in one server. Follow these precautions: • **Operation across volumes**. Since each TrueCopy command causes the server software to handle the volume by volume, a single volume should not be partitioned to prevent it from being used by some servers. • **Using LVM and TrueCopy together**. When constructing the LVM on the paired volume in the mutual hot standby configuration, the LVM logical volumes must be constructed in units of volume to prevent the volumes from being mounted by the LVM.
Coexistence of LVM mirror and TrueCopy	When the LVM mirror and TrueCopy volumes are used together, the LVM mirror handles write errors and changes the volumes. Thus, the fence level of the volumes used by the LVM mirror must be set to **data**.
Using paired volume in a single host	When constructing paired volume in a single host, it is necessary to activate two or more CCI instances. To activate two or more CCI instances, instance numbers must be assigned using the environment variable **HORCMINST**. The HORCM and TrueCopy/ ShadowImage commands must possess this environment variable. A configuration definition file and a log directory is set for each instance. For sharing command devices over 17 instances, use SCSI path among the storage system ports to share the command devices.

Items	Notes and restrictions
Sharing volumes in a hot standby configuration	When paired volume is used for the disk shared by the hosts in hot standby configuration using HA software, use the primary volume as the shared disk and describe the corresponding hosts using the paired volume in the configuration definition file as shown below. In the HA configuration, if a TrueCopy command issued by host C fails in host B (because host B has gone down and/or IO_ERROR of the command device), host A is connected and the command execution is retried. 
Linkage with HA software	The HORC Manager must not be an object of the process monitoring by the HA software (cluster manager), because HORCM should run in the same level as the cluster manager. Cooperation with HA software is done by activating the takeover command from the shell script activated by the cluster manager in units of the package software. ***Note:*** Cannot use a pair volume for the cluster lock disk that HA software uses for election.
Maintenance	Restart of HORCM is required if the storage system configuration is changed (for example, microcode exchange, cache memory install/uninstall). TrueCopy only: In the case of an error (for example, single error in cache memory) which made the pair volume is accompanied by maintenance work, the **`pairresync`** or **`paircreate`** command cannot execute copy rejection.
Command device	Each TrueCopy/ShadowImage command is executed by issuing a command to the command device. The TrueCopy/ShadowImage command is read or written from/into the specific block area of the command device. Therefore, the command device cannot be used. In addition, this device must not belong to an LVM volume group. For Windows systems, do not assign a drive letter to the command device to prevent utilization by general users.
SCSI alternate path restrictions	If the P-VOL and S-VOL are on the same server, alternate path from P-VOL to S-VOL cannot be used. Use of SCSI alternate path to a volume pair in the pair status is limited to among primary (secondary) volumes. Alternate path using Path Manager (Safe Path) is limited to primary volumes.

Items	Notes and restrictions
horctakeover (Swap-Takeover)	When executing **horctakeover** on a standby server manually, I/O on the active server must be stopped. When the package software goes for a standby server a failover by HA software, the HA software must guarantee an I/O insulation of the active server.
HORCM failure to activate	After a new system has been constructed, a failure to activate HORCM may occur due to improper environment setting and/or configuration definition. Refer to the HORCM activation log, and correct the settings.
Abnormal termination of command	Refer to the command log file and HORCM log file to identify the cause of the error. If a command terminates abnormally because of a remote server failure, recover the server from the failure, then re-execute the command. If HORCM has shut down, restart HORCM. If an unrecoverable error occurs, obtain the log files and contact the Hitachi Data Systems Support Center.
Error in paired volume operation	TrueCopy only: If an error occurs in duplicated writing in paired volumes (that is, pair suspension), the server software using the volumes may detect the error by means of the fence level of the paired volume. In such a case, check the error notification command or syslog file to identify a failed paired volume. The system administrator can confirm that duplicated writing in a paired volume is suspended due to a failure and the system runs in regressed state using the error notification command of the TrueCopy. HORCM monitors failures in paired volumes at regular intervals. When it detects a failure, it outputs it to the host's syslog file. Thus, the system administrator can detect the failure by checking the syslog file. Concerning the operation of the RAID storage system, the failure can also be found on Storage Navigator (or SVP) provided. Issue the TrueCopy commands manually to the identified failed paired volume to try to recover it. If the secondary volume is proved to be the failed volume, issue the pair resynchronization command to recover it. If the primary volume fails, delete the paired volume (pair splitting simplex) and use the secondary volume as the substitute volume.

Items	Notes and restrictions

About "/var(usr)/tmp" directory	CCI uses "/var/tmp" or "/usr/tmp" as the directory for the UNIX domain socket for IPC (Inter Process Communication), and makes the directory and files as "/var/tmp/.lcm*" in CCI version 01-16-03/06 or later.
	Caution: This "/var/tmp/.lcm*" should not be removed while HORCM is running.
	On Red Hat Linux, Cron executes the following "/etc/cron.daily/tmpwatch" file as default:
	`----------`
	`/usr/sbin/tmpwatch 240 /tmp`
	`/usr/sbin/tmpwatch 720 /var/tmp`
	`for d in /var/{cache/man,catman}/{cat?,X11R6/cat?,local/cat?}; do`
	`  if [ -d "$d" ]; then`
	`  /usr/sbin/tmpwatch -f 720 $d`
	`  fi`
	`done`
	`----------`
	The command of second line will remove "/var/tmp/.lcm*" directory after 720 Hr from HORCM startup, even though CCI command is used.
	Action: So administrator needs to add the following command in order to avoid this problem:
	`----------`
	`/bin/touch -c /var/tmp/.lcm* 2>/dev/null`
	`/usr/sbin/tmpwatch 240 /tmp`
	`/usr/sbin/tmpwatch 720 /var/tmp`
	`for d in /var/{cache/man,catman}/{cat?,X11R6/cat?,local/cat?}; do`
	`  if [ -d "$d" ]; then`
	`  /usr/sbin/tmpwatch -f 720 $d`
	`  fi`
	`done`
	`----------`

Error messages and error codes

System log messages

The following table lists and describes the HORCM system log messages and provides recommended actions for resolving the error conditions.

Table 9-1 System log messages

Message ID	Condition	Cause	Recommended action
HORCM_001	The HORCM log file cannot be opened.	The file cannot be created in the HORCM directory.	Create space on the disk on which the root directory resides.
HORCM_002	The HORCM trace file cannot be opened.	The file cannot be created in the HORCM directory.	Create space on the disk on which the root directory resides.

Message ID	Condition	Cause	Recommended action
HORCM_003	The HORCM daemon process cannot create a child process due to an error.	HORCM daemon attempted to create more processes than the maximum allowable number.	Terminate unnecessary programs or daemon processes running simultaneously.
HORCM_004	HORCM assertion failed, resulting in a fatal internal error in the HORCM.	An internal error that could not be identified by the HORCM occurred.	Restart the system, and contact the Hitachi Data Systems Support Center.
HORCM_005	The CCI software failed to create the end point for remote communication.	HORCM failed to create a socket, or an error exists in the format or a parameter in the HORCM configuration file ($HORCM_CONF).	Refer to the HORCM startup log to identify the cause of the error.
HORCM_006	HORCM memory allocation failed.	HORCM memory could not be secured.	Increase the system virtual memory, or close any unnecessary programs.
HORCM_007	An error exists in the parameter value in the HORCM setup file.	An error exists in the parameter value setting in the HORCM setup file.	Refer to the startup log and reset the parameters.
HORCM_008	HORCM configuration file parameters reading fails.	An error exists in the format or parameters of the HORCM configuration file ($HORCM_CONF).	Refer to the HORCM startup log to identify the cause of the error.
HORCM_009	TrueCopy/ ShadowImage connection to the CCI software failed.	System devices are improperly connected, or an error exists in the device parameter in the HORCM configuration file.	Refer to the HORCM startup log to identify the cause of the error.
HORCM_101	TrueCopy/ ShadowImage and the CCI software communication fails.	A system I/O error occurred or an error exists in the device parameter in the HORCM configuration file ($HORCM_CONF).	Refer to the HORCM startup log to identify the cause of the error.
HORCM_102	The volume is suspended.	The pair status was suspended due to code XXXX.	Contact the Hitachi Data Systems Support Center.

Message ID	Condition	Cause	Recommended action
HORCM_103	Detected a validation check error on this volume (xxxx unit#x,ldev#x) : CfEC=n, MNEC=n, SCEC=n, BNEC=n	A validation error occurs on the database volume, or validation parameters for this volume are illegal.	Please confirm the following items, and use **raidvchkdsp -v <op>** command for verifying the validation parameters. (1)Check if the block size (-vs <size>) is an appropriate size. (2)Check if the type for checking (-vt <type>) is an appropriate type. (3)Check if the data validations are disabled for LVM configuration changes. (4)Check if the data validations are not shared on file system. (5)Check if the redo log and data file are separated among the volumes.

Command error messages

The following table lists and describes the command error messages and their return values and provides recommended action for resolving the error conditions.

They are typical messages of command error messages. Check the command log file for details of the error. For more details about the command log file, see CCI log files on page 2-36.

Table 9-2 Command error messages

Error code	Error message	Condition	Recommended action	Value
EX_COMERR	Can't be communicate with HORC Manager	This command failed to communicate with the CCI software.	Verify that HORCM is running by using UNIX commands [ps - ef | grep horcm].	255
EX_REQARG	Required Arg list	An option or arguments of an option are not sufficient.	Please designate the correct option using the -h option.	254
EX_INVARG	Invalid argument	An option or arguments of an option are incorrect.	Please designate the correct option using the -h option.	253
EX_UNWOPT	Unknown option	Designated an unknown option.	Please designate the correct option using the -h option.	252
EX_ATTHOR	Can't be attached to HORC Manager	Could not connect with HORCM.	Please verify that HORCM is running and/or that HORCMINST is set correctly.	251
EX_ATTDBG	Can't be attached to a Debug layer	Failed to communicate with HORCM, or cannot make a log directory file.	Verify that HORCM is running by using UNIX commands [ps - ef | grep horcm].	250

Error code	Error message	Condition	Recommended action	Value
EX_INVNAM	Invalid name of option	The name specified in an argument of an option is not appropriate.	Please designate the correct name using the -h option.	249
EX_OPTINV	A specified option is invalid	Detected contradiction in information that RAID reported.	Contact the Hitachi Data Systems Support Center.	248
EX_ENOENT	No such device or group	The designated device or group name does not exist in the configuration file.	Verify the device or group name and add it to the configuration file of the remote and local hosts.	247
EX_ENODEV	No such device	The designated device name does not exist in the configuration file.	Verify the device name and add it to the configuration file of the remote and local hosts.	246
EX_ENOUNT	No such RAID unit	The designated RAID unit ID does not exist in the configuration file.	Verify the RAID unit ID and add it to the configuration file of the remote and local hosts.	219
EX_ENQSER	Unmatched Serial# vs RAID unitID	The group designated by ShadowImage paircreate does not have the same RAID unit, or the unitID is not identical to the unit ID in the same RAID serial# (Seq#).	Confirm the serial# (Seq#) of the storage system using the **pairdisplay** command, or confirm that the serial# (Seq#) and the unit ID of storage system are the same among hosts using the **raidqry -r** command.	218
EX_ENOMEM	Not enough core	Insufficient memory exists.	Increase the virtual memory capacity of the system, or close any unnecessary programs and/or daemon processes.	245
EW_ENESCR	Cannot execute script file	The script file specified by the -zt option cannot be performed.	Confirm the execution right, permission the extension, the execution path of the script file.	131
EX_ERANGE	Result too large	Your entry is one of the following statuses. • The value was entered beyond the maximum. • The result value is beyond the maximum. • The unit you set is invalid.	Refer to the error message, and designate an appropriate value or confirm whether you specified the unit correctly.	244
EX_ENAMLG	File name too long	Undefined error.	Contact the Hitachi Data Systems Support Center.	243

Error code	Error message	Condition	Recommended action	Value
EX_ENORMT	No remote host alive for remote commands or remote HORCM might be blocked (sleeping) on an existing I/O	A timeout occurred on remote communication, and HORC Manager failed to re-execute.	Please confirm that the HORC Manager in the remote host is running, and then increase the value of the timeout in the configuration file.	242
EX_INVMOD	Invalid RAID command mode	Detected a contradiction for a command.	Contact the Hitachi Data Systems Support Center.	241
EX_INVCMD	Invalid RAID command	Detected a contradiction for a command.	Contact the Hitachi Data Systems Support Center.	240
EX_ENOGRP	No such group	The designated device or group name does not exist in the configuration file, or the network address for remote communication does not exist.	Verify the device or group name and add it to the configuration file of the remote and local hosts.	239
EX_UNWCOD	Unknown function code	Detected a contradiction for a command.	Retry your operation after restart of the instance for CCI. Contact the Hitachi Data Systems Support Center if the operation fails because of same error again.	238
EX_CMDIOE	Control command I/O error	A read/write to the command device failed with an I/O error.	Refer to the host syslog file, and investigate the cause of the error. If the problem persists, collect the log information of HORCM ($HORCM_LOG), and contact the Hitachi Data Systems Support Center.	237

Error code	Error message	Condition	Recommended action	Value

EX_CMDRJE	An order to the control/command device was rejected	The request to the command device failed or was rejected.
		Note: This error code is sometimes caused by the operating system and reported as EX_CMDIOE instead of EX_CMDRJE (see next row).
			Verify TrueCopy/ ShadowImage functions are installed.
			Verify ports are set.
			Verify CU paths have been established.
			Verify that the target volume is available.
			CCI displays "SSB" in the output of the commands so a service representative can identify the cause of EX_CMDRJE (except for Tru64, DYNIX).
			Example:
			`# paircreate -g G1 -f never -vl -nocopy`
			`paircreate: [EX_CMDRJE] An order to the control/ command device was rejected`
			`Refer to the command log (/HORCM/log10/horcc_u1-1.log) for details.`
			`It was rejected due to SKEY=0x05, ASC=0x26, SSB=0xB9BF,0xB9C7 on Serial#(63502).`
				221

EX_CMDIOE	Control command I/O error or rejected	A read/write to the command device failed with an I/O error or was rejected.	Refer to the host syslog file, and investigate the cause of the error. If the cause is "Illegal Request (0x05)" Sense Key, please confirm the following items. Verify TrueCopy/ ShadowImage functions are installed. Verify ports are set. Verify CU paths have been established. Verify that the target volume is available. If the problem persists, contact the Hitachi Data Systems Support Center.	237
EX_ENQVOL	Unmatched volume status within the group	The volume attribute or the fence level within a group is not identical.	Confirm status using the **`pairdisplay`** command. Make sure all volumes in the group have the same fence level and volume attributes.	236

Error code	Error message	Condition	Recommended action	Value
EX_EVOLCE	Pair Volume combination error	Combination of a volume is unsuitable between the remote and local host.	Confirm volume status using the **pairdisplay** command, and change the combination of volumes properly.	235
EX_EWSUSE	Pair suspended at WAIT state	Detected a suspended status (PSUE) for the paired volume, before it made it to the designated status.	Please issue the **pairresync** command manually to the identified failed paired volume to try to recover it. If the problem persists, contact the Hitachi Data Systems Support Center.	234
EX_EWSTOT	Timeout waiting for specified status	Detected a time out, before it made it to the designated status.	Please increase the value of the timeout using the -t option. For details, refer to the troubleshooting information in the relevant user document.	233
EX_EWSLTO	Timeout waiting for specified status on the local host	Timeout error because the remote did not notify about expected status in time.	Please confirm that HORC Manager on the remote host is running.	232
EX_ESTMON	HORCM Monitor stopped	HORC Manager monitoring was refused.	Please confirm the value of "poll" in the configuration file.	231
EX_UNWCMD	Unknown command	An unknown command was attempted.	Please confirm the command name.	230
EX_INCSTG	Inconsistent status in group	The pair status of a volume within a group is not identical to the status of the other volumes in the group.	Please confirm the pair status using the **pairdisplay** command.	229
EX_INVSTP	Invalid pair status	The pair status of the target volume is not appropriate.	Please confirm the pair status using the **pairdisplay** command.	228
EX_INVVOL	Invalid volume status	The volume status of the target volume is not appropriate.	Please confirm the volume status using the **pairdisplay -l** or the raidvchkdsp -v aou command.	222
EX_INVMUN	Invalid mu# with HORC/UR or HOMRCF	The MU# of the volume to be operated is not appropriate.	Please confirm the MU# (MU #1/2 cannot be used for TrueCopy and must be P-VOL for ShadowImage.) for the specified group using the **pairdisplay** command. And also confirm the command execution environment to be set as HOMRCF.	220

Error code	Error message	Condition	Recommended action	Value
EX_ENLDEV	No such LDEV within the RAID	A device defined in the configuration file does not have a mapping to a real LUN and target ID within the RAID storage system.	Please confirm that the Port, Target ID, LUN are defined correctly under HORCM_DEV in the configuration file.	227
EX_INVRCD	Invalid return code	Wrong return code.	Contact the Hitachi Data Systems Support Center.	226
EX_VOLCUR	S-VOL currency error	Currency check error for S-VOL. Cannot guarantee identical data on S-VOL.	Check the volume list to see if an operation was directed to the wrong S-VOL.	225
EX_VOLCUE	Local volume currency error	The volume specified with the SVOL-takeover command is not the same as the P-VOL.	Please confirm the pair status of the local volume using the pairdisplay command.	224
EX_VOLCRE	Local and remote volume currency error	The combination of the volumes specified with Swap-takeover is unsuitable.	Please confirm the pair status of remote and local volumes using the **pairdisplay** command.	223
EX_UNWERR	Unknown error code.	Wrong error code.	Contact the Hitachi Data Systems Support Center.	--
EX_ENOCTG	Not enough CT groups in RAID	When creating TrueCopy Async/UR or ShadowImage volume, CTGID could not be registered due to being beyond the max number of CT groups for an async volume: 0-255 for VSP G1000, VSP, USP V/VM, TagmaStore USP, TagmaStore NSC. 0-127 for HUS VM and 9900V. 0-15 for 7700E.	Please create a pair with cutting the number of the group on the configuration files or make already existing group and the target group the same CTGID. Please confirm already existing group CTGID using the **pairvolchk** command. Then, please create a pair specifying CTGID as the **paircreate -f** option.	217
EX_EXTCTG	Extended CT group across RAIDs	A TrueCopy Async/UR or ShadowImage volume is defined in the configuration file (HORCM_CONF) as a group that extends across storage systems.	Please confirm the serial # of the volumes by using the **pairdisplay** command to verify that the CT group is contained completely within one RAID storage system.	216
EX_ENXCTG	No CT groups left for OPEN Vol use.	An available CT group for OPEN Volume does not exist.	Please confirm whether all CT groups are already used by mainframe volumes.	215

Error code	Error message	Condition	Recommended action	Value
EX_ENQCTG	Unmatched CTGID within the group	The CT group references within a group do not have an identical CTGID.	Please confirm the CTGID using the **pairvolchk** command and confirm that group references within the configuration file (HORCM_CONF) refer to the same CT group.	214
EX_ENPERM	Permission denied with the LDEV	A device mentioned in the configuration file does not have a permission for a pair-operation.	Please confirm whether pair-operation is permitted on the device by using the **pairdisplay** or **raidscan -find verify** command.	213
EX_ENQSIZ	Unmatched volume size for pairing	Size of a volume is unsuitable between the remote and local volume.	Please confirm volume size or number of LUSE volume using the 'raidscan -f' command, and make sure the volume sizes are identical.	212
EX_ERPERM	Permission denied with the RAID	A storage system (RAID) mentioned in the configuration file does not have a permission for CCI.	Please confirm if the type of storage system is permitted for a CCI by using the **inqraid -CLI** and **raidqry -h** commands.	211
EX_ESVOLD	SVOL denied due to be disabling	A specified target volume for S-VOL is denied to become S-VOL by the setting of Data Retention Utility.	Please confirm whether a target volume is setting to S-VOL disabling by using **inqraid -fl** or **raidvchkscan -v gflag** command.	209
EX_ENOSUP	Microcode not supported	The storage system does not support a function for CCI.	Please confirm the microcode version by using the **raidqry -l** command.	210
EX_EPRORT	Mode changes denied due to retention time	A target volume is denied to be changing due to retention time via LDEV guarding.	Please confirm the retention time for a target volume that is set to Data Retention Utility by using **raidvchkscan -v gflag** command.	208
EX_ESPERM	Permission denied with the SLPR	A specified command device does not have a permission to access other SLPR.	Please make the SLPR so that the target port and the command device belongs to the same SLPR.	207
EX_ENOPOL	Not enough Pool in RAID	Could not retain the pool for executing a command due to be exceeded the threshold rate.	Please release the pair of older generations paired volume, or re-synchronize the pair of split status paired volume.	206

Error code	Error message	Condition	Recommended action	Value
EX_ENOOBJ	No such Object in the RAID	The specified object is not installed. There are port, LDEV, and Hostgroup in the object.	Specify the appropriate object. Check the status of one of the following. • The specified port is not installed. • The value of specified port is invalid. • LU path is defined. • A logical path between MCU and RCU remain. • LDEV is not installed. • The attribute of the port is not Target (TAR) or RCU Target (RCU). • LUN security is invalid. • The specified host group is not installed.	205
EX_EPPERM	Permission denied with the privilege	The specified command device does not have an authority to execute this command.	Check the operation authentication.	203
EX_ENQCLP	Unmatched CLPR with JNL and Volume	The specified command device does not have an authority to execute this command.	Check the operation authentication.	204
EX_CTXCHK	Context check error	An error is detected by the Context Checking.	Check if the operation by the command executes a proper procedures and has the consistency or not.	199
EX_EACCES	Access denied with Lock/Unlock	The resource that you specified to lock or unlock has already been used by another user.	Check if the specified resource is used by such as Device Manager - Storage Navigator or not.	200
EX_ENAUTH	Authentication failed with User	User authentication failed at the authentication command device.	Check the user ID and password.	202
EW_INVARG	Invalid argument	Invalid option or an argument of the option.	User -h option to check the correct option, and specify it.	253
EW_INVOPA	Invalid option argument	Invalid argument of an option	Use -h option to check the correct option and use it.	131
EW_INVOPT	Invalid option	Invalid option.	Use -h option to check the correct option and use it.	131

Error code	Error message	Condition	Recommended action	Value
EW_LNGARG	Argument too long	The number of character for action, object, option or argument of option exceeded the maximum.	Specify the number of characters of action, object, option, an argument of option, or the total number of characters are to be appropriate number of characters.	131
EW_MAXARG	Maximum argument	The total number of option or the argument of option exceeded the maximum.	Check the total number of option or argument of option.	131
EW_ENFILE	No such file	The specified file dies not exist.	Check if the specified file exist or not, and specify the correct file.	131
EW_REQCMD	Required action/ object list	The number of action or the argument of object is insufficient.	Use -h option and specify the correct action or object.	131
EW_REQOPT	Required option list	The number of option or the argument of option is insufficient.	Use -h option and specify the correct option.	131
EW_UNWCMD	Unknown command	The command action or an object is undefined.	Check the issued command action and object.	230
EW_UNWOPT	raidcom: [EW_UNWOPT] Unknown option	Specifies an undefined option.	Use -h option and specify the correct option.	252
EW_SYSERR	System error	An invalid internal error has detected.	Contact the Hitachi Data Systems Support Center.	131
EW_ENOMEM	Not enough core	Memory to execute a command cannot be allocated in HORCM.	Add more virtual memory of a whole system, or terminate unnecessary programs or daemons that are executed in parallel.	245
EX_CHGOBJ	Objects was changed while referring	The object is in operation.	Issue the command again after the operation of the object is complete.	198

Generic error codes (horctakeover and pair commands)

The following table lists the generic error codes returned by these commands:

- **horctakeover**
- **paircurchk**, **paircreate**, **pairsplit**, **pairresync**, **pairevtwait**, **pairvolchk**, **pairsyncwait**, **pairdisplay**

In this table, "Unrecoverable" indicates errors that cannot be recovered by reexecuting the command, and "Recoverable" indicates errors that can be recoverable by reexecuting the command.

