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Hitachi Freedom Storage™ Lightning 9900™ V Series

LUN Expansion and Virtual LVI/LUN User Guide

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Document Revision Level

Revision	Date	Description
MK-92RD104-P	April 2002	Preliminary Release
MK-92RD104-0	July 2002	Initial Release
MK-92RD104-1	October 2002	Revision 1, supersedes and replaces MK-92RD104-0

Source Documents for This Revision

- Vll45d0d (Hitachi Source Document, September, 2002)
- E-mail from Yin Chen (Friday, September 27, 2002)
- R104_1b (Hitachi Source Document)

Changes in This Revision

- Added new section creating a LUSE volume using Volume Count (section 3.2.2 and Figure 3.12)
- Added LDEV Security icon to section 4.1.3
- Added Volume Count definition (section 3.1.4)
- Replaced Figure 3.4

Referenced Documents

- *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100)
- *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console – Storage Navigator User's Guide* (MK-92RD101)
- *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105)
- *Hitachi Freedom Storage™ Lightning 9900™ V Series FlashAccess User's Guide* (MK-92RD102)

Preface

This *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Expansion and Virtual LVI/LUN User's Guide* provides instructions for using these options on the 9900V Storage Navigator, using the web client Java™ applet program for the 9900V subsystem.

This user's guide assumes that the:

- user has a background in data processing and understands direct-access storage device (DASD) subsystems and their basic functions,
- user is familiar with the Lightning 9900V subsystem and has read and understands the *Hitachi Lightning 9900™ V Series User and Reference Guide* (MK-92RD100), and
- user is familiar with the operating system (for example, Windows®, Solaris™) and web browser software (for example, Internet Explorer, Netscape) on the system hosting the 9900V Storage Navigator remote console software.

Note: The term "9900V" refers to the entire Lightning 9900™ V Series subsystem family, unless otherwise noted. For further information on the 9900V subsystem, please contact your Hitachi Data Systems account team, or visit Hitachi Data Systems online at http://www.hds.com.

Note: The use of the Storage Navigator software and all other Hitachi Data Systems products is governed by the terms of your license agreement(s) with Hitachi Data Systems.

Note: This product includes software developed by the Apache Group for use in the Apache HTTP server project (http://www.apache.org/).

Note: The Storage Navigator screens shown in this document were captured on a Windows® system with the Internet Explorer web browser. The Storage Navigator screens may display differently on other operating systems and browsers.

Microcode Level

This document revision applies to 9900V microcode versions 21-03-*xx* and higher.

COMMENTS

Please send us your comments on this document: doc.comments@hds.com.

Make sure to include the document title, number, and revision.
Please refer to specific page(s) and paragraph(s) whenever possible.

(All comments become the property of Hitachi Data Systems Corporation.)

Thank you!

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1.1 Overview of LUSE Operations

LUSE operations allow hosts that can only use a limited amount of LUs per fibre interface to have access to larger amounts of data by using expanded LUs (see Figure 1.1). See Table 1.1 and Table 1.2 for LUSE and VLL LUSE specifications.

LUSE operations include the following:

- Viewing concatenated parity groups (see section 3.2.1)
- Creating new LUSE volumes (see section 3.2.2)
- Releasing LUSE volumes to individual LUs (see section 3.2.3)
- Changing the size of a LUSE volume (see section 3.2.4)

The following guidelines apply to LUN Expansion:

- A maximum of 256 expanded LUs can be configured on the same port.
- LDEVs that are to be combined into LUSE volumes should have no assigned SCSI paths and be unmounted from the host. These are known as free (or available) LDEVs. For instructions on deleting SCSI paths, please see *Hitachi Freedom Storage™ Lightning 9900™ LUN Manager User's Guide* (MK-92RD105).
- Combining non-sequential LDEVs into a LUSE is supported, provided they are on the same CU.
- Combining Virtual LVI/LUN volumes into a LUSE is supported, provided they are the same size and emulation type and on the same CU. The order of operation is important.
  a) Create one or more Virtual LVI/LUN volumes.
  b) Combine those volumes into a LUSE volume.

