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Hitachi Freedom Storage™ Thunder 9500™ V Series

LUN Management 9500V Configuration Guide

Trademarks

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Document Revision Level

Revision	Date	Description
MK-93DF660-P	March 2003	Preliminary Release
MK-93DF660-0	April 2003	Initial Release

Source Documents Used in this Revision

The following source documents were used to produce this guide:

- *LUN Management Configuration Guide* (DF600), LUNManagementSysConfig_r0, dated 2/14/03 (RSD K6602950-0).
- *LUN Management Configuration Guide* (MK-93DF660-Pa7), Hitachi Data System review, dated 3/15/03.
- *LUN Management Configuration Guide* (RSD-93DF660-1), RSD review, dated 3/31/03.
- *LUN Management Configuration Guide* (Modified-MK-93DF660-Pb2), Hitachi Data System review, dated 4/09/03.

Changes in this Revision

- Updated Figure 1.1.
- Updated Figure 2.1.
- Replaced LUN Security with SANtinel™ throughout the document.

Referenced Documents

- *9500V User and Reference Manual* (MK-92DF601)
- *LUN Management 9500V User's Guide* (MK-93DF657)

Preface

The Hitachi Freedom Storage™ Thunder 9500™ V Series LUN Management Configuration Guide describes and provides instructions for connecting the disk array subsystem to hosts via the SAN (Storage Area Network) using LUN Management. The document also provides notes on the SAN system configuration. This configuration guide assumes that:

- the user has a background in data processing and understands direct-access storage device subsystems and their basic functions,
- the user is familiar with the Hitachi Freedom Storage™ Thunder 9500™ V Series array subsystem, and
- the user is familiar with Windows operating system, system commands, and utilities.

Note: The term "9500V" refers to the entire Hitachi Freedom Storage™ Thunder 9500™ V Series subsystem family, unless otherwise noted. Please refer to the *Hitachi Freedom Storage™ Thunder 9500™ V Series User and Reference Guide* (MK-92DF601) for further information on the 9500V disk array subsystems.

Note: The term "SANtinel™" refers to "LUN Security" unless otherwise noted.

Microcode Level

This document revision applies to microcode versions 0652/B and higher.

COMMENTS

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Chapter 1 Overview of LUN Management

1.1 What is LUN Management?

LUN Management is an optional function that manages access paths between hosts and logical units (LUs) for each port. By using LUN Management, two or more host systems or operating systems (Host Storage Domain(HostGroup)) can be connected to a port of the DF600 and LUs can be freely assigned to each Host system.

Illegal access to LUs from any host system can be prevented. Using system security, each host system can safely use a Disk Array Subsystem as if they are connected to several storage systems.

LUN Management function can set Option (Host Connection Mode), Logical Unit (LU) and WWN (World Wide Name) settings for each Connected-Host so that multiple Hosts can be connected to a Port. By using LUN Management function, each Host can access a Logical Unit as if a dedicated Port to the Host even if the Host shares the Port with other Hosts.

Figure 1.1 shows that a port can be shared by each host system.

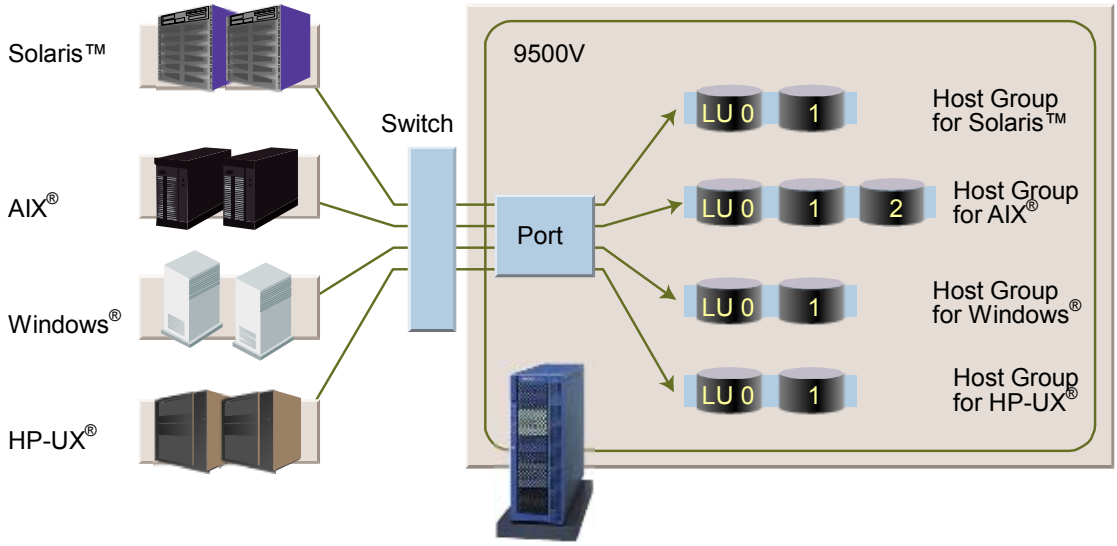

Figure 1.1 Setting Access Paths between Hosts and Logical Units

1.2 Features

Table 1.1 lists LUN Management features.

Table 1.1 Features of LUN Management and Differences between LUN Management and SANtinel™

Item	Features	LUN Management	SANtinel™
1	Illegal access from the other hosts can be prevented.	○ LUs are grouped and the group is registered in a port as a Host Storage Domain (Host Group). It specifies which host can access which LU through assignment of hosts and LUs to each Host Storage Domain (Host Group).	○ For any LU, host access can be specified.
2	The host connection mode can be set for each host connected.	○ The host connection mode can be set for each Host Storage Domain (Host Group). "HP Connection Mode 2", which enables the LU8 and above to be recognized in the HP® connection, can be connected to the same port to which the other hosts are connected.	× (The host connection mode is set for each port.)
3	The LU mapping can be set for each host connected.	○ LU numbers (H-LUN) recognized by a host can be assigned to each Host Storage Domain (Host Group). By virtue of this, two or more hosts that require LU0 can be connected to the same port.	× (The LU mapping is set for each port.)

Note: More hosts can be connected when connections to hosts are concentrated at one port. On the other hand, the traffic on the disk array subsystem is increased. When you use LUN Management, you should design the system configuration to disperse the heavy traffic concentrated at the port, controller, and disk drive.