Table 9-3 Generic error codes (horctakeover and pair commands)

Category	Error code	Error message	Return Value
Syntax for Argument (Unrecoverable)	EX_REQARG	Required Arg list	254
	EX_INVARG	Invalid argument	253
	EX_INVNAM	Invalid name of option	249
	EX_UNWOPT	Unknown option	252
	EX_UNWCOD	Unknown function code	238
	EX_UNWCMD	Unknown command	230
	EX_ERANGE	Result too large	244
	EX_ENAMLG	File name too long	243
	EX_INVRCD	Invalid return code	226
Configuration (Unrecoverable)	EX_ENOGRP	No such group	239
	EX_ENOENT	No such device or group	247
	EX_ENODEV	No such device	246
	EX_ENLDEV	No such LDEV within the RAID	227
	EX_ENOUNT	No such RAID unit	219
	EX_INVMUN	Invalid mu# with HORC or HOMRCF	220
	EX_ENQSER	Unmatched Serial# vs RAID unitID	218
	EX_EXTCTG	Extended CTgroup across RAIDs	216
	EX_ENQCTG	Unmatched CTGID within the group	214
	EX_ENPERM	Permission denied with the LDEV	213
	EX_ERPERM	Permission denied with the RAID	211
	EX_ESPERM	Permission denied with the SLPR	207
Command I/O to RAID (Recoverable)	EX_CMDRJE	An order to the control/command was rejected	221
	EX_CMDIOE	Control command I/O error, or rejected	237
	EX_OPTINV	A specified option is invalid	248
	EX_INVMOD	Invalid RAID command mode	241
	EX_INVCMD	Invalid RAID command	240
Communication for HORCM (Recoverable)	EX_ATTHOR	Cannot be attached to HORC manager	251
	EX_ATTDBG	Cannot be attached to a Debug layer	250
	EX_COMERR	Cannot be communicate with HORC manager	255
Recoverable	EX_ENORMT	No remote host alive for remote commands, or Remote CCI might be blocked (sleeping) on an existing I/O.	242
Resource (Unrecoverable)	EX_ENOMEM	Not enough core	245

Generic error codes (raidscan, raidqry, raidar, horcctl)

The following table lists the generic error codes returned by these commands:

- **raidscan**
- **raidqry**
- **raidar**
- **horcctl**

In this table, "Unrecoverable" indicates errors that cannot be recovered by reexecuting the command, and "Recoverable" indicates errors that can be recoverable by reexecuting the command.

Table 9-4 Generic error codes (raidscan, raidqry, raidar, horcctl)

Category	Error code	Error message	Value
Syntax for Argument (Unrecoverable)	EX_REQARG	Required Arg list	254
	EX_INVARG	Invalid argument	253
	EX_INVNAM	Invalid name of option	249
	EX_UNWOPT	Unknown option	252
	EX_UNWCOD	Unknown function code	238
	EX_UNWCMD	Unknown command	230
	EX_ERANGE	Result too large	244
	EX_ENAMLG	File name too long	243
	EX_INVRCD	Invalid return code	226
Configuration (Unrecoverable)	EX_ENLDEV	No such LDEV within the RAID	227
	EX_ENOUNT	No such RAID unit	219
	EX_INVMUN	Invalid mu# with HORC or HOMRCF	220
	EX_ERPERM	Permission denied with the RAID	211
	EX_ENOSUP	Microcode not supported	210
	EX_ESPERM	Permission denied with the SLPR	207
Command I/O to RAID (Recoverable)	EX_CMDIOE	Control command I/O error	237
	EX_OPTINV	A specified option is invalid	248
	EX_INVMOD	Invalid RAID command mode	241
	EX_INVCMD	Invalid RAID command	240
Communication for HORCM (Recoverable)	EX_ATTHOR	Can't be attached to HORC manager	251
	EX_ATTDBG	Can't be attached to a Debug layer	250
	EX_COMERR	Can't be communicated with HORC manager	255
Resource (Unrecoverable)	EX_ENOMEM	Not enough core	245

Specific error codes

The following table lists the specific error codes returned by these commands:

- **horctakeover**
- **paircurchk**, **paircreate**, **pairsplit**, **pairresync**, **pairevtwait**, **pairvolchk**, **pairsyncwait**, **raidvchkset**

In this table, "Unrecoverable" indicates errors that cannot be recovered by reexecuting the command, and "Recoverable" indicates errors that can be recoverable by reexecuting the command.

See the Command Control Interface Command Reference for more information on error codes for each command.

Table 9-5 Specific error codes

Category	Error code	Error message	Value
Volume Status (Unrecoverable)	EX_ENQVOL	Unmatched volume status within the group	236
	EX_INCSTG	Inconsistent status in group	229
	EX_INVVOL	Invalid volume status	222
	EX_EVOLCE	Pair Volume combination error	235
	EX_INVSTP	Invalid pair status	228
	EX_VOLCUR	S-VOL currency error	225
	EX_VOLCUE	Local Volume currency error	224
	EX_VOLCRE	Local and Remote Volume currency error	223
	EX_EWSUSE	Pair suspended at WAIT state	234
	EX_ENQSIZ	Unmatched volume size for pairing	212
	EX_ESVOLD	SVOL denied due to be disabling	209
	EX_EPRORT	Mode changes denied due to retention time	208
Timer (Recoverable)	EX_EWSTOT	Timeout waiting for specified status	233
	EX_EWSLTO	Timeout waiting for specified status on the local host	232
Resource (Unrecoverable)	EX_ENOCTG	Not enough CT groups in the RAID	217
	EX_ENXCTG	No CT groups left for OPEN Vol use.	215
	EX_ENOPOL	Not enough Pool in RAID	206

SSB codes

An SSB code is error information that is output when an error occurs by executing a CCI command. The SSB code is output to the CCI execution log file or to the console. Identify the SSB code from an error code as follows:

- SSB code that is output to the CCI execution log file.

  The following shows an example of a SSB code that is output to the CCI execution log file.

  Example:11:06:03-37897-10413- SSB = 0xb9a0,2089

  The alphanumeric characters after the equal sign shows an error code. The last four digits of alphanumeric characters on the left side of the comma (,) is SSB1 (for example, b9ao), and the alphanumeric characters on the right side is SSB2 (for example, 2089).

- SSB code that is output on the console.

  The following shows an example of an SSB code that is output to the console.

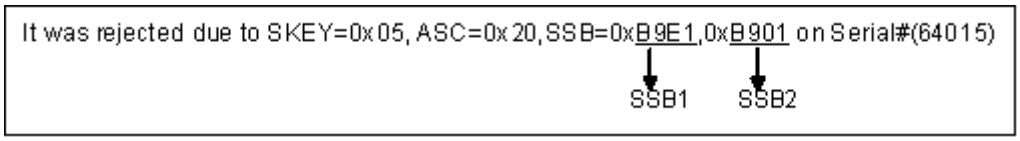


Figure 9-1 An example of SSB code that is output to the console

The alphanumeric characters after the "SSB=" show an error code. The last four digits of alphanumeric characters on the left side of comma (,) is SSB1 (for example, B9E1), and the last four digits of alphanumeric characters on the right side is SSB2 (for example, B901).

The following describes the SSB codes that are returned by the replication commands and the configuration setting command (raidcom).

SSB codes returned by the replication commands

When a replication command returns an SSB code, refer to the troubleshooting information in the user document for the product as follows:

Command	Product returning the SSB code
• paircreate • pairresync • pairsplit • horctakeover • horctakeoff	Hitachi TrueCopy®
• paircreate • pairresync • pairsplit • horctakeover • horctakeoff	Universal Replicator
• paircreate • pairresync • pairsplit	Hitachi ShadowImage®
• raidvchkset -vt • raidvchkset -vs	Database Validator
raidvchkset -vg	Data Retention Utility
• raidvchkset -vext	Hitachi Dynamic Provisioning

SSB codes returned by the configuration setting command (raidcom)

Executing the configuration setting command (raidcom command) may return an SSB code. An error may occur whether the command is executed synchronously or asynchronously. For an asynchronous error, the error information is displayed on the console by executing raidcom get command_status command. When the error message shows "CMDRJE" or "Get Command Status", check the contents of SSB1 and SSB2. You can

verify a content of an error by the raidcom get error_message command. When you specify the SSB code with the raidcom get error_message command, make sure not to specify a wrong SSB code.

The following tables provide information about each SSB code returned by the configuration setting command (raidcom command). If you see an error not described in the tables, contact the Hitachi Data Systems Support Center.

Table 9-6 SSB codes returned by the configuration setting command (common)

common				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
CMDRJE Get Command Status	Executing/ Async	2E10	8000	Unavailable to operate because another application is in progress on Device Manager - Storage Navigator or SVP.
CMDRJE	Executing	2E11	2205	The resource group to which the operation object belongs is locked by the other user.
CMDRJE	Executing	2E11	8303	The command cannot be executed because there is blocked part in the system.
CMDRJE	Executing	2E31	9100	The command cannot be executed because the user authentication is not performed.
CMDRJE	Executing	2EF4	0026	The virtual storage machine with the specified serial number was not found.

Table 9-7 SSB codes returned by raidcom add external_grp

raidcom add external_grp				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
CMDRJE	Executing	2E00	000D	Invalid emulation type.
Get Command Status	Async	2E00	0013	There are not enough cache management devices.
CMDRJE	Executing	2E00	4100	The external volume group is not in a effective range.
Get Command Status	Async	2E00	4108	The external volume group exists already.
Get Command Status	Async	2E00	410B	The specified CLPR does not exist.
CMDRJE	Executing	2E00	410D	The volume cannot be mapped for online data migration because the emulation type is not OPEN-V.
CMDRJE	Executing	2E00	410E	Invalid attribute of the specified external volume group.
CMDRJE	Executing	2E00	4500	The path group is not in a effective range.
CMDRJE	Executing	2E00	8400	The value of specified port is not enabled.

raidcom add external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E10	4200	LUN of specified external storage port does not exist.
Get Command Status	Async	2E10	4201	The external volume cannot be created because the specified external LU is a command device.
Get Command Status	Async	2E10	4400	The WWN on the side of specified external storage does not connected to a External port. This message may be output if the migration source storage system is USP V/VM and the host mode option 2 is not set to the port that connects to the migration target storage system.
Get Command Status	Async	2E11	4106	The specified external LU cannot create a external volume because the transition of data is required.
Get Command Status	Async	2E11	4200	The specified path group cannot be operated because a path between other devices exists.
CMDRJE	Executing	2E11	8010	The storage system is in internal process, or the configuration changing processes are conflicting.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E20	4102	Package for Mainframe is required when you specify the emulation type of mainframe.
Get Command Status	Async	2E20	8300	The specified MP Blade is not installed.
CMDRJE Get Command Status	Executing/ Async	2E21	9008	The program product of Universal Volume Manager is not installed.
CMDRJE Get Command Status	Executing Async	2E21	9013	The program product of nondisruptive migration is not installed.
Get Command Status	Async	2E22	4100	The external volume group exists already.
CMDRJE	Executing	2E22	4100	The external volume group exists already.
Get Command Status	Async	2E23	4102	Exceeded the number of mapping that can be set per 1 port.
Get Command Status	Async	2E23	4303	The operation cannot be done because the number of path in the path group exceeds 8.
Get Command Status	Async	2E30	4119	The external volume cannot be added because the number of virtual volumes that can be created in the system exceeded the maximum number.
Get Command Status	Async	2E30	4201	The specified external LU has mapped already.
CMDRJE	Executing	2E30	8400	The port attribute is not External.
Get Command Status	Async	2E31	4000	The specified external storage LU is the device of not supported.

raidcom add external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E31	4001	The specified external storage system is not supported.
Get Command Status	Async	2E31	4002	The specified external volume does not support nondisruptive migration.
Get Command Status	Async	2E31	9000	The usage capacity exceeds the license capacity of the program product.
CMDRJE	Executing	2EDA	00EE	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EDA	41FA	An internal error occurred.
CMDRJE	Executing	2EF3	4102	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-8 SSB codes returned by raidcom check_ext_storage external_grp

raidcom check_ext_storage external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	4100	The external volume group is not in the effective range.
CMDRJE	Executing	2E10	4301	The specified external volume has already disconnected the path, or is in the process of checking path.
CMDRJE	Executing	2E11	001B	The target LDEV is blocked.
CMDRJE	Executing	2E11	4000	The path for the specified external path is in the state of disconnected.
CMDRJE	Executing	2E11	4302	All the paths for the specified external path are blocked.
CMDRJE	Executing	2E20	4100	There is no external volume group.
CMDRJE	Executing	2E20	4300	There is no external path.
CMDRJE	Executing	2E30	001E	Online from the mainframe host.
Get Command Status	Async	2EDA	0905	An internal error occurred by the operation of external path. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EDA	0905	An internal error occurred by the operation of external volume. Call Hitachi Data Systems Support Center.

Table 9-9 SSB codes returned by raidcom delete external_grp

raidcom delete external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	4100	The external volume group # is in the effective range.
Get Command Status	Async	2E10	0012	LDEVs in the external volume group are devices that have a CC/XRC attributes.
CMDRJE	Executing	2E11	0153	The specified external volume group is used in another operation.
Get Command Status	Async	2E11	4103	Destage is not executed.
Get Command Status	Async	2E11	4104	The external volume is used as Compatible FlashCopy® V2.
Get Command Status	Async	2E11	4105	The specified external volume cannot be deleted because audit logs for the system disk are being used.
Get Command Status	Async	2E11	8004	The operation cannot be done because the internal processing is in progress.
CMDRJE	Executing	2E11	8010	The storage system is in internal process, or the configuration changing processes are conflicting.
Get Command Status	Async	2E11	8108	The operation cannot be done because there is blocked part in the system.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2E20	4100	There is no external volume group.
CMDRJE	Executing	2E30	0007	LU path is defined to LDEV in the external volume group.
Get Command Status	Async	2E30	0057	The external volume is used as a system disk.
Get Command Status	Async	2E30	4101	The external volume is used as LUSE.
Get Command Status	Async	2E30	4102	The external volume is used as a TrueCopy pair volume.
Get Command Status	Async	2E30	4103	The external volume is used as a TrueCopy pair volume.
Get Command Status	Async	2E30	4104	The external volume is used as a ShadowImage pair volume.
Get Command Status	Async	2E30	4105	The external volume is used as a ShadowImage pair volume.
Get Command Status	Async	2E30	4106	There is the volume that has path definition.
Get Command Status	Async	2E30	4107	The external volume is used as a ShadowImage reserved VOL.
Get Command Status	Async	2E30	4108	The external volume is used as a Volume Migration reserved VOL.

raidcom delete external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E30	4109	There is a mainframe path group setting in the external volume.
Get Command Status	Async	2E30	410A	There is a Data Retention Utility setting in the external volume.
Get Command Status	Async	2E30	410B	There is a mainframe LDEV Guard setting in the external volume.
Get Command Status	Async	2E30	410C	There is a Volume Security setting in the external volume.
Get Command Status	Async	2E30	410D	The external volume is used as a Universal Replicator pair volume.
Get Command Status	Async	2E30	410E	The external volume is used as a Universal Replicator journal volume.
Get Command Status	Async	2E30	410F	The external volume is used as a pool-VOL.
Get Command Status	Async	2E30	4110	The external volume is used as a pool-VOL.
Get Command Status	Async	2E30	4111	The external volume is used as a Volume Migration VOL.
Get Command Status	Async	2E30	4112	The external volume is used as a Volume Migration VOL.
Get Command Status	Async	2E31	0001	The target external group cannot be deleted because a quorum disk exists in it.
CMDRJE	Executing	2EDA	00EE	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EE8	FFFB	An internal error occurred. Call Hitachi Data Systems Support Center.
Get Command Status	Async	2EFF	41FF	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-10 SSB codes returned by raidcom check_ext_storage path

raidcom check_ext_storage path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	4500	The path group is not in the enabled range.
CMDRJE	Executing	2E00	8400	The value of the port is not enabled.
Get Command Status	Async	2E10	4301	The specified external volume has already disconnected the path, or is in the process of checking path.
Get Command Status	Async	2E11	001B	The target LDEV is blocked.
Get Command Status	Async	2E11	4000	The path for the specified external path is in the state of disconnected.

raidcom check_ext_storage path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E11	4302	All the paths for the specified external path are blocked.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E20	4100	There is no specified external volume.
Get Command Status CMDRJE	Async/ Executing	2E20	4300	There is no specified path.
CMDRJE	Executing	2E20	4400	WWN is not registered.
CMDRJE	Executing	2E20	4500	The path group is not registered.
CMDRJE	Executing	2E20	4500	The path group does not exist.
Get Command Status	Async	2E30	001E	Online from the mainframe host.
CMDRJE	Executing	2E30	8400	The port attribute is not External (ELUN).
CMDRJE	Executing	2EDA	00EE	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EDA	0905	An internal error occurred by the operation of external path. Call Hitachi Data Systems Support Center.

Table 9-11 SSB codes that are returned by raidcom disconnect external_grp command

raidcom disconnect external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	4100	The external volume group is not in the effective range.
CMDRJE	Executing	2E10	0000	The specified LDEV is used as a ShadowImage pair.
CMDRJE	Executing	2E10	0001	It is used as a TrueCopy or Universal Replicator pair.
CMDRJE	Executing	2E10	0003	A ShadowImage pair, a Thin Image/Copy-on-Write Snapshot pair or a Compatible FlashCopy® V2 relationship or in status of splitting or pending exists.
CMDRJE	Executing	2E10	0004	The specified LDEV is used as a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0008	It is used as a system disk.
CMDRJE	Executing	2E10	0012	It is used as a concurrent copy or a XRC.

raidcom disconnect external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E10	0062	The specified LDEV is used as the primary volume of a global-active device (GAD) pair.
Get Command Status	Async	2E10	0063	The specified LDEV is used as the secondary volume of a GAD pair.
CMDRJE	Executing	2E10	4100	The specified external volume group is in the state of disconnected.
CMDRJE	Executing	2E10	4102	The specified external device is in the state of disconnected.
CMDRJE	Executing	2E10	4301	The specified external volume has already disconnected the path, or is in the process of checking path.
CMDRJE	Executing	2E11	0007	It is in the state of shredding.
CMDRJE	Executing	2E11	001B	The target LDEV is blocked.
CMDRJE	Executing	2E11	4000	The path for the specified external path is in the state of disconnected.
CMDRJE	Executing	2E11	4302	All the paths for the specified external path are blocked.
CMDRJE	Executing	2E11	6005	The specified external volume belongs to a Thin Image or Copy-on-Write Snapshot where the pair in the PSUS status exists.
CMDRJE	Executing	2E11	800E	The operation cannot be done because the internal processing is in progress. Wait for a while, then retry the operation.
CMDRJE	Executing	2E20	4100	There is no specified external volume.
CMDRJE	Executing	2E20	4300	There is no specified path.
CMDRJE	Executing	2E30	000A	It is included the Hitachi Dynamic Provisioning volume that is associated with a pool.
Get Command Status	Async	2E30	000C	The specified LDEV is used as a quorum disk.
CMDRJE	Executing	2E30	000E	It is used as a pool volume.
CMDRJE	Executing	2E30	000F	It is used as a journal volume.
CMDRJE	Executing	2E30	0014	It is used as a reserved volume of Volume Migration.
CMDRJE	Executing	2E30	001A	Volume Security is set.
CMDRJE	Executing	2E30	001C	It is used as a remote command device.
CMDRJE	Executing	2E30	001E	Online from the mainframe host.
CMDRJE	Executing	2E30	004E	This is a volume that the Data Retention Utility is set.
CMDRJE	Executing	2E30	0061	The Dynamic Provisioning volume not in the blocked state is included in the Dynamic Provisioning that is associated with the pool to which the pool volume is belongs.

raidcom disconnect external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EDA	0000	An internal error occurred by the operation of disconnecting the external volume. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EDA	0905	An internal error occurred by the operation of external volume. Call Hitachi Data Systems Support Center.