  Note: You cannot perform Virtual LVI/LUN operations on an existing LUSE volume because a LUSE volume must have a SCSI path already specified.
- Combining Virtual LVI/LUN volumes and normal volumes into the same LUSE is not supported.
- Combining command devices, Just In Time or CruiseControl volumes into a LUSE is not supported.
- Combining RAID 1 and RAID 5 volumes into the same LUSE is supported, but not recommended.
- Combining emulation types (OPEN-3, OPEN-8, OPEN-9, OPEN-E, or OPEN-L) into the same LUSE is not supported.
- Combining LUSE volumes into larger LUSE volumes is not supported.
- Some operating systems may experience slow disk access times with large logical units, if they contain a large number of high-usage files.
- The size of a LUSE can affect the amount of time required to perform backups.

Note: The queue depth for open systems can vary, depending on the type of platform. For more information on queue depth, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ LUN Manager User's Guide* (MK-92RD105) or contact your Hitachi Data Systems Customer Support Center for assistance.

Warning: Except for systems running Windows NT® or Windows® 2000, creating and releasing expanded LUs is a destructive process. Be sure to back up your data before proceeding.

Table 1.1 LUSE Specifications

Parameter	OPEN-3	OPEN-8	OPEN-9	OPEN-E	OPEN-L
LU Capacity	2.4 GB	7.3 GB	7.3 GB	14.5 GB	36.4 GB
Possible number of expanded LUs	2 - 36 LUs	2 - 36 LUs	2 - 36 LUs	2 - 36 LUs	2 - 36 LUs
Expanded LU Capacity	4.8 GB - 88.6 GB	14.6 GB - 264.4 GB	14.7 GB - 265.8 GB	29.1 GB - 524.4 GB	72.9 GB - 1312.2 GB
Product Name	OPEN-3*n (n = # of LUs in the expanded LU)	OPEN-8*n (n = # of LUs in the expanded LU)	OPEN-9*n (n = # of LUs in the expanded LU)	OPEN-E*n (n = # of LUs in the expanded LU)	OPEN-L*n (n = # of LUs in the expanded LU)

Table 1.2 VLL LUSE Specifications

Parameter	OPEN-3	OPEN-8	OPEN-9	OPEN-E
LU Capacity	35 MB - 2.4 GB	35 MB - 7.3 GB	35 MB - 7.3 GB	35 MB - 14.5 GB
Possible number of connected LUs	2 - 36 LUs	2 - 36 LUs	2 - 36 LUs	2 - 36 LUs
Capacity of expanded LUs	70 MB - 84.2 GB	70 MB - 250.2 GB	70 MB - 252.6 GB	70 MB - 524.4 GB
Product Name	OPEN-3*n-VLL (n = # of LUs in the expanded LU)	OPEN-8*n-VLL (n = # of LUs in the expanded LU)	OPEN-9*n-VLL (n = # of LUs in the expanded LU)	OPEN-E*n-VLL (n = # of LUs in the expanded LU)

Note: Virtual LVI/LUN is not applicable to OPEN-L.