1.3 Specifications

1.3.1 Specifications of LUN Management

The specifications of LUN Management are shown in Table 1.2.

Table 1.2 LUN Management Specifications

Item	Specifications
Host Storage Domain (Host Group)	• Up to 128 Host Storage Domains (Host Groups) can be set for each Port. • Host Group 0 (zero) is required.
Setting/Deleting a Host Storage Domain (Host Group)	• Host Groups 1 through 127 can be set or deleted. • Host Group 0 (zero) cannot be deleted. In order to delete WWN, options, and LU Mapping of Host Group 0 (zero), initialize Host Group 0 (zero).
Host Storage Domain (Host Group) Name	• A name is assigned to a Host Storage Domain (Host Group) upon creation. This Host Storage Domain (Host Group) Name can be changed.
WWN (Node Name, Port Name)	• Up to 128 World Wide Names (WWN) of Host Bus Adapters (HBA), can be set for a Host Storage Domain (Host Group) or port. • An identical WWN cannot be assigned to another Host Storage Domain (Host Group) in on the identical same Port.
WWN Nickname	• An optional Nickname can be assigned to a WWN allocated to the Host Storage Domain (Host Group). A Nickname can also be omitted. • A Nickname assigned to a WWN is valid until the WWN id deleted.
Host Connection Mode	• The Host Connection Mode of the Host Storage Domain (Host Group can be changed.
LU Mapping	• LU Mapping can be set to the Host Storage Domain (Host Group). • Up to 512 LU Mappings can be set for a Host Storage Domain (Host Group). Up to 512X128 LU Mappings can be set for a Port.
Enable/Disable setting for each port	• LUN Management can be set enable or disable for each Port. • When LUN Management is disabled, previously set LUN Management information is kept and is available when it is enabled again.
Online setting	• When adding, modifying or deleting the setting by LUN Management, it is not necessary to reboot the Disk Array subsystem.
Concurrent use with SANtinel™	• LUN Management cannot be used together with SANtinel™ concurrently.

- Although LU(s) range between LU0 and LU511 for the subsystem, the host recognizes LUN(s) in the range between H-LUN0 and H-LUN255. When you assign LU(s) in the range between LU256 and LU511 to the host, you must set the Host Storage Domain (Host Group) LU Mapping to be between H-LUN0 and H-LUN255.

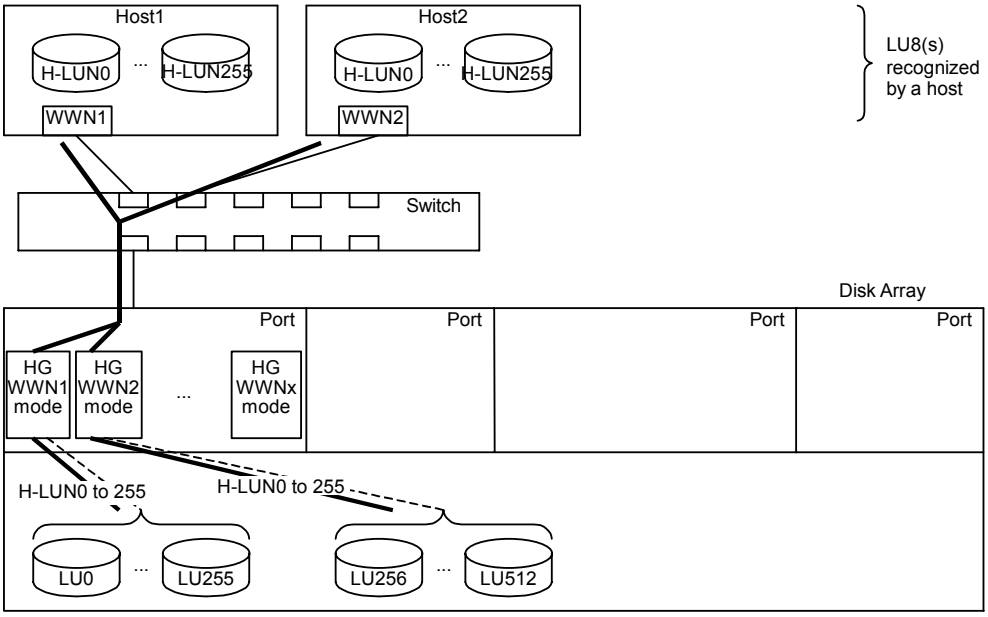

Figure 1.2 Mapping LU(s) in the range between LU256 and LU511 to the Host

- The number of LU Mappings

Up to 512 LU Mappings can be set for a Host Storage Domain (Host Group). Up to 512×128 LU Mappings can be set for a Port.

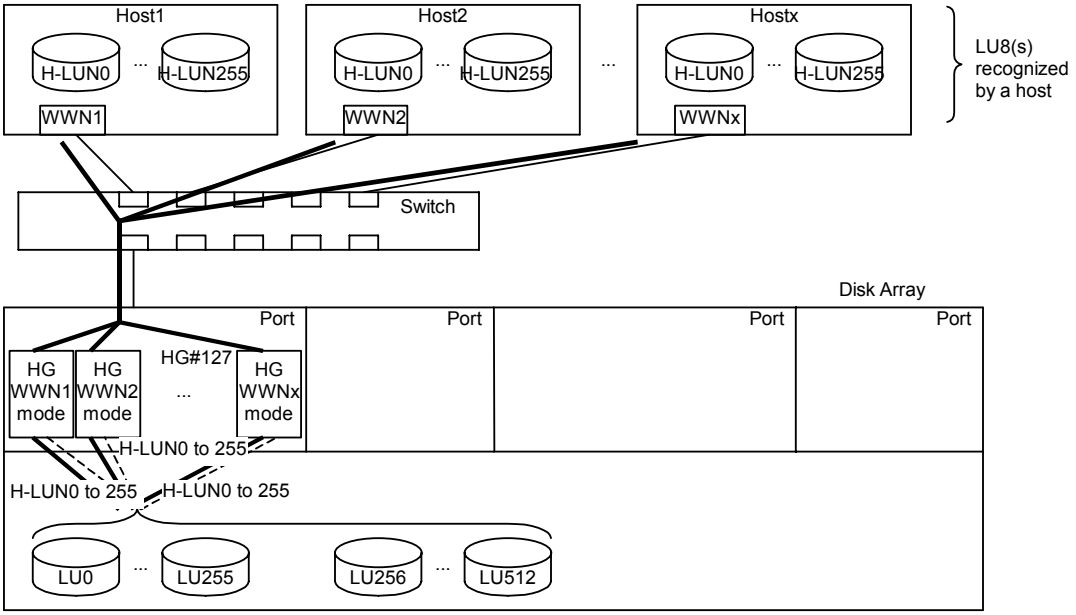

Figure 1.3 The number of LU Mappings

1.3.2 Requirements for Using LUN Management

The requirements for using LUN Management are shown in Table 1.3.