Table 9-12 SSB codes that are returned by raidcom modify external_grp command

raidcom modify external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	4100	The external volume group is not in the effective range.
CMDRJE	Executing	2E00	410F	The specified value of the load balance mode is invalid.
CMDRJE	Executing	2E00	4110	The specified value of the ALUA mode is invalid.
CMDRJE	Executing	2E00	8301	MP Blade ID is not in the effective range.
CMDRJE	Executing	2E10	4202	The operation cannot be performed because the volume used for data migration is reserved from the host.
CMDRJE	Executing	2E10	8300	The specified MP Blade is blocked.
CMDRJE	Executing	2E11	4107	The attribute cannot be changed because Volume Migration is being executed.
CMDRJE	Executing	2E11	4303	The load balance mode cannot be changed because the alternative path mode is set to Single.
CMDRJE	Executing	2E11	800F	The load balance mode cannot be changed because microcodes of multiple versions are in the storage system.
CMDRJE	Executing	2E20	4100	There is no external volume group.
CMDRJE	Executing	2E20	8300	The specified MP Blade is not installed.
CMDRJE	Executing	2E30	4104	The attribute cannot be changed because the external volume is used as a ShadowImage pair volume.
CMDRJE	Executing	2E30	410D	The external volume is used as a Universal Replicator pair volume.
CMDRJE	Executing	2E30	411A	The external volume is used as a TrueCopy volume.
CMDRJE	Executing	2E31	000C	Cache mode cannot be changed because there is an LDEV that Cache Residency Manager bind mode is set.

raidcom modify external_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E31	4101	Cache mode cannot be changed because the specified external volume includes a pool volume or an LDEV that is used by LUSE.
CMDRJE	Executing	2E31	4107	The cache mode cannot be changed because one of the following applies to the specified external volume. • A pool volume of the pool that consists of both external volumes and internal volumes. • A pool volume of the pool where the multi tier pool option is enabled.
CMDRJE	Executing	2E31	4108	The attribute of the external volume cannot be changed from the current cache mode to the specified cache mode.
CMDRJE	Executing	2E31	4109	The attribute cannot be changed because the external volume group is not mapped for online data migration.
CMDRJE	Executing	2EDA	00F1	The specified command cannot be accepted because the command is not supported.
CMDRJE	Executing	2EDA	0905	An internal error occurred on the changing of an external volume option. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	0002	The specified parameter is incorrect. Check the Command Control Interface Command Reference.

Table 9-13 SSB codes that are returned by raidcom modify port -loop_id command

raidcom modify port -loop_id				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B955	044C	The specified AL-PA is invalid.
CMDRJE	Executing	B955	054E	The specified topology is invalid.
CMDRJE	Executing	B955	05A6	The other than "fabric on" cannot be specified when specifying a topology of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	05A7	The other than "P-to-P (point to point)" cannot be specified when specifying a topology of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	1039	The command device being used at the local CCI exists under the port.
CMDRJE	Executing	B955	104F	The program product is not installed.
CMDRJE	Executing	B955	113D	Invalid host speed is set for the 4Gbps fibre adapter. The available host speeds are AUTO, 1G, 2G, and 4G only.

raidcom modify port -loop_id				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B955	113F	Invalid host speed is set for the 8Gbps fibre adapter. The available host speeds are AUTO, 2G, 4G, and 8G only.
CMDRJE	Executing	B955	11A5	The other than "10G" cannot be specified when specifying a host speed of the package for Fibre Channel over Ethernet.

Table 9-14 SSB codes that are returned by raidcom modify port -topology command

raidcom modify port -topology				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B955	044C	The specified AL-PA is invalid.
CMDRJE	Executing	B955	054E	The specified topology is invalid.
CMDRJE	Executing	B955	05A6	The other than "fabric on" cannot be specified when specifying a topology of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	05A7	The other than "P-to-P (point to point)" cannot be specified when specifying a topology of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	1039	The command device being used at the local CCI exists under the port.
CMDRJE	Executing	B955	104F	The program product is not installed.
CMDRJE	Executing	B955	113D	Invalid host speed is set for the 4Gbps fibre adapter. The available host speeds are AUTO, 1G, 2G, and 4G only.
CMDRJE	Executing	B955	113F	Invalid host speed is set for the 8Gbps fibre adapter. The available host speeds are AUTO, 2G, 4G, and 8G only.
CMDRJE	Executing	B955	11A5	The other than "10G" cannot be specified when specifying a host speed of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	12AF	Topology FC-AL and 16G as the host speed is not supported for the 16Gbps fibre adapter.

Table 9-15 SSB codes that are returned by raidcom modify port -security _switch command

raidcom modify port -security _switch				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B955	044C	The specified AL-PA is invalid.
CMDRJE	Executing	B955	054E	The specified topology is invalid.

raidcom modify port -security _switch				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B955	05A6	The other than "fabric on" cannot be specified when specifying a topology of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	05A7	The other than "P-to-P (point to point)" cannot be specified when specifying a topology of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	1039	The command device being used at the local CCI exists under the port.
CMDRJE	Executing	B955	104F	The program product is not installed.
CMDRJE	Executing	B955	113D	Invalid host speed is set for the 4Gbps fibre adapter. The available host speeds are AUTO, 1G, 2G, and 4G only.
CMDRJE	Executing	B955	113F	Invalid host speed is set for the 8Gbps fibre adapter. The available host speeds are AUTO, 2G, 4G, and 8G only.
CMDRJE	Executing	B955	11A5	The other than "10G" cannot be specified when specifying a host speed of the package for Fibre Channel over Ethernet.

Table 9-16 SSB codes that are returned by raidcom add ldev command

raidcom add ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceeds the range of LDEV number.
CMDRJE	Executing	2E00	0002	Cannot create because the specified capacity is invalid.
CMDRJE	Executing	2E00	0003	SSID is not in the effective range.
CMDRJE	Executing	2E00	000D	The value of specified emulation type is invalid.
CMDRJE	Executing	2E00	000E	The specified emulation type is not supported in this command.
CMDRJE	Executing	2E00	0010	A Dynamic Provisioning virtual volume cannot be created because the specified LDEV number is already used.
Get Command Status	Asynchronous	2E00	0013	There are not enough cache management devices.
Get Command Status	Asynchronous	2E00	0014	Cannot create because the specified capacity is invalid.
CMDRJE	Executing	2E00	0019	The capacity in the case of specifying a emulation type of the mainframe series must be dividable by the cylinder.
CMDRJE	Executing	2E00	001A	The capacity when 3390-V emulation type is specified must be divisible by page unit.

raidcom add ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	001C	When you specify emulation type for open system, you cannot specify the size by the cylinder.
CMDRJE Get Command Status	Executing Async	2E00	0025	A volume for online data migration cannot be created because the specified value of capacity (LBA) is not the maximum.
CMDRJE	Executing	2E00	0026	The capacity must be specified because LDEVs are in the parity group (or the external volume group).
CMDRJE	Executing	2E00	0027	The capacity must be specified.
Get Command Status	Async	2E00	002D	The emulation type of the mainframe cannot be specified because the virtual volume is set for the specified LDEV.
CMDRJE	Executing	2E00	0101	The parity group number or the external group number is not in the effective range.
Get Command Status	Async	2E00	1005	Failed to restore the LDEV that is created to external volume group.
CMDRJE	Executing	2E00	6000	The specified pool ID is not in the effective range.
Get Command Status	Asynchronous	2E00	6002	The total capacity of Dynamic Provisioning V-VOL which is defined in the specified pool exceeds the permitted capacity in the pool.
CMDRJE	Executing	2E00	7000	The specified CLPR number is not in the effective range.
CMDRJE	Executing	2E00	8301	MP Blade ID is not in the effective range.
CMDRJE	Executing	2E10	0003	The specified LDEV is used as a Compatible FlashCopy® V2 relationship.
Get Command Status	Async	2E10	001F	The operation cannot be done because the total capacity of virtual volumes for Dynamic Tiering in the system exceeds the maximum.
Get Command Status	Async	2E10	005A	The operation cannot be performed because the following information of the migration source and the migration target does not match. • serial number • product ID • emulation type • SSID • LUSE • CVS configuration • LDEV number
Get Command Status	Async	2E10	0100	The volumes cannot be added because the encryption value of the key number that is set to encryption ECC is invalid.
Get Command Status	Async	2E10	0101	The volumes cannot be added because the check sum of the encryption key is not coincident.

raidcom add ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE Get Command Status	Executing /Async	2E10	6014	The specified pool be associated with the virtual volume of Dynamic Provisioning because the state of the pool is incorrect.
Get Command Status	Async	2E11	0003	An LDEV that is in the state of shredding is included in the parity group of the target LDEV.
Get Command Status	Async	2E11	0004	An LDEV that is in the state of formatting is included in the parity group of the target LDEV.
Get Command Status	Async	2E11	0005	An LDEV that is in the state of executing quick format is included in the parity group of the target LDEV.
CMDRJE	Executing	2E11	0053	The specified LDEV is used in another operation.
Get Command Status	Async	2E11	0102	The parity group of the target LDEV is in the state of correction copy.
CMDRJE	Executing	2E11	0153	The parity group or the external volume group that the specified LDEV is belongs to is used in another operation.
Get Command Status	Async	2E11	8004	The operation cannot be done because the internal processing is in progress.
CMDRJE	Executing	2E11	8010	The storage system is in internal process, or the configuration changing processes are conflicting.
Get Command Status	Async	2E11	8105	Cache segment size is incorrect.
Get Command Status	Async	2E11	8108	The operation cannot be done because there is blocked part in the system.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE Get Command Status	Executing/ Async	2E20	0007	The specified CLPR does not exist.
CMDRJE	Executing	2E20	0100	There is no parity group.
CMDRJE Get Command Status	Executing/ Async	2E20	6000	Pool ID is invalid.
Get Command Status	Async	2E20	8300	The specified MP Blade is not installed.
Get Command Status	Asynchronous	2E21	6003	There is not enough free shared memory space.
Get Command Status	Asynchronous	2E21	8300	Package for Mainframe is required when you specify the emulation type of mainframe.
CMDRJE	Executing	2E21	9001	The program product is not installed.
CMDRJE	Executing	2E21	9002	The program product is not installed.
CMDRJE/Get Command Status	Executing/ Async	2E21	9004	The program product is not installed.

raidcom add ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E21	900E	Compatible Software for IBM® FlashCopy® SE program product is not installed.
CMDRJE	Executing	2E22	0001	LDEV is already defined.
CMDRJE	Executing	2E22	000F	You cannot create the volume because the size of the specified external volume group exceeds the maximum capacity of the external volume for online data migration.
CMDRJE Get Command Status	Executing/ Async	2E23	0001	The number exceeds the maximum number of LDEV that can be created in the current system configuration.
Get Command Status	Async	2E30	0006	The specified LDEV is used in the FICON® Data Migration.
CMDRJE	Executing	2E30	0020	The specified SSID is already used in another CU.
CMDRJE	Executing	2E30	0021	The SSID is allocated to the CU already.
Get Command Status	Asynchronous	2E30	0025	The specified volume is used as an alias device in Compatible PAV.
Get Command Status	Async	2E30	0026	An LDEV of another emulation type is allocated in the range where the number is divided into each 32LDEVs.
CMDRJE	Executing	2E30	004C	The emulation type that cannot be mixed with is specified.
CMDRJE	Executing	2E30	004D	The number of ldevs exceeds the maximum number of ldevs that can be created in the parity group or the external volume group.
CMDRJE	Executing	2E30	0104	There is not enough amount of free space that is specified in the parity group or the external volume group.
CMDRJE	Executing	2E30	0105	The location is out of the range that can be specified.
CMDRJE	Executing	2E30	0106	Volume whose emulation type is 3390-V cannot be created in RAID1 parity group.
CMDRJE Get Command Status	Executing/ Async	2E30	4119	The virtual volume cannot be added because the number of virtual volumes that can be created in the system exceeded the maximum number.
CMDRJE Get Command Status	Executing/ Async	2E30	6003	The specified pool is the pool for Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	2E31	6003	A virtual volume of Dynamic Provisioning that is associated with the specified pool cannot be created with the specified emulation type.

raidcom add ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E31	6007	TSE-VOL cannot be created because of the following conditions. • The specified pool is other than HDPz pool. • The specified emulation type is other than 3390-A.
CMDRJE	Executing	2E31	6008	TSE-VOL cannot be created in combination with the specified pool ID and the CU number of LDEV. You must specify the even CU number for the pool of even pool ID, and the odd CU number for the pool of odd pool ID.
Get Command Status	Async	2E31	6009	A TSE-VOL cannot be created in the specified pool for Dynamic Tiering.
CMDRJE	Executing	2EE8	00EE	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EE8	FFFB	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	0002	The specified parameter is invalid. Check the Command Control Interface Command Reference.
ERANGE Result too large	Executing	-	-	The value of the capacity is invalid.

Table 9-17 SSB codes that are returned by raidcom delete journal command

raidcom delete journal				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	The number of specified LDEV is invalid.
Get Command Status	Async	2E00	0023	The specified volume capacity is too small.
CMDRJE	Executing	2E00	5000	The specified journal ID is exceeds the range.
Get Command Status	Async	2E10	0011	The specified volume is not installed or cannot be used.
Get Command Status	Async	2E10	0053	The specified volume is used in maintenance operation.
Get Command Status	Async	2E10	5000	The specified operation failed because the journal or mirror is not in the operable status.
Get Command Status	Async	2E10	5010	The journal volume cannot be deleted with the specified journal status.
Get Command Status	Async	2E11	800B	The operation cannot be done because it is in the state of start-up.
Get Command Status	Async	2E11	800E	The operation cannot be done because the internal processing is in progress. Wait for a while, then retry the operation.

raidcom delete journal				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2E13	5002	The specified LDEV is not in the journal.
CMDRJE	Executing	2E20	5000	The specified journal ID is not registered.
Get Command Status	Async	2E21	5000	The operation failed because the specified journal is not registered.
Get Command Status	Async	2E21	8104	The journal volume cannot be added, or the journal cannot be added to the extended CT group due to insufficient capacity of the shared memory (SM).
CMDRJE	Executing	2E21	8105	SM for Universal Replicator is not installed.
CMDRJE	Executing	2E23	0008	The number of specified LDEVs is invalid.
Get Command Status	Async	2E30	0062	The specified volume cannot be used as a journal volume because it is an external volume that can execute the I/O suppression mode.
Get Command Status	Async	2E30	5002	The specified journal cannot be deleted because there are data volumes.
CMDRJE	Executing	2EE4	08E6	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EE4	50EE	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-18 SSB codes that are returned by raidcom add journal command

raidcom add journal				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	The value of LDEV number is invalid.
CMDRJE	Executing	2E00	0018	A new journal volume cannot be registered because the number of journal volume exceeds the maximum that can be registered.
Get Command Status	Async	2E00	0023	The specified volume capacity is too small.
CMDRJE	Executing	2E00	8301	The specified MP Blade ID is invalid.
CMDRJE Get Command Status	Executing Async	2E10	0000	The specified volume is already used by another program product.
CMDRJE Get Command Status	Executing Async	2E10	0011	The specified volume is not installed or cannot be used.
Get Command Status	Async	2E10	001A	The specified volume is connected from the mainframe host.

raidcom add journal				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE Get Command Status	Executing Async	2E10	001B	There is a PIN slot in the journal volume.
CMDRJE Get Command Status	Executing Async	2E10	001C	The specified volume cannot be registered as a journal volume because it is in shredding. Wait until the shredding operation is completed, then retry the operation.
Get Command Status	Async	2E10	0053	The specified volume is used in maintenance operation.
Get Command Status	Async	2E10	0056	The specified volume cannot be used as the journal volume because the virtual LDEV ID is deleted.
Get Command Status	Async	2E10	0057	The specified volume cannot be used as the journal volume because it is the virtual volume.
Get Command Status	Async	2E10	5000	The specified operation failed because the journal or mirror is not in the operable status.
Get Command Status	Async	2E11	800B	The operation cannot be done because it is in the state of start-up.
Get Command Status	Async	2E11	800E	The operation cannot be done because the internal processing is in progress. Wait for a while, then retry the operation.
CMDRJE Get Command Status	Executing Async	2E11	810A	Abnormal cache status.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2E20	0000	The specified LDEV is not defined.
CMDRJE	Executing	2E20	8300	The specified MP Blade is not installed.
Get Command Status	Async	2E21	5000	The operation failed because the specified journal is not installed.
Get Command Status	Async	2E21	8104	The journal volume cannot be added, or the journal cannot be added to the extended CT group due to insufficient capacity of the shared memory (SM).
CMDRJE	Executing	2E21	8105	The SM for Universal Replicator is not installed.
Get Command Status	Async	2E21	9000	A journal volume cannot be registered, or a journal cannot be added to the extended CT group because the program product of Universal Replicator or Universal Replicator for Mainframe is not installed.
Get Command Status	Async	2E23	0005	A new journal volume cannot be registered, or the number of selected volumes is too many.
CMDRJE	Executing	2E23	0008	The number of specified LDEVs is invalid.
Get Command Status	Async	2E23	003E	The operation failed because the multiple LDKC numbers cannot be mixed in the journal.

raidcom add journal				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E23	5000	The operation failed because the number of journals in the journal or the extended CT group exceeds the maximum.
CMDRJE Get Command Status	Executing Async	2E30	0005	The specified volume cannot be used as a journal volume because it is set by Cache Residency Manager or Cache Residency Manager for Mainframe.
CMDRJE Get Command Status	Executing Async	2E30	0006	The specified volume cannot be used because it is used in FICON(R) Data Migration.
CMDRJE Get Command Status	Executing Async	2E30	0007	A path is defined in the specified volume.
CMDRJE Get Command Status	Executing Async	2E30	000C	The operation failed because the specified volume is a Quorum disk.
CMDRJE Get Command Status	Executing Async	2E30	000D	The specified volume cannot be used as a journal volume because it is a system disk.
Get Command Status	Async	2E30	000E	The operation failed because the specified volume is a pool volume of Dynamic Provisioning.
Get Command Status CMDRJE	Async/ Executing	2E30	000F	The specified volume is already used as a journal volume or a data volume.
CMDRJE Get Command Status	Executing Async	2E30	0010	The specified volume is used as a command device.
CMDRJE Get Command Status	Executing Async	2E30	0013	The specified volume cannot be used as a journal volume because it is a LUSE volume.
CMDRJE Get Command Status	Executing Async	2E30	0019	The specified volume cannot be used as a journal volume because it is set by Data Retention Utility or Volume Retention Manager.
CMDRJE Get Command Status	Executing Async	2E30	001A	Using the specified volume is prohibited by Volume Security.
CMDRJE	Executing	2E30	0035	The internal volumes and external volumes exist in the specified journal.
Get Command Status	Async	2E30	0040	The emulation type of the specified volume is not supported. Or, the combination of an emulation type of the journal volume is incorrect.

raidcom add journal				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
Get Command Status	Async	2E30	0041	The volume cannot be registered as a journal volume because the CLPR number of the specified volume differs from the CLPR number of the registered journal volume.
CMDRJE	Executing	2E30	005F	The specified LDEV is a remote command device.
CMDRJE Get Command Status	Executing Async	2E30	0062	The specified volume cannot be used as a journal volume because it is an external volume that can execute the I/O suppression mode.
CMDRJE Get Command Status	Executing Async	2E30	0064	The specified volume is a reserved volume of a mainframe host.
CMDRJE Get Command Status	Executing Async	2E30	0065	The specified volume is used by the XRC.
CMDRJE Get Command Status	Executing Async	2E30	0067	The specified volume is a volume of Just in Time (On-demand) function.
Get Command Status	Async	2E30	0068	The specified volume cannot be used as a journal volume because it is used by Compatible PAV.
CMDRJE Get Command Status	Executing Async	2E30	0070	The resource group ID of the specified volume cannot be registered because the resource group ID is different from the resource group ID of the other journal volume in the specified journal group.
CMDRJE Get Command Status	Executing Async	2E30	0074	The specified LDEV cannot be operated because it is an external volume mapped for online data migration.
Get Command Status	Async	2E30	0084	The specified LDEV cannot be used as a journal volume because the size of the LDEV is less than the minimum capacity of journal volume.
CMDRJE Get Command Status	Executing Async	2E30	0086	The operation cannot be performed because the specified volume is not the Dynamic Provisioning V-VOL.
CMDRJE	Executing	2EE4	08E6	The command cannot be accepted. After a while, execute the same command.
CMDRJE Get Command Status	Executing Async	2EE4	50EE	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE Get Command Status	Executing Async	2EE4	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	5002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-19 SSB codes that are returned by raidcom modify journal command

raidcom modify journal				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0023	The specified volume capacity is too small.
CMDRJE	Executing	2E00	500B	The specified path block watch time exceeds the range.
CMDRJE	Executing	2E00	8301	The specified MP Blade ID is invalid.
CMDRJE	Executing	2E10	0011	The specified volume is not installed or cannot be used.
CMDRJE	Executing	2E10	5000	The specified operation failed because the journal or mirror is not in the operable status.
CMDRJE	Executing	2E10	5006	The specified operation failed because the mirror of journal is not in the operable status.
CMDRJE	Executing	2E10	8300	The specified MP Blade is blocked.
CMDRJE	Executing	2E11	800B	The operation cannot be done because it is in the state of start-up.
CMDRJE	Executing	2E20	5000	The specified journal ID is not registered.
CMDRJE	Executing	2E21	5000	The operation failed because the specified journal is not registered.
CMDRJE	Executing	2E21	8104	The journal volume cannot be added, or the journal cannot be added to the extended CT group due to insufficient capacity of the shared memory (SM).
Get Command Status	Async	2E30	0062	The specified volume cannot be used as a journal volume because it is an external volume that can execute the I/O suppression mode.
CMDRJE	Executing	2E30	5001	The timer type cannot be changed because the specified journal belongs to the extended CT group.
CMDRJE	Executing	2E30	5003	The parameter of inflow control cannot be changed because the specified journal is not a primary journal.
CMDRJE	Executing	2E30	5005	The cache mode option or the data overflow monitoring time cannot be changed because the specified journal is used by both the primary and the secondary journals.
CMDRJE	Executing	2EE4	50EE	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-20 SSB codes that are returned by raidcom modify ldev -mp_blade_id command

raidcom modify ldev -mp_blade_id				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	The number of LDEV exceeded the range.
CMDRJE	Executing	2E00	8301	MP Blade ID is not in the effective range.
CMDRJE	Executing	2E10	8300	The specified MP Blade is blocked.
CMDRJE	Executing	2E20	0000	LDEV is not installed.
CMDRJE	Executing	2E20	8300	The specified MP Blade is not installed.