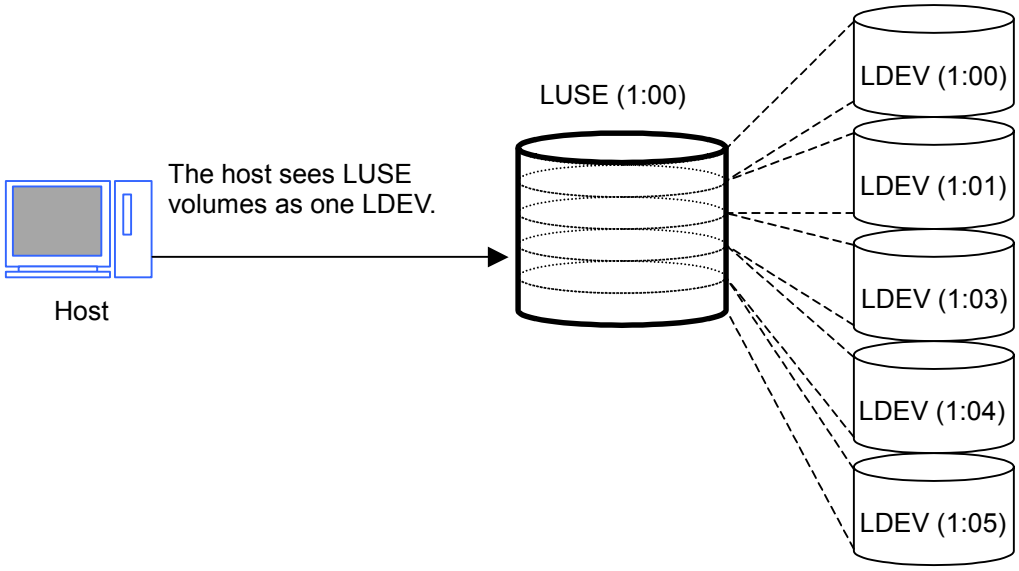


Figure 1.1 LUSE Configuration

1.2 Overview of Virtual LVI/LUN

1.2.1 Virtual LVI/LUN Parameters

Virtual LVI/LUN (VLL) allows you to configure variable-size volumes, which are usually smaller than normal (fixed-size) volumes. Virtual LVI/LUN improves data access performance by reducing logical device contention and host I/O queue times, particularly when several frequently accessed files are located on the same volume. Virtual LVI/LUN enables better utilization of the physical storage capacity of the 9900V, and reduces the amount of administrative effort required to balance I/O workloads.

Virtual LVI/LUN allows you to perform the following types of operations:

- Viewing concatenated parity groups (see section 4.2.1)
- Converting a normal volume into free space (see section 4.2.2)
- Defining and installing a Virtual LVI/LUN (customized) volume (see section 4.2.3)
- Deleting a Virtual LVI/LUN volume (see section 4.2.4)
- Initializing a Virtual LVI/LUN volume (see section 4.2.5)

Figure 1.2 illustrates the available Virtual LVI/LUN functions:

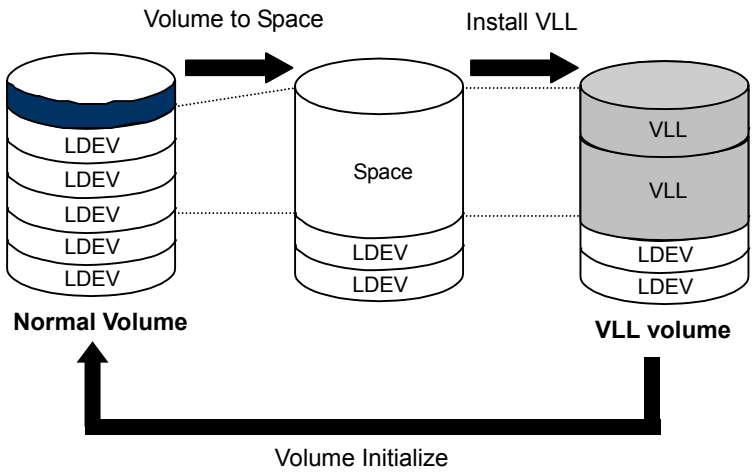


Figure 1.2 Virtual LVI/LUN Operations

Note: Virtual LVI/LUN used in conjunction with FlashAccess can achieve greater performance improvements than when either of these options is used individually. For more information on FlashAccess, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series FlashAccess User's Guide* (MK-92RD102).

A parity group is called a normal or fixed-size volume (FV) when all of its member LDEVs are a fixed-size. In a normal volume, the size of the member LDEVs is determined by type of device that is being emulated, and the number of LDEVs is determined by the physical size of the parity group.

Generally, each array group has a certain amount of free space available after the standard LDEVs for the array group have been defined. On the 9900V, Virtual LVI/LUN formats one or more of the LDEVs on a selected volume into free space. That free space can either be used to install one or more variable-sized volumes, or left as free space for future use.

Note: At least one LDEV must remain defined as a normal volume in each array group.