Table 1.3 Requirements of Using LUN Management

Item	Conditions
Means of making setting	Disk Array Management Program 2 (Version 7.20 or later) is required.
Microprogram revision	Microprogram 0652 or later is required.
Coexistence of LUN Management with other optional functions	Optional functions (other than SANtinel™) can be used together with LUN Management.
Queue Depth	512 commands/port

1.4 System Configuration Example

The subsystem is connected to a host with an optical fibre cable. The end of the cable on the host side is connected to an HBA (Host Bus Adapter), and that on the subsystem side, to a port of the disk array subsystem.

Using LUN Management, LUs can be grouped and assigned to a port as a Host Storage Domain (Host Group). The user can then specify which HBA can access the group by assigning the WWNs of the HBAs to each Host Storage Domain (Host Group). The idea is to identify which LUs you want to use through which physical port with a particular host, and define a host storage domain on that port for these LUNs.

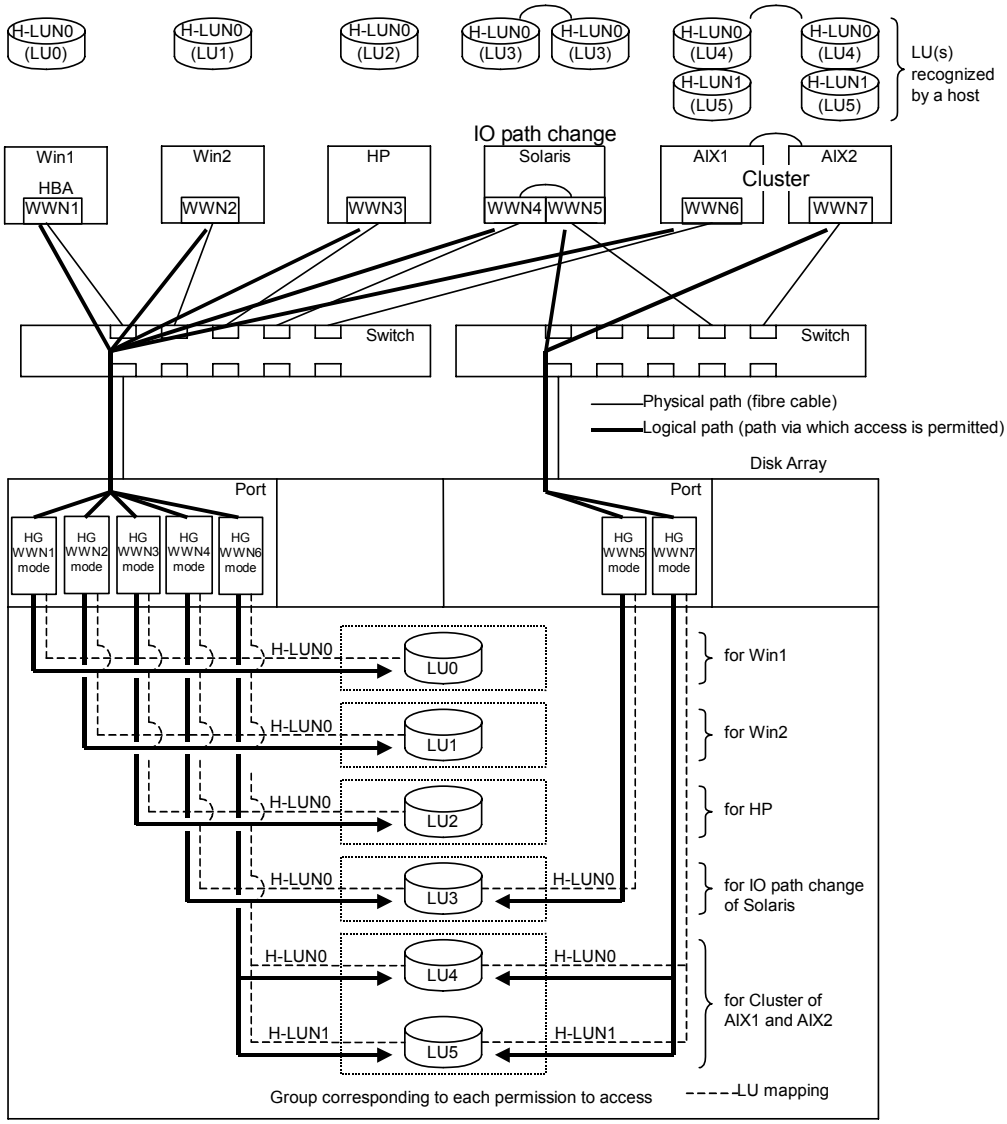

Figure 1.4 System Configuration Sample

Figure 1.5 and Figure 1.6 show possible configurations for creating the Host Storage Domain (Host Group) for multipathed and clustered environments.