Table 9-21 SSB codes that are returned by raidcom delete device_grp command

raidcom delete device_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceeds the range of LDEV number.
CMDRJE	Executing	2E20	0000	LDEV is not installed.
CMDRJE	Executing	2E20	0002	LDEV is not registered in the device group.
CMDRJE	Executing	2E20	2100	A device group is not installed.
CMDRJE	Executing	2E22	000E	The number of LDEVs that can be deleted in a operation exceeds the maximum. The number of LDEVs that can be deleted includes the number of LDEVs of a LUSE.
CMDRJE	Executing	2E23	0008	The number of specified LDEVs is invalid.

Table 9-22 SSB codes that are returned by raidcom add device_grp command

raidcom add device_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceeds the range of LDEV number.
CMDRJE	Executing	2E20	0000	LDEV is not installed.
CMDRJE	Executing	2E22	0009	The number of device name in the system has reached the maximum.
CMDRJE	Executing	2E22	000A	The device name of an LDEV is duplicated in the system.
CMDRJE	Executing	2E22	000E	The number of LDEVs that can be registered in a operation exceeds the maximum. The number of LDEVs that can be registered includes the number of LDEVs of a LUSE.
CMDRJE	Executing	2E23	0008	The number of specified LDEVs is invalid.

raidcom add device_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E23	2100	It exceeds the number of device group in the system.
CMDRJE	Executing	2E30	0051	The LDEV to be allocated to the device group is not set the device name.
CMDRJE	Executing	2E30	0072	The specified resource group ID of the LDEV cannot be registered because it is different from other resource group ID of the LDEV in the specified device group.
CMDRJE	Executing	2EEA	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-23 SSB codes that are returned by raidcom modify ldev -ldev_name command

raidcom modify ldev -ldev_name				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceeds the range of LDEV number.
CMDRJE	Executing	2E00	0007	LDEV nickname is not specified.
CMDRJE	Executing	2E20	0000	LDEV is not installed.
Invalid Character	Executing	-	-	Unavailable character is included in LDEV nickname.

Table 9-24 SSB codes that are returned by raidcom initialize ldev command

raidcom initialize ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceeds the range of LDEV number.
Get Command Status	Async	2E10	0000	The specified LDEV is used as a ShadowImage pair.
Get Command Status	Async	2E10	0001	The specified LDEV is used as a TrueCopy pair or a Universal Replicator pair.
Get Command Status	Async	2E10	0003	The specified LDEV is used as a Compatible FlashCopy® V2 relationship.
Get Command Status	Async	2E10	0004	The specified LDEV is used as a Thin Image or Copy-on-Write Snapshot pair.
Get Command Status	Async	2E10	0008	The specified LDEV is used on the system disk.
Get Command Status	Async	2E10	0010	LDEV is not blocked.

raidcom initialize ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E10	0012	The specified LDEV is a CC/XRC attribute device.
Get Command Status	Async	2E10	0062	The specified LDEV is used as the primary volume of a GAD pair.
Get Command Status	Async	2E10	0063	The specified LDEV is used as the secondary volume of a GAD pair.
Get Command Status	Async	2E10	0100	The formatting operation cannot be done because the encryption value of the key number that is set to encryption ECC is invalid.
Get Command Status	Async	2E10	0101	The formatting operation cannot be done because the check sum of the encryption key is not coincident.
Get Command Status	Async	2E11	0007	The LDEV is in shredding.
Get Command Status	Async	2E11	0009	The operation cannot be done because LDEV is now expanding.
Get Command Status	Async	2E11	001E	The operation cannot be done because the virtual disk space is blocked.
CMDRJE	Executing	2E11	0053	The specified LDEV is used in another operation.
Get Command Status	Async	2E11	0102	The parity group of the target LDEV is in the state of correction copy.
CMDRJE	Executing	2E11	0153	The parity group or the external volume group to which the specified LDEV belongs is used in another operation.
Get Command Status	Async	2E11	6004	The operation of Dynamic Provisioning V-VOL cannot be done because there is a blocked pool.
Get Command Status	Async	2E11	6006	The operation of Dynamic Provisioning V-VOL cannot be done because there is a blocked pool volume.
Get Command Status	Async	2E11	8004	The operation cannot be done because the internal processing is in progress.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E14	0000	The processing stopped because aborting processing is required.
CMDRJE	Executing	2E20	0000	LDEV is not installed.
CMDRJE	Executing	2E21	9011	The program product is not installed.
Get Command Status	Async	2E22	0100	The quick format cannot be performed because the total number of parity groups in which the LDEVs in quick formatting or the LDEVs blocked while quick formatting are implemented exceeds the maximum number that can be performed at the same time.
Get Command Status	Async	2E30	000A	The specified LDEV is used as a Dynamic Provisioning.

raidcom initialize ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E30	000C	The specified LDEV is used as a quorum disk.
CMDRJE Get Command Status	Executing Async	2E30	000E	The specified LDEV is used as a pool volume.
Get Command Status	Async	2E30	000F	The specified LDEV is used as a journal volume.
Get Command Status	Async	2E30	001A	Volume Security is set to the specified LDEV.
Get Command Status	Async	2E30	002D	Quick format cannot be done because the target LDEV is not an internal volume.
Get Command Status	Async	2E30	004E	The specified LDEV is a Data Retention Utility/ Volume Retention Manager attribute device.
Get Command Status	Async	2E30	0061	The specified LDEV is a pool volume and the pool volume include the Dynamic Provisioning volume that is not in the blocked status.
Get Command Status	Async	2E30	0074	The specified LDEV cannot be operated because it is an external volume mapped for online data migration.
Get Command Status	Async	2E31	0001	Maintenance work cannot be performed because the target LDEV is a quorum disk.
Get Command Status	Async	2E31	0017	LDEV cannot be formatted because there is no normal external path.
CMDRJE	Executing	2EE8	00EE	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EE8	0A18	An internal error occurred.
CMDRJE Get Command Status	Executing Async	2EE8	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	0002	The specified parameter is incorrect. Check the Command Control Interface Command Reference.

Table 9-25 SSB codes that are returned by raidcom modify ldev -command_device

raidcom modify ldev -command_device				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	0000	The command device cannot be set to the specified LDEV because of the following causes. • The LDEV is used as a ShadowImage pair. • The reserve attribute of a ShadowImage is configured.

raidcom modify ldev -command_device				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	0001	The specified LDEV is used as a TrueCopy pair.
CMDRJE	Executing	2E10	0002	The specified LDEV is used as a Universal Replicator pair or a journal.
CMDRJE	Executing	2E10	0004	The specified volume cannot be set because it is used by the Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0062	The specified LDEV is used as the primary volume of a GAD pair.
CMDRJE	Executing	2E10	0063	The specified LDEV is used as the secondary volume of a GAD.
CMDRJE	Executing	2E20	0000	The specified LDEV is not defined.
CMDRJE	Executing	2E21	9000	The following settings cannot be performed because the program product of LUN Manager is not installed. • Command device settings • Command security settings
CMDRJE	Executing	2E30	0004	The emulation type of the specified volume is not OPEN volume.
CMDRJE	Executing	2E30	0008	The command device cannot be set because LDEV is used as a Thin Image or Copy-on-Write Snapshot virtual volume.
CMDRJE	Executing	2E30	000C	The specified volume cannot be set because it is a quorum disk.
CMDRJE	Executing	2E30	000D	The specified volume cannot be set because it is a system disk.
CMDRJE	Executing	2E30	000E	The specified volume cannot be set because it is a pool volume.
CMDRJE	Executing	2E30	0012	The specified LDEV cannot be released because it is command device that is being used.
CMDRJE	Executing	2E30	0013	The specified volume cannot be set because it is a LUSE volume.
CMDRJE	Executing	2E30	0014	The command device cannot be set to the specified LDEV because of the following causes. • It is used as a Volume Migration. • The reserve attribute of a Volume Migration is configured.
CMDRJE	Executing	2E30	0016	The specified LDEV cannot be set because it has a reserve attribute of a Data Retention Utility.
CMDRJE	Executing	2E30	0019	The specified volume cannot be used as a command device because it is set by a Data Retention Utility.
CMDRJE	Executing	2E30	0074	The specified LDEV cannot be operated because it is an external volume mapped for online data migration.

raidcom modify ldev -command_device				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EE8	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-26 SSB codes that are returned by raidcom modify ldev -ssid command

raidcom modify ldev -ssid				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E11	0023	SSID cannot be changed because there are LDEVs in the boundary where the specified LDEV belongs.
CMDRJE	Executing	2E22	7201	The specified SSID is used for the other boundary.
CMDRJE	Executing	2EE8	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	0002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-27 SSB codes that are returned by raidcom modify ldev -status nml command

raidcom modify ldev -status nml				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceeds the range of LDEV number.
Get Command Status	Async	2E10	0000	The specified LDEV is used as a ShadowImage pair.
Get Command Status	Async	2E10	0001	The specified LDEV is used as a TrueCopy pair or a Universal Replicator pair.
Get Command Status	Async	2E10	0003	The specified LDEV is used as a Compatible FlashCopy® V2 relationship.
Get Command Status	Async	2E10	0004	The specified LDEV is used as a Thin Image or Copy-on-Write Snapshot pair.
Get Command Status	Async	2E10	0008	The specified LDEV is used as a system disk.
CMDRJE	Executing	2E10	0010	LDEV is not blocked.
Get Command Status	Async	2E10	0012	The specified LDEV is a CC/XRC attribute device.
Get Command Status	Async	2E10	001E	The specified LDEV is not formatted after it is used as the journal volume.
Get Command Status	Async	2E11	0009	The operation cannot be done because LDEV is not expanding.

raidcom modify ldev -status nml				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E11	001E	The operation cannot be done because the virtual disk space is blocked.
Get Command Status	Async	2E10	0062	The specified LDEV is used as the primary volume of a GAD pair.
Get Command Status	Async	2E10	0063	The specified LDEV is used as the secondary volume of a GAD pair.
CMDRJE	Executing	2E11	0053	The specified LDEV is used in another operation.
CMDRJE	Executing	2E11	0153	The parity group or the external group to which the specified LDEV belongs is used in another operation.
Get Command Status	Async	2E11	6006	The operation of Dynamic Provisioning V-VOL cannot be done because there is a blocked pool volume.
Get Command Status	Async	2E11	8004	The operation cannot be done because the internal processing is in progress.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2E20	0000	The specified LDEV is not installed.
Get Command Status	Async	2E30	000A	The specified LDEV is used as a Dynamic Provisioning.
Get Command Status	Async	2E30	000C	The specified LDEV is used as a quorum disk.
Get Command Status	Async	2E30	000E	The specified LDEV is used as a pool volume.
Get Command Status	Async	2E30	0014	The specified LDEV is used as a reserved volume of Volume Migration.
Get Command Status	Async	2E30	001A	Volume Security is set to the specified LDEV.
Get Command Status	Async	2E30	002C	The specified LDEV cannot be restored because the shredding or the formatting operation has not been performed.
Get Command Status	Async	2E30	004E	The specified LDEV is a Data Retention Utility/ Volume Retention Manager attribute device.
Get Command Status	Async	2E31	0017	LDEV cannot be restored because there is no connection path to the normal external path.
CMDRJE	Executing	2EE8	00EE	The command cannot be accepted. After a while, execute the same command.

Table 9-28 SSB codes that are returned by raidcom modify ldev -status blk command

raidcom modify ldev -status blk				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceed the range of LDEV number.
Get Command Status	Async	2E10	0000	The specified LDEV is used as a pair of ShadowImage/Thin Image/Copy-on-Write Snapshot/Volume Migration or a relationship of Compatible FlashCopy® V2/Compatible Software for IBM® FlashCopy® SE.
Get Command Status	Async	2E10	0001	The specified LDEV is used for a pair of TrueCopy or Universal Replicator.
Get Command Status	Async	2E10	0003	The specified LDEV is used as a Compatible FlashCopy® V2 relationship.
Get Command Status	Async	2E10	0004	The specified LDEV is used as a Thin Image or Copy-on-Write Snapshot pair.
Get Command Status	Async	2E10	0008	The specified LDEV is used as a system disk.
CMDRJE	Executing	2E10	0011	LDEV is not installed, or LDEV is not in the state of Normal.
Get Command Status	Async	2E10	0012	The specified LDEV is used at the concurrent copy or XRC.
Get Command Status	Async	2E10	0062	The specified LDEV is used as the primary volume of an GAD pair.
Get Command Status	Async	2E10	0063	The specified LDEV is used as the secondary volume of an GAD pair.
Get Command Status	Async	2E11	0009	The operation cannot be done because LDEV is now expanding.
Get Command Status	Async	2E11	001E	The operation cannot be done because the virtual disk space is blocked.
CMDRJE	Executing	2E11	0053	The specified LDEV is used in another operation.
CMDRJE	Executing	2E11	0153	The parity group or the external group to which the specified LDEV belongs is used in another operation.
Get Command Status	Async	2E11	8004	The operation cannot be done because the internal processing is in progress.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Execution	2E20	0000	The specified LDEV is not installed.
Get Command Status	Async	2E30	000A	The specified LDEV is used as a Dynamic Provisioning.
Get Command Status	Async	2E30	000C	The specified LDEV is used as a quorum disk.
Get Command Status	Async	2E30	000E	The specified LDEV is used as a pool volume.
CMDRJE	Executing	2E30	000F	It is used as a journal.

raidcom modify ldev -status blk				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E30	0014	The specified LDEV is used as a reserved volume of Volume Migration.
Get Command Status	Async	2E30	001A	Volume Security is set to the specified LDEV.
Get Command Status	Async	2E30	001C	It is used as a remote command device.
Get Command Status	Async	2E30	004E	It is a volume that the Data Retention Utility is set.
Get Command Status	Async	2E30	004E	The specified LDEV is a Data Retention Utility/ Volume Retention Manager attribute device.
Get Command Status	Async	2E30	0060	It is used as a command device that is used at extended consistency group.
Get Command Status	Async	2E30	0061	DP volume that is not in the blocked state is included in the DP volume associated with a pool that the pool volume is belongs to.
Get Command Status	Async	2E31	0001	Maintenance work cannot be performed because the target LDEV is a quorum disk.
Get Command Status	Async	2E31	0017	LDEV cannot be blocked because there is no connection path to the normal external path.
Get Command Status	Async	2EE8	0A18	An internal error occurred.

Table 9-29 SSB codes that are returned by raidcom modify ldev -status enable_reallocation/disable_reallocation/new_page_allocation/ enable_relocation_policy command

raidcom modify ldev -status enable_reallocation/disable_reallocation/ new_page_allocation/enable_relocation_policy				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	Invalid LDEV number.
CMDRJE	Executing	2E00	6101	The tiering policy is not in the effective range.
CMDRJE	Executing	2E00	6102	The new page assignment tier is invalid.
CMDRJE	Executing	2E20	0000	The specified LDEV is not installed.
CMDRJE	Executing	2E21	8102	The SM (Shared Memory) for Dynamic Tiering is not installed.
CMDRJE	Executing	2E30	000B	The specified LDEV is not a virtual volume of Dynamic Provisioning/Dynamic Tiering.
CMDRJE	Executing	2E30	0073	The specified LDEV is not a virtual volume of Dynamic Tiering.

Table 9-30 SSB codes that are returned by raidcom modify ldev -status discard_zero_page command

raidcom modify ldev -status discard_zero_page				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
CMDRJE	Executing	2E10	0000	The specified LDEV is used as an ShadowImage pair.
CMDRJE	Executing	2E10	0001	The specified LDEV is used as a TrueCopy pair.
CMDRJE	Executing	2E10	0002	The specified LDEV is used as a Universal Replicator pair.
CMDRJE	Executing	2E10	0004	The specified LDEV is used as a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0005	The specified LDEV is used as a Volume Migration pair.
CMDRJE	Executing	2E10	0011	The specified LDEV is blocked.
CMDRJE	Executing	2E10	600B	The associated pool is blocked.
CMDRJE	Executing	2E11	0054	Page cannot be discarded because the pool volume is being deleted or the Tier is being reallocated.
CMDRJE	Executing	2E11	0055	The operation cannot be done because the system pool volume is blocked.
CMDRJE	Executing	2E20	0000	The specified LDEV is not installed.
CMDRJE	Executing	2E30	000B	The specified LDEV is not a virtual volume of Dynamic Provisioning/Dynamic Tiering.
CMDRJE	Executing	2E30	000F	The specified LDEV is used as a journal volume.
CMDRJE	Executing	2E30	0033	It is not associated to a pool.
CMDRJE	Executing	2E30	0075	Page cannot be discarded because the specified LDEV is a TSE-VOL.
CMDRJE	Executing	2EE8	00E7	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-31 SSB codes that are returned by raidcom modify ldev -quorum_enable command

raidcom modify ldev -quorum_enable				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
CMDRJE	Executing	2E00	0000	The LDEV number is out of settable range.
CMDRJE	Executing	2E00	8000	The device type is invalid.
CMDRJE	Executing	2E00	8001	The serial number is invalid.
CMDRJE	Executing	2E00	A001	The quorum disk ID is out of settable range.
Get Command Status	Async	2E10	0005	The specified LDEV is used for Volume Migration.

raidcom modify ldev -quorum_enable				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E10	0057	The specified LDEV cannot be configured because the LDEV is a virtual volume.
Get Command Status	Async	2E10	A001	The specified quorum disk ID is being used.
Get Command Status	Async	2E10	A003	The specified quorum disk is in processing.
Get Command Status	Async	2E10	A005	The specified quorum disk is used as the quorum disk of the different device.
Get Command Status	Async	2E10	A006	The specified LDEV is used as the quorum disk.
Get Command Status	Async	2E11	001B	The specified LDEV is being blocked.
CMDRJE	Executing	2E11	0053	The specified LDEV is used for other operation.
Get Command Status	Async	2E13	0001	The specified LDEV is not the first LDEV that belongs to the external volume group.
CMDRJE	Executing	2E20	0000	LDEV is not installed.
Get Command Status	Async	2E20	000E	The specified LDEV is not an external volume.
Get Command Status	Async	2E21	810A	A shared memory is not installed.
Get Command Status	Async	2E30	0005	Cache Residency Manager is set to the specified volume.
Get Command Status	Async	2E30	0007	A path is defined to the specified volume.
Get Command Status	Async	2E30	000E	The specified LDEV is used as a pool volume.
Get Command Status	Async	2E30	000F	The specified LDEV is used as a journal volume.
Get Command Status	Async	2E30	0010	The specified volume is used as a command device.
Get Command Status	Async	2E30	004E	Data Retention Utility is set to the specified volume.
Get Command Status	Async	2E30	0074	The specified LDEV cannot be operated because it is an external volume mapped for online data migration.
Get Command Status	Async	2E30	008E	The emulation type of the specified LDEV is not OPEN-V.
Get Command Status	Async	2E30	0092	The specified LDEV cannot be used because the size of LDEV is less than the minimum capacity of the quorum disk.
CMDRJE Get Command Status	Executing Async	2EE8	FEEC	Internal error occurred.