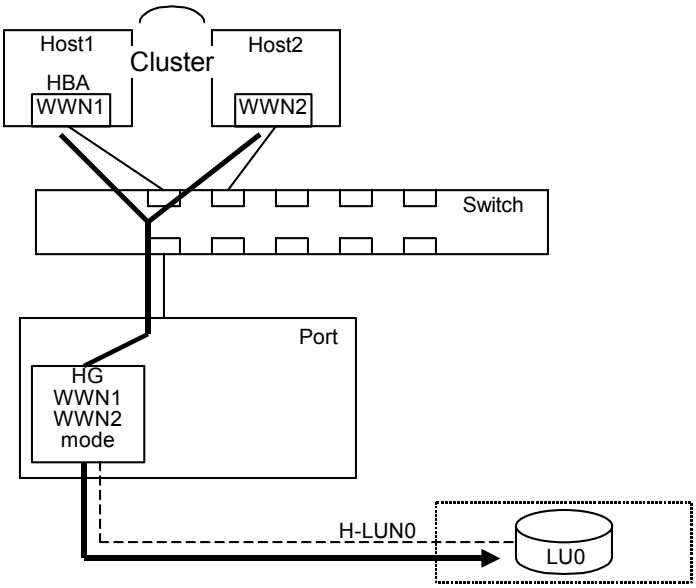

Figure 1.5 Configuration 1 (One Host Storage Domain (Host Group))

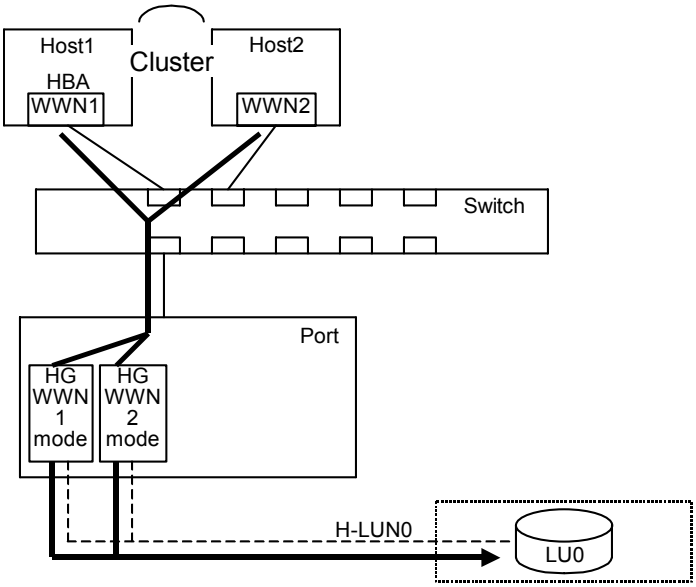

Figure 1.6 Configuration 2 (Two Host Storage Domains (Host Groups))

1.5 Notes

- Verify that the Host Storage Domain (Host Group) information is correct and accurate.
- This function is not available when a host (OS or driver) cannot identify an LU without LUN#0. It is necessary to set H-LUN = 0 to the Host Storage Domain (Host Group) in this case.

Table 1.4 Combinations of OS (Operating System) and HBA

OS	HBA*	Remarks
HP-UX®	Genuine HP® HBA	When HP connection mode2 = ON is selected
IRIX®	Genuine SGI™ HBA	
Windows® 2000	Emulex HBA (with Miniport Driver) Qlogic HBA	
Linux®	Emulex HBA Qlogic HBA	

* ***Note:*** HBAs listed may not be all inclusive. For information on supported fibre-channel adapters (FCAs), optical cables, hubs, and fabric switches, please contact your Hitachi Data Systems account team or the Hitachi Data Systems Support Center (see section 5.2).

- When you replace an HBA in a host server attached to a 9500V using Host Storage Domain (Host Group), be sure to change the WWN setting in LUN Management.
- Host Storage Domain (Host Group) settings (enabling or disabling) are not valid immediately after the setting. To make the setting valid, reboot the host (to be recognized again).
- The WWN set up when using SANtinel™ is succeeded and used after uninstalling SANtinel™ and installing LUN Management. However, if the WWN is set as 0 when using SANtinel™, the WWN should be deleted before installing LUN Management.

1.5.1 The Default Queue Depth Configuration of Each System

The default Queue Depth setting for each host operating system is shown in Table 1.5. Each system has an individual Queue Depth value unit and setting unit.

Table 1.5 The Queue Depth Configuration

Platform	HBA	Queue Depth		Unit of Setting
		Unit of Value	Default	
Solaris™		LU	512	OS
HP-UX®		LU	8	LU
AIX®		LU	1	LU
IRIX®		LU	1	LU
Windows®	Emulex (Port)	LU	8	HBA
	Emulex (MiniPort)	LU	32	HBA
	Qlogic	Port	16	HBA

1.5.2 Queue Depth Limits of System Combination

When the following host operating system combination is connected to a single port of the disk array subsystem, you must set the Queue Depth value described in Table 1.6.

Please see 3.6 for more information on the setting of queue depth.

Table 1.6 Queue Depth Limits of System Combination

System Combination	Setting Queue Depth
Windows NT®/Windows® 2000 MSCS	16/port (for Qlogic HBA
HP-UX® MC/ServiceGuard	No limit (Adjust the Queue Depth to other systems)

Chapter 2 Using LUN Management

This chapter explains procedures required when installing, using, and configuring LUN Management. Actions to be taken when failures occur are also explained.

2.1 Flow of Operations Required

The procedures required to install and use LUN Management are shown in Figure 2.1.
Note: The individual responsible for each procedure is the customer.

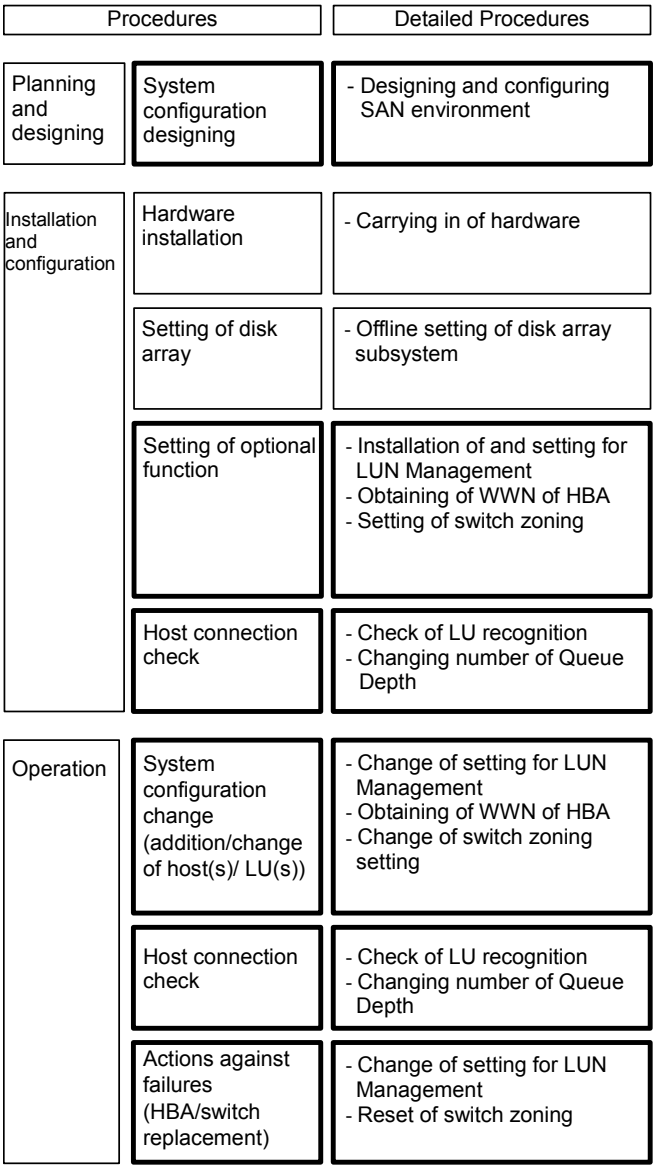

Figure 2.1 Flow of Operations Required for Using LUN Management

2.2 Operations Required for Installation and Operation

- Planning and designing: System configuration designing

  Design connections between hosts and the disk array subsystem for constructing the SAN (Storage Area Network) environment.

  Design connections to the switch, setting for LUN Management, and setting of the switch zoning. Additionally, Queue Depth for each host connected to the disk array subsystem must be identified.

- Installation and configuration: Setting of optional function

  The WWN(s) of the HBA(s) to be set for LUN Management must be identified. Please refer to the *LUN Management User's Guide* (MK-93DF657) for how to identify the WWN of each platform or HBA.

  Install LUN Management and make setting for it according to the system configuration design.

  Set a zoning of the switch when necessary.

- Installation and configuration: Host connection check

  Check and verify that each host can recognize the LU(s).

  Change the Queue Depth of each host when necessary. For instructions on changing the Queue Depth of each host or HBA, refer to the *LUN Management User's Guide*.

- Operation: System configuration change (addition/change of host(s)/LU(s))

  It is necessary to add or change setting for LUN Management when the hosts connected to the disk array subsystem are added or changed, or when the number of LUs assigned to a Host Storage Domain (Host Group) is increased. When adding a host or changing a connected host, a WWN of an HBA of the host must be identified.

  Set a zoning of the switch when necessary.

- Operation: Host connection check

  When the setting for LUN Management is added to or changed, also check if each host can recognize the LU(s) in accordance with the change.

  Change the Queue Depth of each host when necessary.

- Operation: Correcting failures (HBA/switch replacement)

  When an HBA is replaced because of an HBA failure, the WWN registered in LUN Management must be changed to that of the new HBA.

  In addition, when the switch is replaced, the same zoning must be set for the new switch.

Chapter 3 Configuration of the SAN System

When connecting multiple hosts to one port of the disk array subsystem, the system must be designed to take into account the following:

- System design
  - Determining assignment of LUs to hosts
  - Determining assignment of LUs to RAID groups
  - Determining the system configuration
  - Determining the method of illegal access prevention
  - Determining the Queue Depth
- System configuration
  - Setting LUN Management
  - Setting the switch zoning
- Component addition and replacement
  - Host and HBA addition
  - LU addition
  - HBA replacement
  - Switch replacement

3.1 System Design

The following must be taken into consideration during system design:

- Assignment of LUs to Hosts

  Group logical units (LUs) of the disk array subsystem into groups with permitted access. Manage the group of the LUs as a Host Storage Domain (Host Group). Use Host Storage Domain (Host Group) when making setting for LUN Management.

- Avoiding Contention

  Each LU is defined as belonging to a RAID group. Therefore, when two LUs (defined as belonging to the same RAID group) are accessed at the same time, operational performance may decrease. When operating two or more hosts at the same time, it is recommended that LUs (assigned to each host) be assigned to separate RAID groups.

- System Configuration

  When connecting more hosts than ports of the disk array subsystem, increase the number of ports to be connected to hosts using the fibre channel switch.

- Methods of Illegal Access Prevention

  Determine input/output paths between hosts and LUs according to the assignment mode using LUN Management. The input/output path is a route permitting access from the host is permitted.

  Set zoning for the switch in order to prevent an effect from the other hosts that share the switch. When the zoning is set, other ports outside the zone do not affect ports within the zone.

- Queue Depth

  Multiple hosts can now be connected to a single port. But, the Queue Depth that can be handled by one port is limited and performance drops if the limit is exceeded. Therefore, specify the Queue Depth so that the sum for all hosts does not exceed the value of the limit per port.

3.2 System Configuration

Configure the system as designed by:

- Making setting for LUN Management

  Set the following for the disk array subsystem in order to specify input/output paths between hosts and LUs using LUN Management.

  - Host Storage Domain (Host Group)
  - WWN of HBA
  - LU mapping
  - Host connection mode

  It is necessary to manage the settings that have been made for the disk array subsystem keeping a documented record. When an HBA is replaced, change the WWN accordingly.

  In this way, you can identify the WWN that was set before the replacement by referring to the record.

- Zoning of switch

  Connect hosts and the disk array subsystem to the switch and set a zoning for the switch.

  The diagram of connections between the switch and hosts and between the switch and disk array subsystem must be managed by keeping a documented record together with the zoning settings. When the switch is replaced, you can make the same connections as before the replacement by referring to the record.

3.3 Addition and Replacement of Equipment

The following are tasks required after introducing LUN Management:

- Adding host and HBA

  When assigning LUs within the disk array subsystem to a host and an HBA, add a Host Storage Domain (Host Group) to the disk array subsystem. When adding a setting of LUN Management, it is not necessary to restart the disk array subsystem. Execute a host boot or the disk recognition command after making a setting of LUN Management.

- Adding LU

  When adding an LU to the disk array subsystem and assigning it to a host that has been connected, add a mapping of the LU to the Host Storage Domain (Host Group) to which the host belongs. When adding the setting for LUN Management, it is not necessary to restart the disk array subsystem. Execute a host boot or the disk recognition command after making a setting of LUN Management.

- Replacing HBA

  When replacing an HBA of a host, the setting for LUN Management must be modified. Change the WWN of the HBA. If you do not make this change, the host will not be able to access the LU after the replacement of the HBA.

  Each setting for LUN Management must be documented when the configuration is created so that the previous setting can be reviewed before making a change to the setting.