Table 9-32 SSB codes that are returned by raidcom delete lun command

raidcom delete lun				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B958	0155	The other than multiplatform volume or OPEN volume is included in the specified LDEV.
CMDRJE	Executing	B958	015D	An used LDEV exists in the specified LDEV.
CMDRJE	Executing	B958	0202	It cannot be deleted because it is the last path of TrueCopy.
CMDRJE	Executing	B958	0203	It cannot be deleted because it is the last path of ShadowImage.
CMDRJE	Executing	B958	020A	It cannot be deleted because it is the last path of Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	B958	020B	It cannot be deleted because it is the last path of Universal Replicator.
CMDRJE	Executing	B958	0233	It cannot be deleted because the operation object LU is executing host I/O.
CMDRJE	Executing	B958	0234	It cannot be deleted because the operation object LU is reserved.
CMDRJE	Executing	B958	0239	The command device is being used in the local Command Control Interface.
CMDRJE	Executing	B958	0240	A command device is being set.
CMDRJE	Executing	B958	0927	The command cannot be operated because the virtual LDEV is not defined yet.
CMDRJE	Executing	B958	0944	The value of LUN exceeds the maximum.
CMDRJE	Executing	B958	0945	The value of LDEV exceeds the maximum.
CMDRJE	Executing	B958	0956	The value of host group ID exceeds the maximum.
CMDRJE	Executing	B958	0957	The program product is not installed.
CMDRJE	Executing	B958	0959	Host group is not installed.
CMDRJE	Executing	B958	095D	An invalid LDEV exists in the specified LDEVs.
CMDRJE	Executing	B958	098C	The multiple LDEV cannot be specified.
CMDRJE	Executing	B958	098D	When the host mode option 60 is set, LUN path of LUN0 cannot be set or released.
CMDRJE	Executing	B958	0996	The LU path cannot be deleted because the virtual LDEV ID of the specified volume was deleted.
CMDRJE	Executing	B958	09A1	Another LDEV is already mapped in the specified LUN.
CMDRJE	Executing	B9F9	B9F9	The command device is being used in the local Command Control Interface.

Table 9-33 SSB codes that are returned by raidcom add lun command

raidcom add lun				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EF6	0014	An invalid LDEV exists in the specified LDEVs.
CMDRJE	Executing	B958	0101	LUN path cannot be set because it is reserved for Volume Migration.
CMDRJE	Executing	B958	0150	The attribute of the specified port is Initiator or External.
CMDRJE	Executing	B958	0155	The other than HMDE volume or OPEN volume is included in the specified LDEV.
CMDRJE	Executing	B958	015A	An LU path has already defined in the relevant LDEV.
CMDRJE	Executing	B958	015D	An invalid LDEV exists in the specified LDEVs.
CMDRJE	Executing	B958	015E	It exceeds the maximum LUN under the port.
CMDRJE	Executing	B958	0178	LDEV is set as a pool volume.
CMDRJE	Executing	B958	017B	LUN path cannot be set because the LDEV is a system disk.
CMDRJE	Executing	B958	017C	LUN path cannot be set because the LDEV is a journal volume.
CMDRJE	Executing	B958	017D	LUN path cannot be set because the access attribute of LDEV Data Retention Utility is reserved.
CMDRJE	Executing	B958	01A3	When the host mode is Universal Volume Manager(0x4C), the LUN path cannot be set in the other than the external volume.
CMDRJE	Executing	B958	01F2	The host group and the LDEV that configure the LU path do not exist in the same virtual storage machine.
CMDRJE	Executing	B958	01F3	The LU path definition cannot be set because the virtual LDEV information of the specified LDEV is not defined yet.
CMDRJE	Executing	B958	0601	Command device cannot be set because it is reserved for Volume Migration.
CMDRJE	Executing	B958	0606	Command device cannot be set because it is an ShadowImage pair/or it is reserved.
CMDRJE	Executing	B958	0639	The command device cannot be operated because it is used at the local CCI.
CMDRJE	Executing	B958	064A	A command device cannot be set because LDEV is other than the OPEN volume.
CMDRJE	Executing	B958	065D	The specified LDEV is not installed.
CMDRJE	Executing	B958	0679	A command device cannot be set because LDEV is the virtual volume of Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	B958	0927	The command cannot be operated because the virtual LDEV is not defined yet.
CMDRJE	Executing	B958	0944	The value of LUN exceeds the maximum.

raidcom add lun				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B958	0945	The value of LDEV exceeds the maximum.
CMDRJE	Executing	B958	0947	Another LDEV is already mapped to the specified LUN.
CMDRJE	Executing	B958	0956	The value of Host group ID exceeds the maximum.
CMDRJE	Executing	B958	0957	The program product is not installed.
CMDRJE	Executing	B958	0959	The specified host group is not installed.
CMDRJE	Executing	B958	095D	An invalid LDEV exists in the specified LDEVs.
CMDRJE	Executing	B958	098C	The multiple LDEV cannot be specified.
CMDRJE	Executing	B958	098D	When the host mode option 60 is set, LUN path of LUN0 cannot be set or released.
CMDRJE	Executing	B958	0994	An invalid LDEV exists in the specified LDEVs.
CMDRJE	Executing	B958	0996	The LU path cannot be added because the virtual LDEV ID of the specified volume was deleted.

Table 9-34 SSB codes that are returned by raidcom modify pool command

raidcom modify pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	6000	The value of pool ID is invalid.
CMDRJE	Executing	2E00	6001	The specified pool is for Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	2E00	6002	The value of maximum reserve ratio is out of range, or it falls below the maximum reserve ratio of the V-VOL.
CMDRJE	Executing	2E00	6003	The specified Tier Range value is invalid.
CMDRJE	Executing	2E00	6004	Relations between the specified lower limit of Tier Range and the Delta value is invalid.
CMDRJE	Executing	2E00	6006	The specified Tier capacity threshold value is out of range.
CMDRJE	Executing	2E00	6009	The threshold of the specified High water mark is out of range.
CMDRJE	Executing	2E00	600A	The operation cannot be done because the specified threshold of Warning is larger than the threshold of the specified High water mark.
CMDRJE	Executing	2E00	6100	The specified tier number is out of range.
CMDRJE	Executing	2E10	001F	The operation cannot be done because the total capacity of virtual volumes for Dynamic Tiering in the system exceeds the maximum.
CMDRJE	Executing	2E10	600B	The specified pool is in the state of blocked.

raidcom modify pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E10	600C	The setting of the threshold value is less than the pool usage value.
CMDRJE	Executing	2E10	600D	The operation cannot be done because it is in the state of shrinking.
CMDRJE	Executing	2E10	6011	The operation cannot be done because it is being discarded pages.
Get Command Status	Async	2E10	6012	Pool cannot be restored because the usage rate of pool is 100%.
CMDRJE	Executing	2E10	6015	The operation cannot be done because the Tier is being deterred reallocation.
CMDRJE	Executing	2E10	6017	The operation cannot be done because collecting the performance monitoring data is being prepared.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2E13	6000	The Dynamic Tiering operations cannot be done to the pool because the specified pool contains RAID 1 pool VOLs.
CMDRJE	Executing	2E13	6002	The specified pool for Dynamic Provisioning cannot be changed to a pool for Dynamic Tiering because the pool is related to TSE-VOL.
CMDRJE	Executing	2E20	6000	Pool ID is not installed.
CMDRJE	Executing	2E20	6101	The specified Tier number is invalid.
CMDRJE	Executing	2E21	8101	SM for Dynamic Provisioning is not installed.
CMDRJE	Executing	2E21	8102	SM for Dynamic Tiering is not installed.
CMDRJE	Executing	2E30	006E	The Dynamic Tiering operation cannot be done to the pool because the specified pool contains the external volumes whose cache mode is invalid.
CMDRJE	Executing	2E30	6000	The threshold value 1 is out of range.
CMDRJE	Executing	2E30	6003	The specified pool is for Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	2E30	6005	The specified pool must be assigned two user-defined thresholds to.
CMDRJE	Executing	2E30	600D	The specified pool is not the pool for Dynamic Tiering.
CMDRJE	Executing	2E31	6004	The specified pool includes the different RAID levels of volumes although the pool cannot include those volumes together.
CMDRJE	Executing	2E31	6005	The specified pool includes external volumes although the pool cannot include those volumes together.
CMDRJE	Executing	2E31	6006	The specified pool cannot be used for a Dynamic Tiering.

raidcom modify pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E31	9000	The capacity that can be used by the installed program products exceeds the maximum.
CMDRJE	Executing	2E31	9001	The program product is not installed.
CMDRJE	Executing	2EE7	0001	Pool ID is not installed.
CMDRJE	Executing	2EE7	0011	An internal error occurred at the pool operation. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EE7	00EE	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2EE7	FEEC	An internal error occurred in the pool operation. Call Hitachi Data Systems Support Center.

Table 9-35 SSB codes that are returned by raidcom rename pool command

raidcom rename pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	6000	The value of pool ID is out of range.
CMDRJE	Executing	2E10	6016	The pool name cannot be changed because the pool configuration is being changed.
CMDRJE	Executing	2E20	6000	Invalid pool ID.
CMDRJE	Executing	2E31	6001	The pool name is duplicated with another pool.
CMDRJE	Executing	2EE7	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-36 SSB codes that are returned by raidcom delete pool command

raidcom delete pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	LDEV# exceeds the range.
CMDRJE	Executing	2E00	6000	The value of pool ID is out of range.
Get Command Status	Async	2E00	600B	All pool volumes associated to a pool cannot be deleted.
Get Command Status	Async	2E10	0009	The specified LDEV is in the state of blocked.
CMDRJE	Executing	2E10	600D	This pool cannot be deleted because a volume in the pool is being deleted.
Get Command Status	Async	2E10	600E	The operation cannot be done because the pool usage rate exceed the threshold value of the pool usage.

raidcom delete pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E10	600F	The operation cannot be done because the current capacity rate exceeds the value of maximum reserved capacity rate.
Get Command Status	Async	2E10	6010	It cannot be deleted because the pool volume is set in the state of being deterred deleting.
Get Command Status	Async	2E10	6011	Deleting operation cannot be done because it is being discarded pages.
Get Command Status	Async	2E10	8002	The specified operation is not supported in the current microcode version.
Get Command Status	Async	2E11	001F	The operation cannot be done because a Thin Image or Copy-on-Write Snapshot pair remains or the association with a Dynamic Provisioning virtual volume exists.
Get Command Status	Async	2E11	0020	The operation cannot be done because a Thin Image or Copy-on-Write Snapshot pair is being deleted or a Dynamic Provisioning virtual volume is being deleted.
Get Command Status	Async	2E11	0021	The operation cannot be done because a pool volume of a specified pool is being formatted.
CMDRJE Get Command Status	Executing/ Async	2E11	6003	The pool is not in the status where the pool can be deleted or a pool volume can be deleted.
Get Command Status	Async	2E11	8003	The operation cannot be done because the power supply is switched off.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2E20	0003	The specified LDEV is not registered to the pool.
Get Command Status	Async	2E20	0003	The operation cannot be done because the pool volume is not of a specified pool.
CMDRJE Get Command Status	Executing/ Async	2E20	6000	Pool ID is not installed.
Get Command Status	Async	2E21	8106	The operation cannot be performed because the shared memory (SM) is not initialized.
CMDRJE	Executing	2E23	0008	The number of specified LDEVs is invalid.
CMDRJE	Executing	2E30	0052	The specified LDEV cannot be deleted because it is a top VOL of the pool.
CMDRJE	Executing	2E30	6003	The specified pool is a pool for Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	2EE7	00EE	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2EE7	00F9	Pool ID is not installed.
CMDRJE	Executing	2EE7	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

raidcom delete pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EF3	6002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-37 SSB codes that are returned by raidcom add snap_pool command

raidcom add snap_pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E00	0000	The value of LDEV number is out of range.
CMDRJE	Executing	2E00	6000	Pool ID is out of range.
CMDRJE	Executing	2E00	6001	The type of pool is invalid.
CMDRJE	Executing	2E00	6002	The maximum reserve ratio for V-VOL is out of range.
Get Command Status	Async	2E10	000C	The operation cannot be done because a SATA-E drive in the state of quick formatting is in the specified LDEV.
Get Command Status	Async	2E10	0009	The specified LDEV is in the state of blocked.
CMDRJE	Executing	2E10	0011	The specified LDEV is in the state of blocked, or not installed.
Get Command Status	Async	2E10	0050	Thin Image cannot be used because there are not enough cache management devices to create pairs.
Get Command Status	Async	2E10	0102	The pool cannot be created because there are not enough resources (VDEV) depending on cache management devices.
Get Command Status	Async	2E10	600D	The operation cannot be performed because the pool volume is being deleted.
CMDRJE Get Command Status	Executing /Async	2E11	6003	The pool is not in the status where the pool volume can be added.
Get Command Status	Async	2E11	8003	The operation cannot be done because the power supply is switched off.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E20	0000	The specified LDEV is not installed.
Get Command Status	Async	2E21	8103	The operation cannot be performed because the memory capacity of the shared memory (SM) is insufficient.
Get Command Status	Async	2E21	8106	The operation cannot be done because the SM for Thin Image or Copy-on-Write Snapshot is not initialized.

raidcom add snap_pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E21	9007	Thin Image or Copy-on-Write Snapshot program product is not installed.
Get Command Status	Async	2E22	0005	Exceeded the number of pool volume that can be registered in a pool.
Get Command Status	Async	2E22	000D	The larger number of drive types than the supported configuration cannot be added to the specified pool.
Get Command Status	Async	2E22	6100	Pool volume cannot be registered because the drive type of specified LDEV is different from the other pool volume type, or the drive type in the pool exceeds the three.
CMDRJE	Executing	2E23	0008	The number of specified LDEVs is invalid.
Get Command Status	Async	2E30	0000	The emulation type of specified LDEV cannot be used as a pool VOL.
Get Command Status	Async	2E30	0007	The specified LDEV has the LU path definition.
Get Command Status	Async	2E30	000C	The specified LDEV is used as a quorum disk.
Get Command Status	Async	2E30	000D	The specified LDEV is used as a system disk.
Get Command Status	Async	2E30	000E	The specified LDEV is already used as a pool volume.
Get Command Status	Async	2E30	0010	The specified LDEV is a command device.
Get Command Status	Async	2E30	0038	It cannot be used as a pool volume because the size of specified LDEV is less than 8GB.
Get Command Status	Async	2E30	0039	Creating a pool or adding a pool volume cannot be done because CLPR is mixed in the specified pool.
Get Command Status	Async	2E30	005C	The specified LDEV is used as a V-VOL.
Get Command Status	Async	2E30	005E	The specified LDEV is used in another program product.
CMDRJE	Executing	2E30	006C	An LDEV, whose emulation type is not available to be mixed, is in the specified LDEVs.
CMDRJE	Executing	2E30	006D	The emulation type of the specified volume is not OPEN-V.
Get Command Status	Async	2E30	006E	The operation cannot be done for the following reasons: • The pool volumes include external volumes whose cache modes are invalid. • The pool includes both external volumes whose cache modes are invalid and internal volumes.

raidcom add snap_pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE Get Command Status	Executing Async	2E30	0071	A pool volume cannot be added because the LDEV of the resource group different from the resource group of the pool volume to which the specified pool belongs is specified.
Get Command Status	Async	2E30	0074	The specified LDEV cannot be operated because it is an external volume mapped for online data migration.
Get Command Status	Async	2E30	0085	The specified volume cannot be used as a pool volume.
CMDRJE	Executing	2E30	6000	The threshold value 1 is out of range.
Get Command Status	Async	2E30	6004	The specified pool attribute differs from the pool attribute of existed pool.
Get Command Status	Async	2E31	0015	The RAID level of the specified LDEV is different from the RAID level of the other pool volumes.
Get Command Status	Async	2E31	0016	There is a blocked pool volume.
Get Command Status	Async	2E31	0018	External volumes whose cache modes are different are included.
CMDRJE	Executing	2E31	6001	The POOL Name is duplicated with another pool.
Get Command Status	Async	2E31	6004	The pool cannot include volumes in different RAID levels because the pool cannot include those volumes. Or the pool cannot include the RAID 1 volumes and the volumes of other RAID levels together.
Get Command Status	Async	2E31	6005	The pool cannot include both internal volumes and external volumes because the pool is not set to Mixable.
Get Command Status	Async	2E31	9000	The usage capacity exceeds the license capacity of program product.
CMDRJE Get Command Status	Executing Async	2EE7	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	0002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-38 SSB codes returned by raidcom add snapshot

raidcom add snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	The value exceeds the range of LDEV number.
CMDRJE	Executing	2E00	0013	A pair cannot be created because there are not enough cache management devices.

raidcom add snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0028	The command ends abnormally because the volume out of the range of LDEV number is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E00	0029	The command ends abnormally because the volume out of the range of LDEV number is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E00	6000	The specified pool ID is out of the range.
CMDRJE	Executing	2E00	9701	There are not enough required input parameters.
CMDRJE	Executing	2E10	0020	A pair cannot be created because the volume exceeded the support size is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0021	A pair cannot be created because the volume exceeded the support size is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0022	A pair cannot be created because the V-VOL is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0023	A pair cannot be created because the pool-VOL is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0024	A pair cannot be created because the journal volume of Universal Replicator is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0025	The command ends abnormally because the LUSE volumes of different structure are specified as the P-VOL and the S-VOL.
CMDRJE	Executing	2E10	0026	A pair cannot be created because the volume in which the VMA is set is specified as the P-VOL.
CMDRJE	Executing	2E10	0027	A pair cannot be created because the external volume is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0028	A pair cannot be created because the volume other than V-VOL is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0029	A pair cannot be created because the pool-VOL is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	002A	A pair cannot be created because the volume (the data volume or the journal volume) of the Universal Replicator pair that is in the intermediate site of the 3DC cascading configuration is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	002B	A pair cannot be created because the P-VOL of a Universal Replicator pair is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.

raidcom add snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	002C	A pair cannot be created because the S-VOL of a Universal Replicator pair is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	002D	A pair cannot be created because the journal volume of the Universal Replicator is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	002E	The command ends abnormally because the volume that is set the S-VOL Disable is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	002F	A pair cannot be created because the volume that is set the VMA is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0030	The command ends abnormally because the volumes of different Max LBA size are specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair and S-VOL.
CMDRJE	Executing	2E10	0031	The command ends abnormally because the volumes in which the number of slots is different are specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair and S-VOL.
CMDRJE	Executing	2E10	0032	A pair cannot be created because the Dynamic Provisioning V-VOL is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0033	The command ends abnormally because the ShadowImage reserved volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0034	The command ends abnormally because the Volume Migration source volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0035	The command ends abnormally because the Volume Migration target volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0036	The command ends abnormally because the Volume Migration reserved volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0037	The command ends abnormally because the P-VOL of a ShadowImage pair is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0038	The command ends abnormally because the S-VOL of a ShadowImage pair is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0039	The command ends abnormally because the ShadowImage reserved volume is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	003A	The command ends abnormally because the Volume Migration source volume is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.

raidcom add snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	003B	The command ends abnormally because the Volume Migration target volume is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	003C	The command ends abnormally because the Volume Migration reserved volume is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	003D	A Thin Image or Copy-on-Write Snapshot pair cannot be created because the volume of Universal Replicator for the delta resync is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	003E	A Thin Image or Copy-on-Write Snapshot pair cannot be created because the volume of Universal Replicator for the delta resync is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	003F	The command ends abnormally because the Quorum disk is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0040	The command ends abnormally because the Quorum disk is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0041	A Thin Image or Copy-on-Write Snapshot pair cannot be created because the Dynamic Provisioning V-VOL in capacity expanding is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0042	A Thin Image or Copy-on-Write Snapshot pair cannot be created because the Dynamic Provisioning V-VOL that is discharging zero data is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0045	A pair cannot be created because the P-VOL of a TrueCopy pair is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0046	A pair cannot be created because the S-VOL of a TrueCopy pair is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0049	The command ends abnormally because the ShadowImage pair is being resynchronized when the volume is shared between the P-VOL of a Thin Image/ Copy-on-Write Snapshot pair and the P-VOL of a ShadowImage pair.
CMDRJE	Executing	2E10	004A	The command ends abnormally because the ShadowImage pair status is other than PSUS when the volume is shared between P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a ShadowImage pair.
CMDRJE	Executing	2E10	004E	The operation cannot be performed because the Quick Restore is being operated on the specified ShadowImage P-VOL.

raidcom add snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	0051	A pair operations cannot be performed because the volume using 2 mirrors included in the 3DC multi-target configuration, 3DC cascade configuration or 3DC delta resync configuration by the 3 Universal Replicator sites is specified.
CMDRJE	Executing	2E10	0052	A Thin Image pair cannot be created because the pair status of all Thin Image pairs sharing the specified P-VOL is PSUE.
CMDRJE	Executing	2E10	005B	A Thin Image pair cannot be operated because the virtual storage machine of the P-VOL is different from the virtual storage machine of the S-VOL.
CMDRJE	Executing	2E10	005C	A Thin Image pair cannot be operated because changing the model and the serial number in the virtual storage machine of the specified P-VOL is in progress.
CMDRJE	Executing	2E10	005D	A Thin Image pair cannot be operated because changing the model and the serial number in the virtual storage machine of the specified S-VOL is in progress.
CMDRJE	Executing	2E10	2300	A Thin Image or Copy-on-Write Snapshot pair with the specified consistency group number cannot be created due to one of the following reasons: • The specified consistency group number is used by the ShadowImage. • The number of pairs that can be defined in a consistency group exceeds the maximum. • The pair created by using the same P-VOL already exists in the specified consistency group.
CMDRJE	Executing	2E10	2302	A Thin Image pair specifying CTG mode cannot be created because the maximum number of consistency groups has already been defined.
CMDRJE	Executing	2E10	6018	A Thin Image or Copy-on-Write Snapshot pair cannot be created due to unavailable of the pool.
CMDRJE	Executing	2E10	8100	A Thin Image or Copy-on-Write Snapshot pair cannot be created because there are not enough pair tables.
CMDRJE	Executing	2E10	8101	A Thin Image or Copy-on-Write Snapshot pair cannot be created because there are not enough differential tables.
CMDRJE	Executing	2E10	8102	A pair cannot be created because there is not enough free shared memory space.
CMDRJE	Executing	2E10	9701	The command ends abnormally because the pair is in the state of unacceptable the command.
CMDRJE	Executing	2E10	9705	A Thin Image or Copy-on-Write Snapshot pair cannot be created because the number of Thin Image or Copy-on-Write Snapshot pairs has already reached the maximum.
CMDRJE	Executing	2E10	9706	A Thin Image pair cannot be created because the maximum number of Snapshot IDs (MU numbers) has already been in use for the specified P-VOL.