- Replacing switch

  When replacing the switch, the same connections and zoning setting used before the replacement must be made for the new switch. If the setting of the port and zoning for the connected switch do not agree with each other, the host will not be able to access the LU. In order to make the same connections as before the replacement, the diagram of connections between the switch and hosts and between the switch and disk array subsystem must be documented together with the setting of zoning.

3.4 Avoiding Contention and RAID Groups

When two or more hosts are connected to a disk array subsystem and LUs assigned to each host belong to the same RAID group, concurrent access to the same disk drive will occur. Because of this conflict for access to the disk drive, performance may decrease. Basically, LUNs in one RAID group should only be accessed by one host. To avoid a conflict, you should never have more than one host access multiple LUNs in one RAID group.

The number of RAID groups that can be created is determined according to the number of mounted disk drives and the RAID level of the RAID groups to be created. If unable to create as many RAID groups as hosts to be connected, organize the RAID groups according to operational states of the hosts (see Figure 3.1 and Figure 3.2).

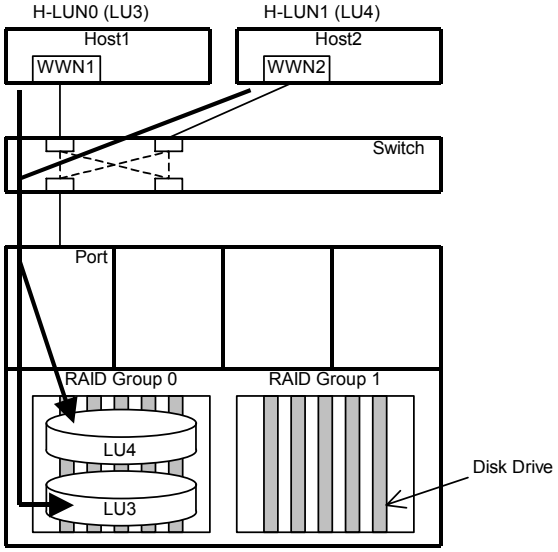

Figure 3.1 In the Case of the Same RAID Group

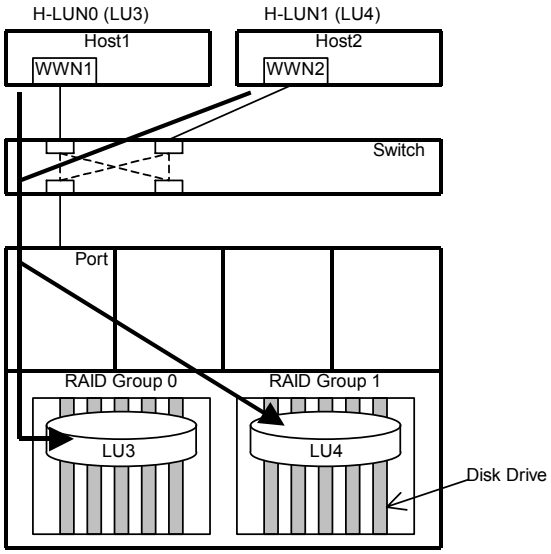

Figure 3.2 In the Case of the Respective RAID Groups

3.5 Design for Preventing Illegal Access of SAN

When connecting hosts to one port of the disk array subsystem using a switch, a control to distinguish accessible hosts is required for each LU.

When assigning LU3 to Host 1 and LU4 to Host 2, both hosts can access the same LU if the LU mapping is set alone as shown in Figure 3.3. When LUN Management is used in this case, the host (WWN: World Wide Name) access to each LU can be distinguished even in the same port. It is recommended that zoning be set in order to prevent ports of the disk array subsystem from being affected by the other host even when LUN Management is used (see Figure 3.5).

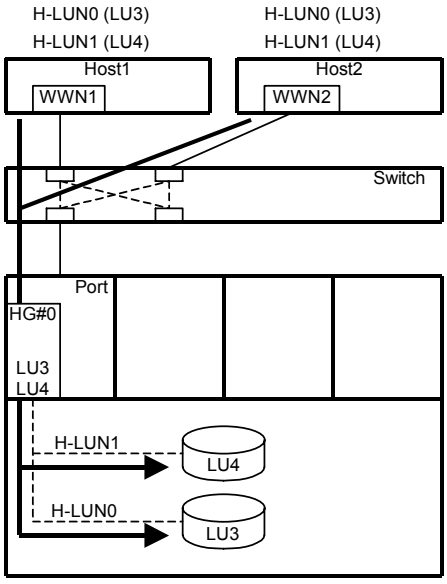

Figure 3.3 A Case Where Only LU Mapping Is Set

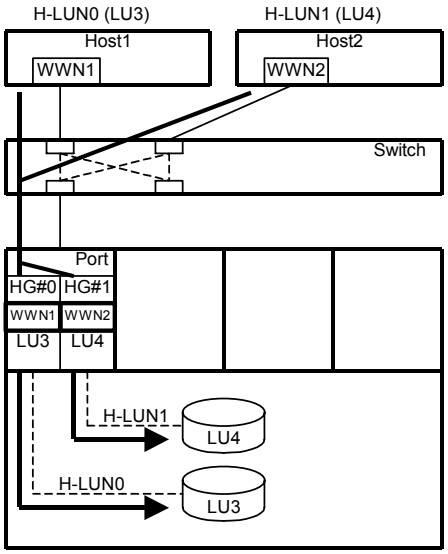

Figure 3.4 A Case Where LUN Management Is Used

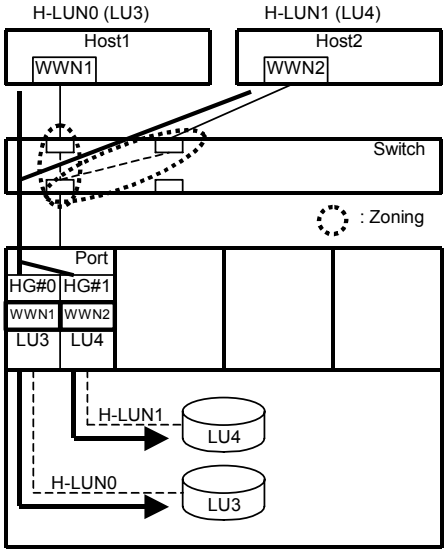

Figure 3.5 A Case Where LUN Management and Switch Zoning is Used

3.6 Queue Depth Setting of SAN

A host can queue successive commands to the disk array subsystem before execution of a previous command can complete. The number of times successive commands are issued is called Queue Depth. When two or more hosts are connected to a port of the disk array subsystem, the number of Queue commands for the port is increased because the host issues commands to the disk array subsystem successively.

Multiple hosts can now be connected to a single port. But, the Queue Depth that can be handled by one port is limited and performance drops if the limit is exceeded. Therefore, specify the Queue Depth so that the sum for all hosts does not exceed the value of the limit per port. The disk array subsystem reports the Queue Full status with commands received after the limit is exceeded. Since the host that has received the report of the Queue Full status stops issuing the multiplex command, a decrease in host performance may occur.

In order to avoid such a situation, Queue Depth should be carefully considered when designing the system.

Note: When the Queue Depth setting is increased, traffic on the disk array subsystem is also increased. At the same time, traffic on the host and switch may also be increased. This should be taken into consideration when changing the Queue Depth setting.

Note: The formula for defining Queue Depth on the host side varies depending on the type of operating system or HBA. When laying out the overall Queue Depth settings for all hosts, consideration should be given to the port limit.

3.6.1 Increasing Queue Depth Setting and Port Sharing

Figure 3.6 shows how to determine the Queue Depth when a port is shared.

In this system, Host 1, Host 2, Host 3, and Host 4 are connected to a port that is given a multiple number of commands limited to 512. In this case, the Queue Depth for the port must be specified so that a sum of numbers of Queue Depth for each host, A, B, C, and D, does not exceed X.

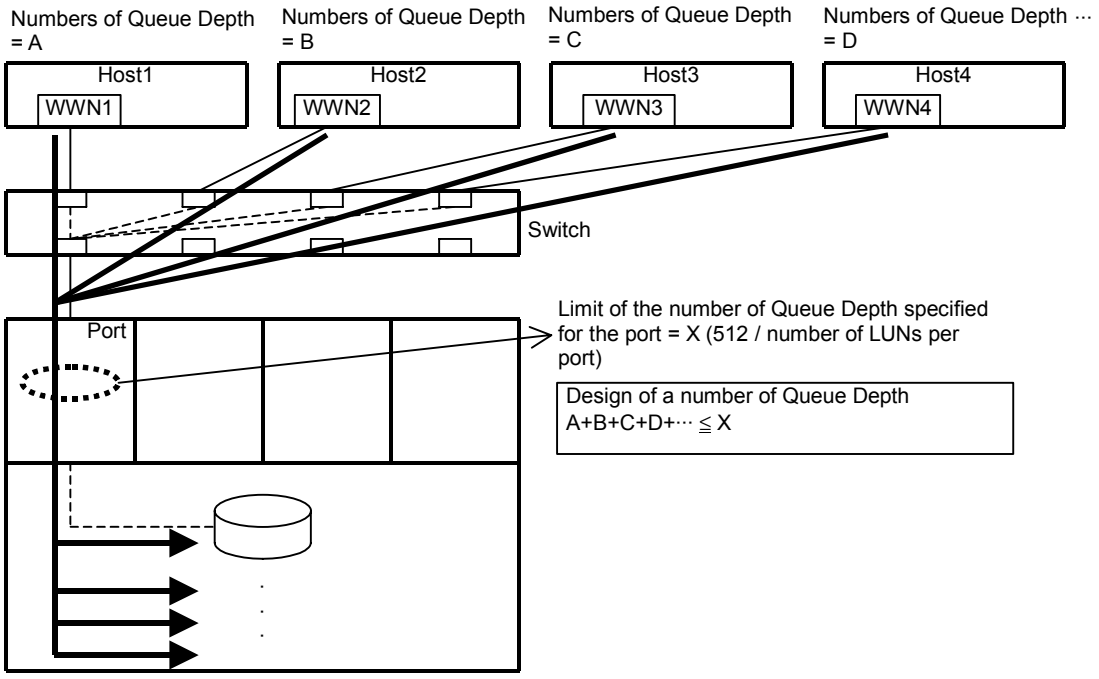

Figure 3.6 Queue Depth in the Case Where Port Is Shared

3.6.2 Increasing Queue Depth Through Path Switching

Figure 3.7 shows how to determine the Queue Depth when an alternative path is configured. The system shown has a configuration with an alternative path: the Host 1 and Host 2 sides of which are assigned to the Primary and Secondary paths respectively.

Normally, commands are supposed to be issued to a LU via the Primary path on the Host 1 side. In a configuration like this, when commands to be issued via the Primary path are moved to the Secondary path because a path switching is done, the Queue Depth for a port connected to a host on the Secondary path is increased. It is necessary to specify the Queue Depth for each host so that the number does not exceed its limit even after the path switching is done.