raidcom add snapshot				
Error message	**Executing /Async**	**Error code**		**Description**
		SSB1	**SSB2**	
CMDRJE	Executing	2E10	9707	A Thin Image pair cannot be created because the maximum number of Snapshot groups has already been defined, or the maximum number of Thin Image pairs has already been defined in the specified Snapshot group.
CMDRJE	Executing	2E10	9708	A Thin Image pair cannot be created because the DP pool is being initialized.
CMDRJE	Executing	2E10	9800	An error occurred at the operation of Thin Image due to one of the following reasons: • The LDEV number specified for the P-VOL or the S-VOL is incorrect. • The LDEV specified as the P-VOL or the S-VOL is not paired. • The pair of the specified P-VOL or the S-VOL is not ready to perform the specified operation. • The specified Snapshot ID (MU number) is wrong. • The specified Snapshot ID (MU number) is already used. • The specified pool is not in the usable status. • The license capacity has exceeded the maximum. • The control table for Thin Image is depleted.
CMDRJE	Executing	2E11	8003	The operation cannot be performed because power-off is in progress.
CMDRJE	Executing	2E13	0000	A Thin Image or Copy-on-Write Snapshot pair cannot be created because the specified P-VOL is a LUSE volume.
CMDRJE	Executing	2E13	6003	A pair cannot be created because there is a pair in the specified primary volume, which is using a different pool number from the specified pool number.
CMDRJE	Executing	2E13	6004	The specified pair operation cannot be performed for the specified pool.
CMDRJE	Executing	2E13	9900	The consistency group to be used in the specified Snapshot Group is in one of the following status: • The number of pairs that can be defined in a consistency group exceeds the maximum. • The pair created by using the same P-VOL already exists in the specified consistency group.
CMDRJE	Executing	2E20	0000	The specified LDEV is not defined.
CMDRJE	Executing	2E20	0008	The command ends abnormally because an unmounted volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E20	0009	The command ends abnormally because the blocked volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E20	000A	The command ends abnormally because the volume in formatting operation is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.

raidcom add snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E20	000B	The command ends abnormally because an unmounted volume is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E20	000C	The command ends abnormally because the blocked volume is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E20	000D	The command ends abnormally because the volume in formatting operation is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E21	8107	The command ends abnormally because the shared memory (FC, TPF, or Extension1) is not expanded for necessary capacity.
CMDRJE	Executing	2E21	8108	The command ends abnormally because the shared memory (SS1 or more) is not expanded for necessary capacity.
CMDRJE	Executing	2E21	8109	A Thin Image or Copy-on-Write Snapshot pair cannot be created due to one of the following reasons: • The shared memory is not expanded for necessary capacity. • It is in the initializing process.
CMDRJE	Executing	2E21	9010	The program product is not installed.
CMDRJE	Executing	2E30	000C	The specified LDEV is used as a quorum disk.
CMDRJE	Executing	2E30	0076	A pair cannot be created because the volume is already used in the S-VOL of a Thin Image or Copy-on-Write Snapshot pair is specified as the P-VOL.
CMDRJE	Executing	2E30	0077	A pair cannot be created because the volume is already used in the P-VOL of a Thin Image or Copy-on-Write Snapshot pair is specified as the S-VOL.
CMDRJE	Executing	2E30	0078	A pair cannot be created because the volume is already used in the S-VOL of a Thin Image or Copy-on-Write Snapshot pair is specified as the S-VOL.
CMDRJE	Executing	2E30	007A	The command ends abnormally because the volume other than OPEN-V is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	007B	A pair cannot be created because the volume that is set the command device is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	007C	The command ends abnormally because the volume other than OPEN-V is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	007D	A pair cannot be created because the volume that is set the command device is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	007E	The command ends abnormally because the volume that has no path definition is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.

raidcom add snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E30	007F	The command ends abnormally because the volume that has no path definition is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	0080	The command ends abnormally because the external volume mapped for the online data migration is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	0081	The command ends abnormally because the external volume mapped for the online data migration is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	0090	The pair operation is rejected because the specified volume as the primary volume is a reserved volume for GAD, or a volume for the GAD pair which is in the invalid status.
CMDRJE	Executing	2E30	0091	The pair operation is rejected because the specified volume as the secondary volume is a reserved volume for GAD, or a volume for a GAD pair.
CMDRJE	Executing	2E30	600E	A pair cannot be created because the attribute of the pool is other than Thin Image or Copy-on-Write Snapshot is specified.
CMDRJE	Executing	2E31	9002	A pair cannot be created because the capacity exceeds the licensed capacity.
CMDRJE	Executing	2E3F	8000	The specified operation is not supported in the current microcode version.
CMDRJE	Executing	2EC6	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-39 SSB codes returned by raidcom modify snapshot

raidcom modify snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	The value exceeds the range of LDEV number.
CMDRJE	Executing	2E00	000B	The MU number exceeds the maximum.
CMDRJE	Executing	2E00	0028	The command ends abnormally because the volume out of the range of LDEV number is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0033	The command ends abnormally because the ShadowImage reserved volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0034	The command ends abnormally because the Volume Migration source volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.

raidcom modify snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	0035	The command ends abnormally because the Volume Migration target volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0036	The command ends abnormally because the Volume Migration reserved volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	003F	The command ends abnormally because the Quorum disk is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0043	The Thin Image or Copy-on-Write Snapshot pair cannot be restored because the TrueCopy pair status is other than PSUS or PSUE when the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the P-VOL of a TrueCopy pair.
CMDRJE	Executing	2E10	0044	A Thin Image or Copy-on-Write Snapshot pair cannot be restored because the Universal Replicator pair status is other than PSUS or PSUE when the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the P-VOL of a Universal Replicator pair.
CMDRJE	Executing	2E10	0047	A Snapshot data cannot be obtained because the TrueCopy pair status is COPY when the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a TrueCopy pair.
CMDRJE	Executing	2E10	0048	A Snapshot data cannot be obtained because the Universal Replicator pair status is COPY when the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a Universal Replicator pair.
CMDRJE	Executing	2E10	0049	The command ends abnormally because the ShadowImage pair is being resynchronized when the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the P-VOL of a ShadowImage pair.
CMDRJE	Executing	2E10	004A	The command ends abnormally because the ShadowImage pair status is other than PSUS when the volume is shared between P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a ShadowImage pair.
CMDRJE	Executing	2E10	004B	The Thin Image or Copy-on-Write Snapshot pair cannot be restored because the Thin Image or Copy-on-Write Snapshot pair status is other than PSUS or PSUE when the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the P-VOL of a ShadowImage pair.

raidcom modify snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	004C	The Thin Image or Copy-on-Write Snapshot pair cannot be restored because the Thin Image or Copy-on-Write Snapshot pair status is other than PSUS when the volume is shared between the P-VOL of a Thin Image/ Copy-on-Write Snapshot pair and the S-VOL of a ShadowImage pair.
CMDRJE	Executing	2E10	004D	A Snapshot data cannot be obtained because the TrueCopy asynchronous pair status is other than PSUS or PSUE when the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a TrueCopy asynchronous pair.
CMDRJE	Executing	2E10	004E	The operation cannot be performed because the Quick Restore is being operated on the specified ShadowImage P-VOL.
CMDRJE	Executing	2E10	0051	A pair operation cannot be performed because the volume using two mirrors included in the 3DC multi-target configuration, 3DC cascade configuration or 3DC delta resync configuration by the three Universal Replicator sites is specified.
CMDRJE	Executing	2E10	0052	A Thin Image pair operation cannot be performed because the pair status of all Thin Image pairs sharing the specified P-VOL is PSUE.
CMDRJE	Executing	2E10	0061	The Thin Image pair operation cannot be performed because the virtual LDEV ID of the specified volume was deleted.
CMDRJE	Executing	2E10	6018	A Thin Image or Copy-on-Write Snapshot pair cannot be created due to unavailable of the pool.
CMDRJE	Executing	2E10	6019	A Snapshot data cannot be obtained because the pool or the pool-VOL is blocked.
CMDRJE	Executing	2E10	8100	A Thin Image or Copy-on-Write Snapshot pair cannot be created because there are not enough pair tables.
CMDRJE	Executing	2E10	8101	A Thin Image or Copy-on-Write Snapshot pair cannot be created because there are not enough differential tables.
CMDRJE	Executing	2E10	8102	A pair cannot be created because there is not enough free shared memory space.
CMDRJE	Executing	2E10	9700	The command ends abnormally because other than the raidcom add snapshot command is issued for the volume other than the Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	9701	The command ends abnormally because the pair is in the state of unacceptable the command.
CMDRJE	Executing	2E10	9702	The Thin Image or Copy-on-Write Snapshot pair cannot be restored because the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a TrueCopy pair.

raidcom modify snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	9703	The Thin Image or Copy-on-Write Snapshot pair cannot be restored because the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a Universal Replicator pair.
CMDRJE	Executing	2E10	9704	The Thin Image or Copy-on-Write Snapshot pair cannot be restored due to one of the following reasons: • Snapshot data of a restore target Thin Image or Copy-on-Write Snapshot pair is being obtained per consistency group. • Snapshot data of a different pair whose primary volume is the restore target P-VOL of a Thin Image or Copy-on-Write Snapshot pair is being obtained per consistency group.
CMDRJE	Executing	2E10	9800	An error occurred at the operation of Thin Image due to one of the following reasons: • The LDEV number specified for the P-VOL or the S-VOL is incorrect. • The LDEV specified as the P-VOL or the S-VOL is not paired. • The pair of the specified P-VOL or the S-VOL is not ready to perform the specified operation. • The specified Snapshot ID (MU number) is wrong. • The specified Snapshot ID (MU number) is already used. • The specified pool is not in the usable status. • The license capacity has exceeded the maximum. • The control table for Thin Image is depleted.
CMDRJE	Executing	2E11	8003	The operation cannot be performed because power-off is in progress.
CMDRJE	Executing	2E20	0000	The specified LDEV is not defined.
CMDRJE	Executing	2E20	0008	The command ends abnormally because an unmounted volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E20	0009	The command ends abnormally because the blocked volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E20	000A	The command ends abnormally because the volume in formatting operation is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E21	8107	The command ends abnormally because the shared memory (FC, TPF, or Extension3) is not expanded for necessary capacity.
CMDRJE	Executing	2E21	8108	The command ends abnormally because the shared memory (SS3 or more) is not expanded for necessary capacity.
CMDRJE	Executing	2E21	9010	The program product is not installed.

raidcom modify snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E30	000C	The specified LDEV is used as a quorum disk.
CMDRJE	Executing	2E30	0079	The Thin Image or Copy-on-Write Snapshot pair cannot be restored because the volume that is set the S-VOL Disable is specified as the P-VOL.
CMDRJE	Executing	2E30	007A	The command ends abnormally because the volume other than OPEN-V is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	0081	The command ends abnormally because the external volume mapped for the online data migration is specified as the S-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E30	0090	The pair operation is rejected because the specified volume as the primary volume is a reserved volume for GAD, or the volume for the GAD pair which is in the invalid status.
CMDRJE	Executing	2E30	0091	The pair operation is rejected because the specified volume as the secondary volume is a reserved volume for GAD, or the volume for the GAD pair.
CMDRJE	Executing	2E3F	8000	The specified operation is not supported in the current microcode version.
CMDRJE	Executing	2EC6	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	0002	The specified parameter is invalid. Check the Hitachi Command Control Interface Command Reference.

Table 9-40 SSB codes returned by raidcom get snapshot

raidcom get snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EC5	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-41 SSB codes returned by raidcom delete snapshot

raidcom delete snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	The value exceeds the range of LDEV number.
CMDRJE	Executing	2E00	000B	The MU number exceeds the maximum.
CMDRJE	Executing	2E00	0028	The command ends abnormally because the volume out of the range of LDEV number is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.

raidcom delete snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	0033	The command ends abnormally because the ShadowImage reserved volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0034	The command ends abnormally because the Volume Migration source volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0035	The command ends abnormally because the Volume Migration target volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0036	The command ends abnormally because the Volume Migration reserved volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	0049	The command ends abnormally because the ShadowImage pair is being resynchronized when the volume is shared between the P-VOL of a Thin Image/ Copy-on-Write Snapshot pair and the P-VOL of a ShadowImage pair.
CMDRJE	Executing	2E10	004A	The command ends abnormally because the ShadowImage pair status is other than PSUS when the volume is shared between P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a ShadowImage pair.
CMDRJE	Executing	2E10	004D	A Snapshot data cannot be obtained because the TrueCopy asynchronous pair status is other than PSUS or PSUE when the volume is shared between the P-VOL of a Thin Image/Copy-on-Write Snapshot pair and the S-VOL of a TrueCopy asynchronous pair.
CMDRJE	Executing	2E10	004E	The operation cannot be performed because the Quick Restore is being operated on the specified ShadowImage P-VOL.
CMDRJE	Executing	2E10	6019	A Snapshot data cannot be obtained because the pool or the pool-VOL is blocked.
CMDRJE	Executing	2E10	9700	The command ends abnormally because other than the raidcom add snapshot command is issued for the volume other than the Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E10	9701	The command ends abnormally because the pair is in the state of unacceptable the command.

raidcom delete snapshot				
Error message	Executing /Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	9800	An error occurred at the operation of Thin Image due to one of the following reasons: • The LDEV number specified for the P-VOL or the S-VOL is incorrect. • The LDEV specified as the P-VOL or the S-VOL is not paired. • The pair of the specified P-VOL or the S-VOL is not ready to perform the specified operation. • The specified Snapshot ID (MU number) is wrong. • The specified Snapshot ID (MU number) is already used. • The specified pool is not in the usable status. • The license capacity has exceeded the maximum. • The control table for Thin Image is depleted.
CMDRJE	Executing	2E11	8003	The operation cannot be performed because power-off is in progress.
CMDRJE	Executing	2E20	0000	The specified LDEV is not defined.
CMDRJE	Executing	2E20	0008	The command ends abnormally because an unmounted volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E20	0009	The command ends abnormally because the blocked volume is specified as the P-VOL of a Thin Image or Copy-on-Write Snapshot pair.
CMDRJE	Executing	2E21	8107	The command ends abnormally because the shared memory (FC, TPF, or Extension2) is not expanded for necessary capacity.
CMDRJE	Executing	2E21	8108	The command ends abnormally because the shared memory (SS2 or more) is not expanded for necessary capacity.
CMDRJE	Executing	2EC6	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-42 SSB codes that are returned by raidcom add ssid command

raidcom add ssid				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	3001	The CU number of the RCU exceeds the effective value.
CMDRJE	Executing	2E00	3008	The command cannot be executed because the parameter of the specified RCU is invalid.
CMDRJE	Executing	2E00	7100	The CU number is out of effective range.
CMDRJE	Executing	2E11	8004	The operation cannot be done because the microcode is being changed.

raidcom add ssid				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E20	3000	The serial number, product ID, or SSID of the target storage system is incorrect.
CMDRJE	Executing	2E20	3001	The command cannot be executed because the specified RCU is not registered.
CMDRJE	Executing	2E22	3002	The operation cannot be performed due to one of the following reasons: • The number of RCUs registered in MCU or RCU is more than four. • The number of RCUs registered in the system is more than 64 in the case of specifying the cu free.
CMDRJE	Executing	2E23	3301	The number of the specified SSIDs is invalid.
CMDRJE	Executing	2E31	3001	The command cannot be executed because the RCU identification code of a path is invalid.
CMDRJE	Executing	2ED6	00EF	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2ED6	3300	The SSID is invalid.
CMDRJE	Executing	2EF3	3002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-43 SSB codes that are returned by raidcom delete ssid command

raidcom delete ssid				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	3001	The CU number of the RCU exceeds the effective value.
CMDRJE	Executing	2E00	3008	The command cannot be executed because the parameter of the specified RCU is invalid.
CMDRJE	Executing	2E00	7100	The CU number is out of effective range.
CMDRJE	Executing	2E11	8004	The operation cannot be done because the microcode is being changed.
CMDRJE	Executing	2E20	3000	The serial number, the product ID, or the SSID of the remote storage system is invalid.
CMDRJE	Executing	2E20	3001	The command cannot be executed because the specified RCU is not registered.
CMDRJE	Executing	2E23	3301	The number of the specified SSIDs is invalid.
CMDRJE	Executing	2ED6	00EF	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2ED6	3300	The SSID is invalid.
CMDRJE	Executing	2EF3	3002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-44 SSB codes that are returned by raidcom add dp_pool command

raidcom add dp_pool				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
Get Command Status	Async	2E00	0000	LDEV number is out of rage.
CMDRJE	Executing	2E00	6000	The value of pool ID is out of range.
CMDRJE	Executing	2E00	6001	The type of pool is invalid.
CMDRJE	Executing	2E00	6002	The maximum reserve ratio of V-VOL is out of range.
CMDRJE	Executing	2E00	6009	The threshold of the specified High water mark is out of range.
CMDRJE	Executing	2E00	600A	The operation cannot be done because the specified threshold of Warning is larger than the threshold of the specified High water mark.
Get Command Status	Async	2E10	0009	The specified LDEV is in the state of blocked.
Get Command Status	Async	2E10	000C	The operation cannot be done because a SATA-E drive in the state of quick formatting is in the specified LDEV.
CMDRJE	Executing	2E10	0011	The specified LDEV is in the state of blocked, or not installed.
Get Command Status	Async	2E10	0102	The pool cannot be created because there are not enough resources (VDEV) depending on cache management devices.
Get Command Status	Async	2E10	600D	The operation cannot be performed because the pool volume is being deleted.
Get Command Status	Async	2E10	8002	The specified operation is not supported in the current microcode version.
CMDRJE Get Command Status	Executing /Async	2E11	6003	The pool is not in the status where the pool volume can be added.
Get Command Status	Async	2E11	8003	The operation cannot be done because the power supply is switched off.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E20	0000	The specified LDEV is not installed.
Get Command Status	Async	2E21	8103	The operation cannot be performed because the memory capacity of the shared memory (SM) is insufficient.
Get Command Status	Async	2E21	8106	The operation cannot be performed because the shared memory (SM) is not initialized.
CMDRJE	Executing	2E21	9007	Dynamic Provisioning program product is not installed.
Get Command Status	Async	2E22	0005	Exceeded the number of pool volume that can be registered in a pool.

raidcom add dp_pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E22	000D	The larger number of drive types than the supported configuration cannot be added to the specified pool.
Get Command Status	Async	2E22	6100	Pool volume cannot be registered because the drive type of specified LDEV is different from the other pool volume type, or the drive type in the pool exceeds three.
CMDRJE	Executing	2E23	0008	The number of specified LDEVs is invalid.
Get Command Status	Async	2E30	0000	The emulation type of specified LDEV cannot be used as a pool VOL.
Get Command Status	Async	2E30	0007	The specified LDEV has the LU path definition.
Get Command Status	Async	2E30	000C	The specified LDEV is used as a quorum disk.
Get Command Status	Async	2E30	000D	The specified LDEV is used as a system disk.
Get Command Status	Async	2E30	000E	The specified LDEV is already used as a pool volume.
Get Command Status	Async	2E30	0010	The specified LDEV is a command device.
Get Command Status	Async	2E30	0038	It cannot be used as a pool volume because the size of specified LDEV is less than 8GB.
Get Command Status	Async	2E30	0039	Creating a pool or adding a pool volume cannot be done because CLPR is mixed in the specified pool.
Get Command Status	Async	2E30	005C	The specified LDEV is used as a V-VOL.
Get Command Status	Async	2E30	005D	The specified LDEV is a volume of unsupported Dynamic Tiering.
Get Command Status	Async	2E30	005E	The specified LDEV is used in another program product.
CMDRJE	Executing	2E30	006C	An LDEV, whose emulation type is not available to be mixed, is in the specified LDEVs.
Get Command Status	Async	2E30	006E	The operation cannot be done for the following reasons: • The pool volumes to be added to the Dynamic Tiering pool include external volumes whose cache modes are invalid. • The Dynamic Provisioning pool includes both external volumes whose cache modes are invalid and internal volumes.
CMDRJE Get Command Status	Executing Async	2E30	0071	A pool volume cannot be added because the LDEV of the resource group different from the resource group of the pool volume to which the specified pool belongs is specified.

raidcom add dp_pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E30	0074	The specified LDEV cannot be operated because it is an external volume mapped for online data migration.
Get Command Status	Async	2E30	0085	The specified volume cannot be used as a pool volume.
CMDRJE	Executing	2E30	6000	The threshold value 1 is out of range.
Get Command Status	Async	2E30	6004	The specified pool attribute differs from the pool attribute of existed pool.
Get Command Status	Async	2E31	0015	The RAID level of the specified LDEV is different with the RAID level of others.
Get Command Status	Async	2E31	0016	There is a blocked pool volume.
Get Command Status	Async	2E31	0018	External volumes whose cache modes are different are included.
CMDRJE	Executing	2E31	6001	The POOL Name is duplicated with another pool.
Get Command Status	Async	2E31	6004	The pool cannot include volumes in different RAID levels because the pool cannot include those volumes. Or the pool cannot include the RAID 1 volumes and the volumes of other RAID levels together.
Get Command Status	Async	2E31	6005	The pool cannot include both internal volumes and external volumes because the pool is not set to Mixable.
Get Command Status	Async	2E31	9000	The usage capacity exceeds the license capacity of program product.
CMDRJE	Executing	2EE7	00EE	The command cannot be accepted. After a while, execute the same command.
CMDRJE Get Command Status	Executing Async	2EE7	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-45 SSB codes that are returned by raidcom modify rcu command

raidcom modify rcu				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	3001	CU# of RCU exceed the effective value.
CMDRJE	Executing	2E00	3002	The value of least path number is invalid.
CMDRJE	Executing	2E00	3003	The value of RIO MIH time is invalid.
CMDRJE	Executing	2E00	3004	The value of Round-trip response time is invalid.
CMDRJE	Executing	2E00	3005	Invalid product ID or path registration ID.

raidcom modify rcu				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	3007	Incident that is created by CU is not in the one of followings. - Incident that is sent to MCU host and RCU. - Incident that is sent to RCU.
Get Command Status	Async	2E00	3008	Command cannot be executed because the parameter of specified RCU is invalid.
Get Command Status	Async	2E00	3009	Command cannot be executed because all the CU numbers in the RCU is not unified at the path that is specified creation or deletion.
CMDRJE	Executing	2E00	7100	The CU number is out of effective range.
CMDRJE	Executing	2E11	8004	The operation cannot be done because the microcode is being changed.
CMDRJE	Executing	2E20	3000	The serial number, the product ID, or the SSID of the target storage system is incorrect.
CMDRJE	Executing	2E20	3001	The attribute of the RCU cannot be changed because the specified RCU is not registered.
Get Command Status	Async	2E21	7101	The specified CU number is not defined, or an LDEV is not defined under the CU number.
CMDRJE	Executing	2E23	3101	The operation cannot be done because the number of paths becomes less than the least path number.
Get Command Status	Async	2E31	3001	Command cannot be executed because the RCU identification code of a path is invalid.
CMDRJE	Executing	2ED6	00EF	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2ED6	3300	The value of SSID for the remote storage system is invalid.