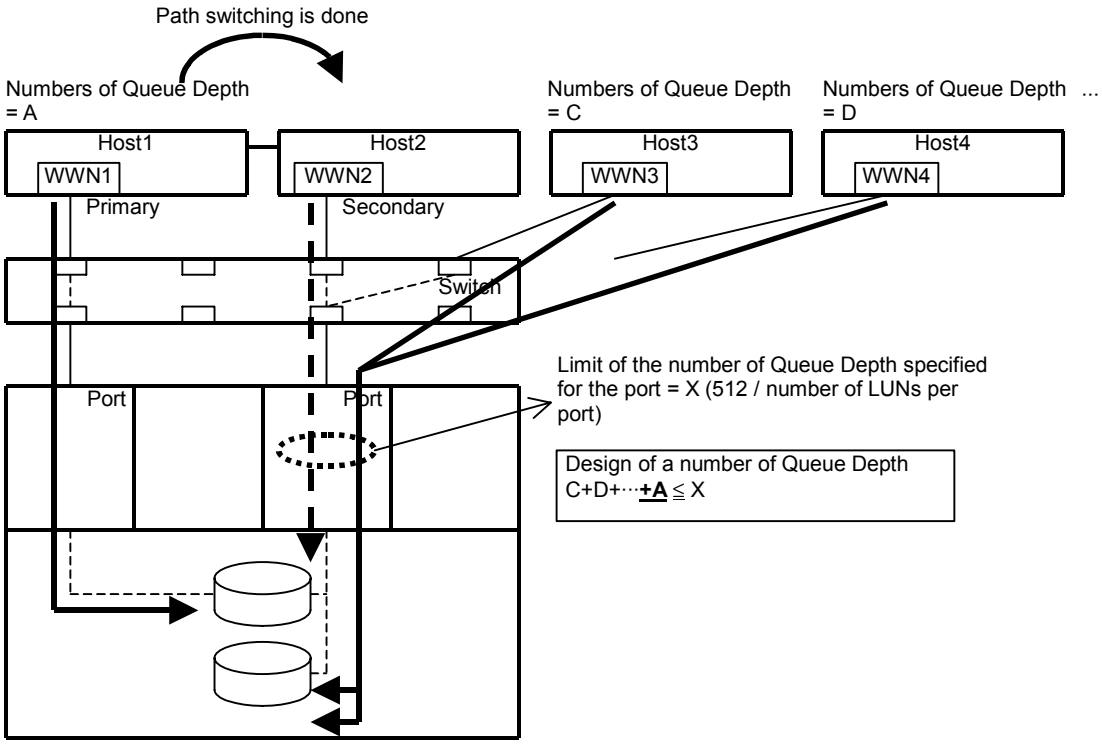

Figure 3.7 Increment of Queue Depth Generated Due to Path Switching

3.6.3 Allocation of Queue Depth According to Priority of Host Job

Figure 3.8 shows how to determine the Queue Depth when the priority order is given to jobs of connected hosts. To raise the priority of the host job individually, increase the Queue Depth for the host. When a Queue Depth for a certain host is increased, it is necessary to have the number for the port concerned not exceed its limit. This is done by reducing the numbers for the other hosts connected to the port.

Note: If the disk array subsystem does not have prioritized order control, you must allocate the number of host Queue Depth.

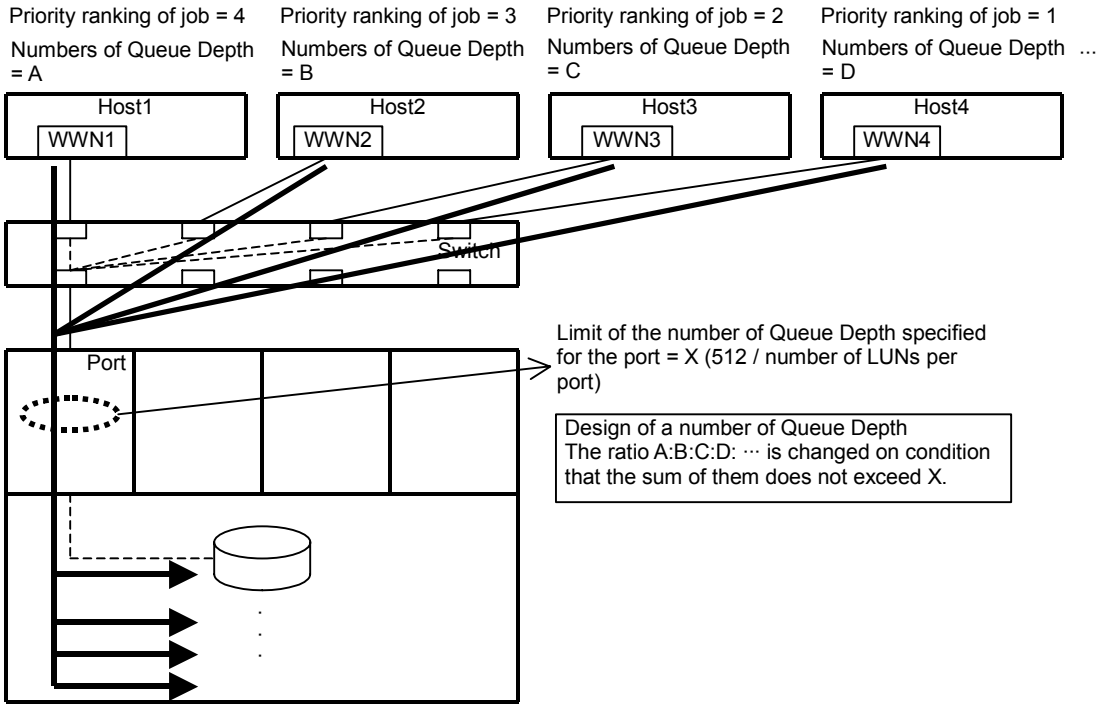

Figure 3.8 A Case Where Priority Order Is Given to Host Jobs

Chapter 4 Troubleshooting

4.1 Troubleshooting

The Freedom Storage™ Thunder 9500™ V Series subsystem provides continuous data availability. For troubleshooting information on the 9500V subsystem, please refer to the *9500V User and Reference Manual* (MK-92DF601).

Table 4.1 lists potential error conditions during 9500V LUN Management configuration and provides instructions for resolving each condition. If you are unable to resolve an error condition, please contact your Hitachi Data Systems representative, or call the Hitachi Data Systems Support Center for assistance.

Table 4.1 Troubleshooting

Error Condition	Recommended Action
LUN Management cannot be used.	Check if SANtinel™ function is used or not. If SANtinel™ is used, uninstall SANtinel™. LUN Management cannot be used together with SANtinel™.
Host cannot access the LU.	-Check the configuration regarding WWN of HBA. -Check the setting regarding the number of the LU to the Host Storage Domain(Host Group).

4.2 Calling the Hitachi Data Systems Technical Support Center

If you need to call the Hitachi Data Systems Technical Support Center, be sure to provide as much information about the problem as possible. Include the circumstances surrounding the error or failure and the exact content of any error codes and/or messages displayed. The worldwide Hitachi Data Systems Technical Support Centers are:

- Hitachi Data Systems North America/Latin America
  San Diego, California, USA
  1-800-348-4357
- Hitachi Data Systems Europe
  Contact Hitachi Data Systems Local Support
- Hitachi Data Systems Asia Pacific
  North Ryde, Australia
  011-61-2-9325-3300

Acronyms and Abbreviations

H-LUN	host-logical unit number
HBA	host bus adapter
FCA	fibre-channel adapter
IO	input/output
LU	logical unit
LUN	logical unit number
LUN Security	Currently known as SANtinel™
OS	operating system
SAN	storage area network
SANtinel™	Previously known as LUN Security
WWN	world wide name

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