Table 9-46 SSB codes that are returned by raidcom delete rcu_path command

raidcom delete rcu_path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	3001	The CU# of RCU exceeds the effective value.
CMDRJE	Executing	2E00	3005	The product ID or the path registration ID is invalid.
Get Command Status	Async	2E00	3008	Command cannot be executed because the parameter of specified RCU is invalid.
CMDRJE	Executing	2E00	3200	The specified port # on the side of RCU is invalid.
CMDRJE Get Command Status	Executing/ Async	2E00	7100	The CU number is out of effective range.

raidcom delete rcu_path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE Get Command Status	Executing /Async	2E00	8400	The value of specified port is invalid.
Get Command Status	Async	2E10	3101	Failed to establish a path or the deletion operation. The following factor can be thought. • Input parameter is invalid. • Port status or the MP Blade status is in the state of abnormal. • Cable is not connected correctly. • Port is specified incorrectly.
Get Command Status	Async	2E11	8004	The operation cannot be done because the microcode is being changed.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E20	3001	A logical path cannot be deleted because the specified RCU is not registered.
Get Command Status	Async	2E21	7101	The specified CU number is not defined, or an LDEV is not defined under the CU number.
Get Command Status	Async	2E23	3101	The operation cannot be done because the number of paths becomes less than the least path number.
CMDRJE	Executing	2E30	840A	The port attribute is not Initiator (MCU).
Get Command Status	Async	2E31	3001	Command cannot be executed because the RCU identification code of a path is invalid.
Get Command Status	Async	2E31	3101	Command cannot be executed because the serial number is not unified in the specified path.
CMDRJE	Executing	2ED6	00EE	The command cannot be accepted because the DKC is busy. After a while, execute the same command.
Get Command Status	Async	2ED6	3005	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	3002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-47 SSB codes that are returned by raidcom add rcu_path command

raidcom add rcu_path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	3001	CU# of RCU exceeds the effective value.
CMDRJE	Executing	2E00	3005	Invalid product ID or path registration ID.
Get Command Status	Async	2E00	3008	Command cannot be executed because the parameter of specified RCU is invalid.

raidcom add rcu_path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E00	3009	Command cannot be executed because all the CU numbers in the RCU is not unified at the path that is specified creation or deletion.
CMDRJE	Executing	2E00	3200	The value of port # on the side of RCU is invalid.
CMDRJE Get Command Status	Executing /Async	2E00	7100	The CU number is out of effective range.
CMDRJE Get Command Status	Executing /Async	2E00	8400	The value of specified port is invalid.
Get Command Status	Async	2E10	3101	Failed to establish a path or the deletion operation. The following factor can be thought. • Input parameter is invalid. • Port status or the MP Blade status is in the state of abnormal. • Cable is not connected correctly. • Port is specified incorrectly.
Get Command Status	Async	2E11	8004	The operation cannot be done because the microcode is being changed.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E20	3000	The serial number, the product ID, or the SSID of the target storage system is incorrect.
Get Command Status	Async	2E20	3001	A logical path cannot be added because the specified RCU is not registered.
Get Command Status	Async	2E21	7101	The specified CU number is not defined, or an LDEV is not defined under the CU number.
Get Command Status	Async	2E23	3100	An RCU path cannot be added because the number of valid paths exceeds the maximum.
Get Command Status	Async	2E23	3101	The operation cannot be done because the number of paths becomes less than the least path number.
CMDRJE	Executing	2E30	840A	The port attribute is not Initiator (MCU).
Get Command Status	Async	2E31	3001	Command cannot be executed because the RCU identification code of a path is invalid.
Get Command Status	Async	2E31	3101	Command cannot be executed because the serial number is not unified in the specified path.
CMDRJE	Executing	2ED6	00EE	The command cannot be accepted because the DKC is busy. After a while, execute the same command.
Get Command Status	Async	2ED6	3005	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2ED6	3300	The value of SSID on the remote storage system is invalid.

raidcom add rcu_path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EF3	3002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-48 SSB codes that are returned by raidcom delete rcu command

raidcom delete rcu				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	3001	CU# on the RCU exceeds the effective range.
CMDRJE	Executing	2E00	3005	Invalid product ID or path registration ID.
Get Command Status	Async	2E00	3008	Command cannot be executed because the parameter of specified RCU is invalid.
CMDRJE	Executing	2E00	3200	The value of specified port# on the side of RCU is invalid.
Get Command Status	Async	2E00	7100	The CU number is out of effective range.
CMDRJE Get Command Status	Executing /Async	2E00	8400	The value of specified port is invalid.
Get Command Status	Async	2E11	8004	The operation cannot be done because the microcode is being changed.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E20	3000	The serial number, the product ID, or the SSID of the target storage system is incorrect.
Get Command Status	Async	2E20	3001	The specified RCU cannot be deleted because the RCU is not registered.
Get Command Status	Async	2E21	7101	The specified CU number is not defined, or an LDEV is not defined under the CU number.
Get Command Status	Async	2E22	3101	Path cannot be deleted because there is a pair of TrueCopy/Universal Replicator, or a journal volume is in the relevant CU.
Get Command Status	Async	2E31	3001	Command cannot be executed because the RCU identification code of a path is invalid.
CMDRJE	Executing	2ED6	00EE	The command cannot be accepted because the DKC is busy. After a while, execute the same command.
Get Command Status	Async	2ED6	3005	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2ED6	3300	The value of SSID on the remote storage system is invalid.
CMDRJE	Executing	2EDE	00D1	RCU storage system does not exist.

raidcom delete rcu				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EF3	3002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-49 SSB codes that are returned by raidcom add rcu command

raidcom add rcu				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	3001	The value of CU# on the RCU exceeds the effective range.
CMDRJE	Executing	2E00	3005	Invalid product ID or path registration ID.
Get Command Status	Async	2E00	3008	Command cannot be executed because the parameter of specified RCU is invalid.
Get Command Status	Async	2E00	3009	Command cannot be executed because all the CU numbers in the RCU is not unified at the path that is specified creation or deletion.
CMDRJE	Executing	2E00	3200	The value of port# on the side of RCU is invalid.
CMDRJE Get Command Status	Executing /Async	2E00	7100	The CU number is out of effective range.
CMDRJE Get Command Status	Executing /Async	2E00	8400	The value of specified port is invalid.
Get Command Status	Async	2E10	3101	Failed to establish a path or the deletion operation. The following factor can be thought. • Input parameter is invalid. • Port status or the MP Blade status is in the state of abnormal. • Cable is not connected correctly. • Port is specified incorrectly.
Get Command Status	Async	2E11	8004	The operation cannot be done because the microcode is being changed.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2E20	3000	The serial number, the product ID, or the SSID of the target storage system is incorrect.
Get Command Status	Async	2E21	7101	The specified CU number is not defined, or an LDEV is not defined under the CU number.
Get Command Status	Async	2E22	3001	The specified RCU is already registered to another product ID.

raidcom add rcu				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E22	3002	The operation cannot be performed due to one of the following reasons: • The number of RCUs registered in MCU or RCU is more than four. • The number of RCUs registered in the system is more than 64 in the case of specifying the cu free.
Get Command Status	Async	2E22	3300	The specified SSID is already registered to another RCU.
Get Command Status	Async	2E23	3000	The specified RCU is cannot be registered because there is no free RCU.
Get Command Status	Async	2E23	3101	The operation cannot be done because the number of paths becomes less than the least path number.
CMDRJE	Executing	2E30	840A	The port attribute is not Initiator (MCU).
Get Command Status	Async	2E31	3001	Command cannot be executed because the RCU identification code of a path is invalid.
Get Command Status	Async	2E31	3002	The operation cannot be performed because the remote storage system does not support the path between CUs.
Get Command Status	Async	2E31	3101	Command cannot be executed because the serial number is not unified in the specified path.
CMDRJE	Executing	2ED6	00EE	The command cannot be accepted because the DKC is busy. After a while, execute the same command.
Get Command Status	Async	2ED6	3005	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2ED6	3300	The value of SSID on the remote storage system is invalid.
CMDRJE	Executing	2EF3	3002	The specified parameter is invalid. Check the Command Control Interface Command Reference.

Table 9-50 SSB codes that are returned by raidcom delete ldev command

raidcom delete ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceeds the range of LDEV number.
Get Command Status	Async	2E00	000E	This command does not support the emulation type of the specified LDEV.

raidcom delete ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E10	0000	The specified LDEV is used as a pair of ShadowImage/Thin Image/Copy-on-Write Snapshot/Volume Migration or a relationship of Compatible FlashCopy® V2/Compatible Software for IBM® FlashCopy® SE.
Get Command Status	Async	2E10	0001	The specified LDEV is used as a TrueCopy pair, a Universal Replicator pair or a command device defined by Business Continuity Manager.
Get Command Status	Async	2E10	0002	The specified LDEV is used as a Universal Replicator pair or a journal.
Get Command Status	Async	2E10	0003	The specified LDEV is used as a Compatible FlashCopy® V2 relationship.
Get Command Status	Async	2E10	0004	The specified LDEV is used as a Thin Image or Copy-on-Write Snapshot pair.
Get Command Status	Async	2E10	0005	The specified LDEV is used as a Volume Migration.
Get Command Status	Async	2E10	0008	The specified LDEV is used as a system disk.
Get Command Status	Async	2E10	0012	The specified LDEV is used as a CC/XRC attribute device.
Get Command Status	Async	2E10	0062	The specified LDEV is used as the primary volume for the GAD pair.
Get Command Status	Async	2E10	0063	The specified LDEV is used as the secondary volume for the GAD pair.
Get Command Status	Async	2E11	0004	An LDEV that is in the state of formatting is included in the parity group of the target LDEV.
Get Command Status	Async	2E11	0005	An LDEV that is in the state of executing quick format is included in the parity group of the target LDEV.
CMDRJE	Executing	2E11	0053	The specified LDEV is used in another operation.
Get Command Status	Async	2E11	0102	The parity group of the target LDEV is in the state of correction copy.
CMDRJE	Executing	2E11	0153	The parity group or the external volume group that the specified LDEV is belongs to is used in another operation.
Get Command Status	Async	2E11	6004	The operation of Dynamic Provisioning V-VOL cannot be done because there is a blocked pool.
Get Command Status	Async	2E11	8004	The operation cannot be done because the internal processing is in progress.
CMDRJE	Executing	2E11	8010	The storage system is in internal process, or the configuration changing processes are conflicting.
Get Command Status	Async	2E11	8108	The operation cannot be done because there is blocked part in the system.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.

raidcom delete ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE Get Command Status	Executing Async	2E20	0000	LDEV is not installed.
CMDRJE	Executing	2E30	0007	An LU path has been defined.
Get Command Status	Async	2E30	000A	The specified LDEV is used as a Dynamic Provisioning.
Get Command Status	Async	2E30	000C	The specified LDEV is used as a quorum disk.
Get Command Status	Async	2E30	000E	The specified LDEV is used as a pool volume.
Get Command Status	Async	2E30	000F	The specified LDEV is used as a journal volume.
Get Command Status	Async	2E30	0006	The specified LDEV is used in the FICON® Data Migration.
Get Command Status	Async	2E30	0010	The specified LDEV is a command device.
CMDRJE Get Command Status	Executing Async	2E30	0013	The specified volume cannot be deleted because it is a LUSE volume.
Get Command Status	Async	2E30	0018	This is a volume that the Data Retention Utility is set.
Get Command Status	Async	2E30	001A	Volume Security is set to the specified LDEV.
Get Command Status	Async	2E30	001E	The specified LDEV cannot be deleted because of online from the mainframe host.
Get Command Status	Async	2E30	004E	The specified LDEV is a Data Retention Utility/ Volume Retention Manager attribute device.
Get Command Status	Async	2E30	0053	This is a volume that the Volume Retention Manager is set.
Get Command Status	Async	2E30	0054	The specified LDEV is used as a Compatible FlashCopy® V2 or a Compatible Software for IBM® FlashCopy® SE relationship.
Get Command Status	Async	2E30	0055	The specified LDEV is used as a Volume Migration.
Get Command Status	Async	2E30	0056	The specified LDEV is used as a Volume Migration
Get Command Status	Async	2E30	0057	The specified LDEV is used as a system disk.
Get Command Status	Async	2E30	0058	The specified LDEV is used as a system disk.
Get Command Status	Async	2E30	0060	The specified LDEV is a command device.

raidcom delete ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E30	0074	The specified LDEV cannot be operated because it is an external volume mapped for online data migration.
Get Command Status	Async	2E30	4102	The specified volume is used as a TrueCopy.
Get Command Status	Async	2E30	4103	The specified volume is used as a TrueCopy.
Get Command Status	Async	2E30	4104	The specified volume is used as a ShadowImage.
Get Command Status	Async	2E30	4105	The specified volume is used as a ShadowImage.
Get Command Status	Async	2E30	4107	The specified volume is used as a ShadowImage.
Get Command Status	Async	2E30	4108	The specified LDEV is used as a reserved volume of Volume Migration.
Get Command Status	Async	2E31	0001	The target LDEV is a quorum disk and cannot be deleted.
CMDRJE	Executing	2EE8	00EE	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EE8	0A18	An internal error occurred.
CMDRJE Get Command Status	Executing Async	2EE8	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
Get Command Status	Async	2EE8	FFFB	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-51 SSB codes that are returned by raidcom delete hba_wwn command

raidcom delete hba_wwn				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B957	404F	The program product is not installed.
CMDRJE	Executing	B957	4087	The host group ID exceeds the maximum value.
CMDRJE	Executing	B957	4089	The specified host group is not installed.
CMDRJE	Executing	B957	408A	The attribute of specified port is Initiator or External.

Table 9-52 SSB codes that are returned by raidcom add hba_wwn command

raidcom add hba_wwn				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B957	404F	The program product is not installed.
CMDRJE	Executing	B957	4081	The value of hba_wwn is invalid.
CMDRJE	Executing	B957	4087	The value of host group ID exceeds the maximum.
CMDRJE	Executing	B957	4089	The host group is not installed.
CMDRJE	Executing	B957	408A	The attribute of specified port is Initiator or External.
CMDRJE	Executing	B957	4184	The number of WWN reached the maximum.
CMDRJE	Executing	B957	4188	HBA WWN is already registered.

Table 9-53 SSB codes that are returned by raidcom set hba_wwn command

raidcom set hba_wwn				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B957	404F	The program product is not installed.
CMDRJE	Executing	B957	4087	The value of host group ID exceeds the maximum.
CMDRJE	Executing	B957	4089	The host group is not installed.
CMDRJE	Executing	B957	408A	The attribute of specified port is Initiator or External.
CMDRJE	Executing	B957	4385	The specified WWN does not exist.
CMDRJE	Executing	B957	438B	The specified WWN nickname is already used in the same port.

Table 9-54 SSB codes that are returned by raidcom reset hba_wwn command

raidcom reset hba_wwn				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B957	404F	The program product is not installed.
CMDRJE	Executing	B957	4087	The value of Host group ID exceeds the maximum.
CMDRJE	Executing	B957	4089	The host group is not installed.
CMDRJE	Executing	B957	408A	The attribute of the specified port is Initiator or External.
CMDRJE	Executing	B957	4385	The specified WWN does not exists.

Table 9-55 SSB codes that are returned by raidcom add copy_grp command

raidcom add copy_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	000B	The number of MU# exceeds the maximum.
CMDRJE	Executing	2E00	2100	Invalid device number.
CMDRJE	Executing	2E00	5000	The specified journal ID exceeds the range.
CMDRJE	Executing	2E20	2100	A device group is not installed.
CMDRJE	Executing	2E22	2000	There is a copy group.
CMDRJE	Executing	2E23	2000	The number of copy groups in the system reached the maximum.
CMDRJE	Executing	2E30	2100	The specified device group is already defined in the other copy group.
CMDRJE	Executing	2E31	0012	There is an LDEV in the device group that has an undefined device name.
CMDRJE	Executing	2E31	0013	The same device names of LDEV are in the device group.
CMDRJE	Executing	2E31	0014	The same LDEVs are in the copy group.
Invalid Character	Executing	-	-	Unavailable character is included in the name of copy group.

Table 9-56 SSB codes that are returned by raidcom delete copy_grp command

raidcom delete copy_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E20	2000	The copy group is not installed.
Invalid Character	Executing	-	-	Unavailable character is included in the name of copy group.

Table 9-57 SSB codes that are returned by raidcom modify port -port_speed command

raidcom modify port -port_speed				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B955	044C	The specified AL-PA is invalid.
CMDRJE	Executing	B955	054E	The specified topology is invalid.
CMDRJE	Executing	B955	05A6	The other than "fabric on" cannot be specified when specifying a topology of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	05A7	The other than "P-to-P (point to point)" cannot be specified when specifying a topology of the package for Fibre Channel over Ethernet.

raidcom modify port -port_speed				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B955	1039	The command device being used at the local CCI exists under the port.
CMDRJE	Executing	B955	104F	The program product is not installed.
CMDRJE	Executing	B955	113D	Invalid host speed is set for 4Gbps fibre adapter. The available host speeds are AUTO, 1G, 2G, and 4G only.
CMDRJE	Executing	B955	113F	Invalid host speed is set for 8Gbps Fibre Adapter. The available host speeds are AUTO, 2G, 4G, and 8G only.
CMDRJE	Executing	B955	11A5	The other than "10G" cannot be specified when specifying a host speed of the package for Fibre Channel over Ethernet.
CMDRJE	Executing	B955	11AE	Invalid host speed is set for 16Gbps Fibre Adapter. The available host speeds are AUTO, 2G, 4G, and 8G only.
CMDRJE	Executing	B955	12AF	Topology FC-AL and 16G as the host speed are not supported for the 16Gbps fibre adapter.

Table 9-58 SSB codes that are returned by raidcom modify port -port_attribute command

raidcom modify port -port_attribute				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	8404	Invalid package
CMDRJE	Executing	2E10	8001	The operation cannot be done because another application, for example Device Manager - Storage Navigator and SVP, is used.
CMDRJE	Executing	2E10	8400	The specified port is blocked.
CMDRJE	Executing	2E10	8402	There is a pair for TrueCopy/Universal Replicator that is used the specified port.
CMDRJE	Executing	2E10	8403	There is a pair for TrueCopy/Universal Replicator that is used the specified port.
CMDRJE	Executing	2E11	800D	The storage system is in the state of start-up. Wait for a while, then retry the operation.
CMDRJE	Executing	2E20	8400	The specified port is not installed.
CMDRJE	Executing	2E30	8403	There is a path for TrueCopy/Universal Replicator in the specified port.
CMDRJE	Executing	2E30	8406	There is an external VOL path in the specified port.
CMDRJE	Executing	2E30	8407	There is a path for TrueCopy/Universal Replicator in the specified port.
CMDRJE	Executing	2E30	8408	There is a path for TrueCopy/Universal Replicator in the specified port.

raidcom modify port -port_attribute				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E30	8409	An LU path has been defined.
CMDRJE	Executing	2ED0	84FC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-59 SSB codes that are returned by raidcom delete host_grp command

raidcom delete host_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B956	302C	The cancelling of the host mode option 61 setting was aborted.
CMDRJE	Executing	B956	304F	The program product is not installed.
CMDRJE	Executing	B956	3071	The value of host group ID exceeds the maximum.
CMDRJE	Executing	B956	3077	The attribute of the specified port is Initiator or External.
CMDRJE	Executing	B956	3203	Deletion cannot be executed because the last path of ShadowImage is included in the host group.
CMDRJE	Executing	B956	320A	Deletion cannot be executed because the last path of Thin Image or Copy-on-Write Snapshot is included in the host group.
CMDRJE	Executing	B956	3239	The command device being used at the local CCI exists under the host group.

Table 9-60 SSB codes that are returned by raidcom add host_grp command

raidcom add host_grp				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B956	304F	The program product is not installed.
CMDRJE	Executing	B956	3071	The value of host group ID exceeds the maximum.
CMDRJE	Executing	B956	3077	The attribute of the specified port is Initiator or External.
CMDRJE	Executing	B956	3173	The same host group name is already installed in the specified port.
CMDRJE	Executing	B956	3174	The default host group name cannot be registered for the host group ID is other than 0.

Table 9-61 SSB codes that are returned by raidcom modify host_grp command

raidcom modify host_grp				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
CMDRJE	Executing	B958	0339	The command device being used at the local CCI exists under the host group.
CMDRJE	Executing	B958	0350	Changing of the host mode/ host mode option cannot be executed for the port of Initiator or External.
CMDRJE	Executing	B958	0354	The invalid host mode is specified.
CMDRJE	Executing	B958	092C	The cancelling of the host mode option 61 setting was aborted.
CMDRJE	Executing	B958	0956	The host group ID exceeds the maximum.
CMDRJE	Executing	B958	0957	The program product is not installed.
CMDRJE	Executing	B958	0959	The specified host group is not installed.
CMDRJE	Executing	B9F9	B9F9	The command device being used at the local CCI exists under the host group.

Table 9-62 SSB codes that are returned by raidcom disconnect path command

raidcom disconnect path				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
CMDRJE	Executing	2E00	4500	The path group is out of the enabled range.
CMDRJE	Executing	2E00	8400	The value of specified port is invalid.
Get Command Status	Async	2E10	4301	The specified external path has already disconnected the path, or is in the process of checking path.
Get Command Status	Async	2E11	001B	The target LDEV is blocked.
Get Command Status	Async	2E11	4000	The path for the specified external path is in the state of disconnected.
Get Command Status	Async	2E11	4302	This command cannot be operated due to one of the following reasons: • All the paths to the external volumes are blocked. • There will be no normal paths.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
Get Command Status CMDRJE	Executing/ Async	2E20	4100	There is no specified external volume.
Get Command Status CMDRJE	Executing/ Async	2E20	4300	There is no connection path to an external volume.

raidcom disconnect path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E20	4400	WWN is not registered.
CMDRJE	Executing	2E20	4500	There is no path group.
CMDRJE	Executing	2E20	4500	external_wwn is not defined.
Get Command Status	Async	2E30	001E	Online from the mainframe host.
CMDRJE	Executing	2E30	8400	The attribute of a port is not External(ELUN).
CMDRJE	Executing	2EDA	00EE	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EDA	0905	An internal error occurred by the operation of a path for an external path. Call Hitachi Data Systems Support Center.

Table 9-63 SSB codes that are returned by raidcom delete path command

raidcom delete path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	4500	The path group is not in a effective range.
CMDRJE	Executing	2E00	8400	The value of the specified port is incorrect.
Get Command Status	Async	2E10	4303	The path operations cannot be performed for the following reasons: • The target of the specified path group is TagmaStore USP/TagmaStore NSC. • The specified path group contains the external volume that is set the reserve attribute from the host.
Get Command Status	Async	2E11	8011	The operation cannot continue because the microcode is being replaced.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2E20	4100	There is no external volume group.
CMDRJE	Executing	2E20	4300	There is no external connection path.
CMDRJE	Executing	2E20	4400	WWN is not registered.
CMDRJE Get Command Status	Executing /Async	2E20	4500	There is no path group.
CMDRJE Get Command Status	Executing /Async	2E23	4300	Paths cannot be deleted because there are no normal paths.
CMDRJE	Executing	2E30	8400	The port attribute is not External (ELUN).
CMDRJE	Executing	2EDA	00EE	The command cannot be accepted. After a while, execute the same command.

raidcom delete path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2EDA	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
Get Command Status	Async	2EDA	FFFF	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-64 SSB codes that are returned by raidcom add path command

raidcom add path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	4500	The path group is not in the enabled range.
CMDRJE	Executing	2E00	8400	The value of specified port is incorrect.
Get Command Status	Async	2E10	4303	The path operations cannot be performed for the following reasons: • The target of the specified path group is TagmaStore USP/TagmaStore NSC. • The specified path group contains the external volume that is set the reserve attribute from the host.
Get Command Status	Async	2E10	4400	The WWN on the side of specified external storage is not connected to an External port. This message may be output if the migration source storage system is USP V/VM and the host mode option 2 is not set to the port that connects to the migration target storage system.
Get Command Status	Async	2E11	8011	The operation cannot continue because the microcode is being replaced.
CMDRJE	Executing	2E11	9400	The command cannot be accepted. After a while, execute the same command.
CMDRJE	Executing	2E20	4100	There is no external volume group.
Get Command Status	Async	2E20	4400	Invalid WWN.
CMDRJE Get Command Status	Executing /Async	2E20	4500	There is no path group.
CMDRJE Get Command Status	Executing/ Async	2E22	4300	The same path has been defined already.
Get Command Status	Async	2E23	4303	The operation cannot be done because the number of path in the path group exceeds 8.
CMDRJE	Executing	2E30	8400	The attribute of a port is not External (ELUN).
Get Command Status	Async	2E31	4000	The specified external storage LU is the device of not supported.

raidcom add path				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
Get Command Status	Async	2E31	4001	The specified external storage system is not supported.
CMDRJE	Executing	2EDA	00EE	The command cannot be accepted. After a while, execute the same command.
Get Command Status	Async	2EDA	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
Get Command Status	Async	2EDA	FFFF	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-65 SSB codes that are returned by raidcom -logout command

raidcom -logout				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E01	2200	Failed to release the resource lock.

Table 9-66 SSB codes that are returned by raidcom monitor pool command

raidcom monitor pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	6000	The value of pool ID is out of range.
CMDRJE	Executing	2E10	6004	Monitor cannot be started because the performance monitor is in the collecting status.
CMDRJE	Executing	2E10	6005	Monitor cannot be stopped because the performance monitor is stopped.
CMDRJE	Executing	2E10	6006	Monitor cannot start because the performance monitor is in use. Retry the operation after completing or stopping the reallocation of Tier.
CMDRJE	Executing	2E10	6007	There is not enough time after collecting performance monitor.
CMDRJE	Executing	2E11	6003	The pool is not in the state of specifying the performance monitor to start or stop.
CMDRJE	Executing	2E20	6000	The pool ID is not installed.
CMDRJE	Executing	2E21	8101	A SM for Dynamic Provisioning is not installed.
CMDRJE	Executing	2E21	8102	A SM for Dynamic Tiering is not installed.
CMDRJE	Executing	2E21	9000	The program product of Dynamic Tiering is not installed.
CMDRJE	Executing	2E30	6002	Start or stop of performance monitor by hand cannot be done because it is a pool for Dynamic Provisioning or it is automatic execution mode.

raidcom monitor pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E30	6003	The specified pool is the one for Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	2EE7	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-67 SSB codes that are returned by raidcom reallocate pool command

raidcom reallocate pool				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	6000	The value of pool ID is out of range.
CMDRJE	Executing	2E10	6007	There is not enough time after collecting performance monitor.
CMDRJE	Executing	2E10	6008	Tier Reallocation cannot be started because the state of performance monitor information is not enabled. Start the performance monitor again.
CMDRJE	Executing	2E10	6009	Reallocation cannot be started because it is reallocating.
CMDRJE	Executing	2E10	600A	Reallocation cannot be stopped because it is not reallocating.
CMDRJE	Executing	2E10	6011	The operation cannot be done because it is being discarded pages.
CMDRJE	Executing	2E10	6015	The operation cannot be done because the Tier is being deterred reallocation.
CMDRJE	Executing	2E11	6003	The pool is not in the status of specifying the reallocation to start or stop.
CMDRJE	Executing	2E20	6000	The pool ID is not installed.
CMDRJE	Executing	2E21	8101	A SM for Dynamic Provisioning is not installed.
CMDRJE	Executing	2E21	8102	A SM for Dynamic Tiering is not installed.
CMDRJE	Executing	2E21	9000	The program product of Dynamic Tiering is not installed.
CMDRJE	Executing	2E30	6002	Start or stop of performance monitor by hand cannot be done because it is a pool for Dynamic Provisioning or it is automatic execution mode.
CMDRJE	Executing	2E30	6003	The specified pool is the one for Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	2E31	6000	Reallocation cannot be done because there is only one Tier in the pool group.
CMDRJE	Executing	2EE7	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-68 SSB codes that are returned by raidcom extend ldev command

raidcom extend ldev				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B96B	0B27	The command cannot be operated because the virtual LDEV is not defined yet.
CMDRJE	Executing	-	-	See the troubleshooting topics in the Provisioning Guide for the storage system.

Table 9-69 SSB codes that are returned by raidcom delete resource command

raidcom delete resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	2201	The specified resource group cannot be operated.
CMDRJE	Executing	2E10	2201	Resource groups cannot be deleted because the resource groups are locked.
CMDRJE	Executing	2E10	2202	The LDEV and the host group cannot be set to the different virtual storage machine.
CMDRJE	Executing	2E20	0100	There is no parity group.
CMDRJE	Executing	2E20	2200	A resource group cannot be deleted because the specified resource group is undefined.
CMDRJE	Executing	2E20	4100	There is no external volume group.
CMDRJE	Executing	2E21	9305	The information for the virtual storage machine is set in the specified resource.
CMDRJE	Executing	2E22	2202	A resource group cannot be deleted because a resource belongs to the specified resource group.
CMDRJE	Executing	2E22	2203	A resource cannot be deleted from the resource group because the specified LDEV number is not the top LDEV number in the LUSE volume.
CMDRJE	Executing	2E30	2201	The operation to resource group 0 (meta_resource) cannot be performed.
CMDRJE	Executing	2ECA	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-70 SSB codes that are returned by raidcom add resource command

raidcom add resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	2200	The specified resource group name is against the naming rules.
CMDRJE	Executing	2E00	2201	The specified resource group cannot be operated.

raidcom add resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	2202	The resource ID and the sub-resource ID are out of the effective range.
CMDRJE	Executing	2E00	8000	The machine type is invalid.
CMDRJE	Executing	2E00	8001	The serial number is invalid.
CMDRJE	Executing	2E00	8400	The value of specified port is invalid.
CMDRJE	Executing	2E10	2202	The LDEV and the host group cannot be set to the different virtual storage machine.
CMDRJE	Executing	2E20	0100	There is no parity group.
CMDRJE	Executing	2E20	2200	You cannot execute this command because of either reason below. • A resource cannot be added to the resource group because the specified resource group is undefined. • A resource group name cannot be changed because the specified resource group is undefined.
CMDRJE	Executing	2E20	4100	There is no external volume group.
CMDRJE	Executing	2E21	900D	The program products of Resource Partition Manager are not installed.
CMDRJE	Executing	2E21	9305	The information for the virtual storage machine is set in the specified resource.
CMDRJE	Executing	2E22	2200	You cannot execute this command because of either reason below. • A resource group cannot be created because the specified resource group name is duplicated. • A resource group name cannot be changed because the specified resource group name is duplicated.
CMDRJE	Executing	2E22	2201	A resource cannot be added to a resource group because the specified resource belongs to the resource group.
CMDRJE	Executing	2E22	2203	A resource cannot be added to the resource group because the specified LDEV number is not the top LDEV number in the LUSE volume.
CMDRJE	Executing	2E23	2200	Any more resource groups cannot be created because the registered number of resource groups has reached the maximum.
CMDRJE	Executing	2E23	2201	A virtual storage machine cannot be created because the number of registered virtual storage machines has reached the maximum.
CMDRJE	Executing	2E30	2201	The operation to resource group 0 (meta_resource) cannot be performed.
CMDRJE	Executing	2ECA	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-71 SSB codes that are returned by raidcom get resource command

raidcom get resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EF0	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-72 SSB codes that are returned by raidcom map resource command

raidcom map resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	The specified LDEV number or the LDEV number for the virtual volume is out of the range.
CMDRJE	Executing	2E00	0003	SSID is not with in the valid range.
CMDRJE	Executing	2E00	000E	The specified emulation type of the LDEV is not supported in this command.
CMDRJE	Executing	2E00	002B	The specified attribute of the virtual LDEV is not supported.
CMDRJE	Executing	2E00	002C	The specified attribute of the virtual LDEV is invalid.
CMDRJE	Executing	2E00	2205	You cannot execute the command because a parameter required for the virtualization was not specified.
CMDRJE	Executing	2E00	9301	The specified emulation type is invalid.
CMDRJE	Executing	2E10	0055	The specified LDEV cannot be operated because it belongs to the default virtual storage machine.
CMDRJE	Executing	2E10	0059	The specified volume cannot be operated because the LDEV number of the specified volume does not match the LDEV number of the virtual volume.
CMDRJE	Executing	2E10	8000	You cannot execute the command because the processing by the other software (Device Manager - Storage Navigator or SVP, and so on) is in progress.
CMDRJE	Executing	2E21	9305	The information of the virtual storage machine is already set in the specified resource.
CMDRJE	Executing	2E21	9307	The specified virtual LDEV number is already exist in the virtual storage machine to which the specified LDEV belongs.
CMDRJE	Executing	2E21	9308	You cannot operate the LDEV that has the LU path definition.
CMDRJE	Executing	2E22	0001	The specified LDEV is already defined.
CMDRJE	Executing	2E30	0013	The specified volume cannot be set because it is a LUSE volume.

raidcom map resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E30	0088	The specified LDEV cannot be operated because it has an attribute.
CMDRJE	Executing	2E30	008C	The specified LDEV cannot be set the information of the virtual volume because it is not virtualized.
CMDRJE	Executing	2ECA	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	2202	The specified operation cannot be performed because it is not supported.

Table 9-73 SSB codes that are returned by raidcom unmap resource command

raidcom unmap resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	0000	The specified LDEV number or the LDEV number for the virtual volume is out of the range.
CMDRJE	Executing	2E10	004F	The specified LDEV for the virtual storage machine is not defined in the specified LDEV.
CMDRJE	Executing	2E10	005E	The specified LDEV is used by the TrueCopy pair or the Universal Replicator pair.
CMDRJE	Executing	2E10	8000	You cannot execute the command because the processing by the other software (Device Manager - Storage Navigator or SVP, and so on) is in progress.
CMDRJE	Executing	2E21	9012	The Resource Partition Manager is not installed.
CMDRJE	Executing	2E21	9306	The information of the virtual storage machine is not set in the specified resource.
CMDRJE	Executing	2E21	9308	You cannot operate the LDEV that has the LU path definition.
CMDRJE	Executing	2E30	000C	The specified LDEV is used as a quorum disk.
CMDRJE	Executing	2E30	008B	The specified LDEV cannot be operated because it is the external volume for the online data migration.
CMDRJE	Executing	2E30	008D	The specified volume cannot be operated because it is the mainframe volume.
CMDRJE	Executing	2ECA	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	2202	The specified operation cannot be performed because it is not supported.

Table 9-74 SSB codes that are returned by raidcom modify resource command

raidcom modify resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EF3	2202	The specified operation cannot be performed because it is not supported.

Table 9-75 SSB codes that are returned by raidcom set resource command

raidcom set resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EF3	2202	The specified operation cannot be performed because it is not supported.

Table 9-76 SSB codes that are returned by raidcom reset resource command

raidcom reset resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2EF3	2202	The specified operation cannot be performed because it is not supported.

Table 9-77 SSB codes that are returned by raidcom unlock resource command

raidcom unlock resource				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E10	2200	Cannot unlock because it is locked in another session.

Table 9-78 SSB codes that are returned by raidcom modify clpr command

raidcom modify clpr				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	2E00	0000	It exceeds the settable range of LDEV numbers.
CMDRJE	Executing	2E00	002A	The specified LDEV is not subject to processing.
CMDRJE	Executing	2E00	0101	The parity group number or the external volume group number is not in the effective range.
CMDRJE	Executing	2E00	0102	The specified group type is not correct.
CMDRJE	Executing	2E00	0107	The combined parity group cannot be set across multiple CLPRs.

raidcom modify clpr				
Error message	**Executing / Async**	**Error code**		**Description**
		SSB1	**SSB2**	
CMDRJE	Executing	2E00	1300	The item cannot be migrated to another CLPR because of either reason below. • The specified parity group or external volume group has an LUSE volume. • The specified volume is an LUSE volume.
CMDRJE	Executing	2E00	7000	The specified CLPR number is invalid.
CMDRJE	Executing	2E11	810A	Abnormal cache status.
CMDRJE	Executing	2E13	0101	The CLPR cannot be migrated because the specified parity group or the external volume group includes the pool volume that is used in the pool for Thin Image or Copy-on-Write Snapshot.
CMDRJE	Executing	2E20	0000	LDEV is not installed.
CMDRJE	Executing	2E20	0100	There is no parity group.
CMDRJE	Executing	2E20	4100	There is no external volume group.
CMDRJE	Executing	2E20	7001	The specified CLPR is not installed.
CMDRJE	Executing	2E30	0005	CLPR cannot be transferred by either one of the following two reasons. • Cache Residency Manager is set for the specified volume. • The specified parity group includes the volumes for which Cache Residency Manager are set.
CMDRJE	Executing	2E30	000F	The specified LDEV is used as a journal volume.
CMDRJE	Executing	2E30	0083	The specified parity group includes HDEV with the journal attribute.
CMDRJE	Executing	2EE8	00F0	The specified command cannot be accepted because the command is not supported.
CMDRJE	Executing	2EE8	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.
CMDRJE	Executing	2EF3	0102	The specified parameter is invalid. Check the Command Control Interface Command Reference.
CMDRJE	Executing	2EF3	9F02	The specified operation cannot be performed because it is not supported.
CMDRJE	Executing	2EF6	FEEC	An internal error occurred. Call Hitachi Data Systems Support Center.

Table 9-79 SSB codes that are returned by raidcom add spm_group command

raidcom add spm_group				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B9D4	B9D0	Server Priority Manager is being used by Device Manager - Storage Navigator.
CMDRJE	Executing	B9D4	B9D4	Server Priority Manager program product is not installed.
CMDRJE	Executing	B9D4	B9D6	The number of Server Priority Manager groups exceeds the maximum.

Table 9-80 SSB codes that are returned by raidcom delete spm_group command

raidcom delete spm_group				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B9D4	B9D0	Server Priority Manager is being used by Device Manager - Storage Navigator.
CMDRJE	Executing	B9D4	B9D2	The specified WWN or nickname does not exist.
CMDRJE	Executing	B9D4	B9D4	Server Priority Manager program product is not installed.

Table 9-81 SSB codes that are returned by raidcom modify spm_group command

raidcom modify spm_group				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B9D4	B9D0	Server Priority Manager is being used by Device Manager - Storage Navigator.
CMDRJE	Executing	B9D4	B9D4	Server Priority Manager program product is not installed.

Table 9-82 SSB codes that are returned by raidcom add spm_wwn command

raidcom add spm_wwn				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B9D4	B9D0	Server Priority Manager is being used by Device Manager - Storage Navigator.
CMDRJE	Executing	B9D4	B9D2	The specified WWN does not exist.
CMDRJE	Executing	B9D4	B9D4	Server Priority Manager program product is not installed.
CMDRJE	Executing	B9D4	B9D7	The specified SPM name has already existed.

Table 9-83 SSB codes that are returned by raidcom delete spm_wwn command

raidcom delete spm_wwn				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B9D4	B9D0	Server Priority Manager is being used by Device Manager - Storage Navigator.
CMDRJE	Executing	B9D4	B9D2	The configuration WWN or nickname does not exist.
CMDRJE	Executing	B9D4	B9D4	Server Priority Manager program product is not installed.

Table 9-84 SSB codes that are returned by raidcom modify spm_wwn command

raidcom modify spm_wwn				
Error message	Executing / Async	Error code		Description
		SSB1	SSB2	
CMDRJE	Executing	B9D4	B9D0	Server Priority Manager is being used by Device Manager - Storage Navigator.
CMDRJE	Executing	B9D4	B9D1	The number of WWNs exceeds the maximum that can be set in the system.
CMDRJE	Executing	B9D4	B9D4	Server Priority Manager program product is not installed.
CMDRJE	Executing	B9D4	B9D5	The number of WWNs exceeds the maximum that can be set to the port.

Calling the HDS Support Center

If you need to contact the Hitachi Data Systems Support Center, please provide as much information about the problem as possible, including:

- The circumstances surrounding the error or failure.
- The exact content of any error messages displayed on the host systems.
- The exact content of any error messages displayed by Storage Navigator.
- The Storage Navigator configuration information (use the Dump Tool).
- The data in the CCI error log file and trace data (all files in the HORCM_LOG directory).
- The service information messages (SIMs), including reference codes and severity levels, displayed by Storage Navigator.

The HDS customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the HDS Portal for contact information: https://portal.hds.com

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