The following parameters apply to Virtual LVI/LUN operations:

- S/390® volumes must be offline from the host OS, and open volumes must be either offline or unmounted from the host OS with no SCSI paths assigned to them. For more information on configuring SCSI paths, please see *Hitachi Freedom Storage™ Lightning 9900* TM *V Series LUN Manager User's Guide (*MK-92RD105).
- LUSE volumes and secured open volumes are not available for Virtual LVI/LUN operations, because these volumes must have SCSI paths already defined.
- To create a VLL/LUSE volume:
  a) Create two or more Virtual LVI/LUN volumes with the same size, emulation type and CU number.
  b) Combine those volumes into a LUSE device.

  For more information on creating VLL volumes, see section 4.2.3. For more information on creating LUSE devices see section 3.2.1.
- Multiple LDEVs can be selected for conversion to Virtual LVI/LUN volumes but they must be in the same Virtual Device (VDEV).
- When space in an LDEV is converted to a Virtual LVI/LUN volume, assign an LDEV address to that Virtual LVI/LUN volume. For mainframes, each Virtual LVI volume also has its own assigned unit control block (UCB), which is controlled from the mainframe host.
- Virtual LUN operations are not available for OPEN-L volumes.
- When you convert a normal volume to a Virtual LVI/LUN volume, you can use all or part of the space previously assigned to that volume (for example, 3339 cylinders for a 3390-3) for use in Virtual LVI/LUN volumes. Each VDEV can support a total of 256 volumes, including both fixed-size and Virtual LVI/LUN volumes.

WARNING: The Virtual LVI/LUN function is destructive. Make sure to back up your data before performing Virtual LVI/LUN operations.

A normal volume consists of some fixed volumes (FV) and some free space. The number of fixed volumes is determined by the emulation type. A Virtual LVI/LUN volume usually consists of at least one fixed volume (FV), one or more customized volumes (VLL volumes), and some free space (see Figure 1.3).

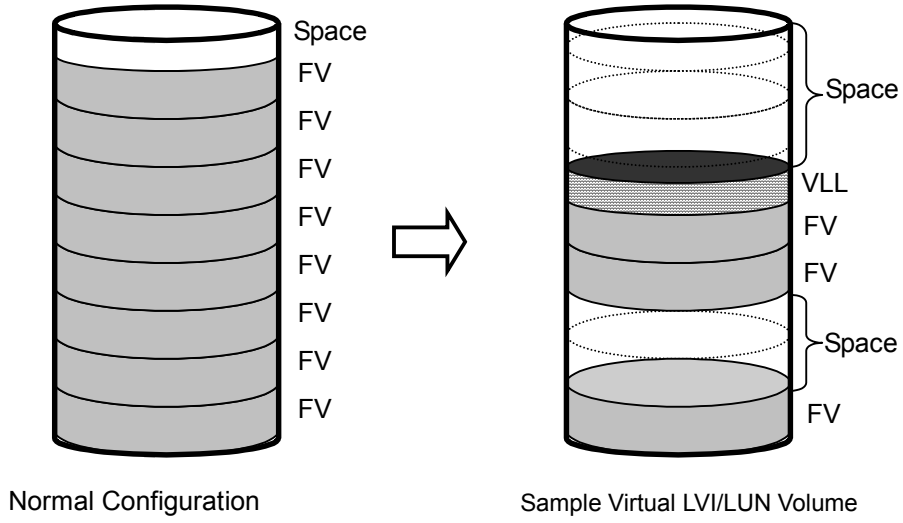


Figure 1.3 Virtual LVI/LUN Volume Configuration

Multiple LVI/LUN types can be configured within each Virtual LVI/LUN volume, so long as the device type is from the same device family (for example, all open volumes, or all 3390s). Open and S/390® volumes are not allowed in the same parity group.

Table 1.3 lists the Virtual LVI/LUN specifications, Table 1.4 lists the minimum and maximum Virtual LUN volume capacities for open systems, and Table 1.5 lists the Control Cylinders/Control Area for Each LVI/LU Type.

Table 1.3 Virtual LVI/LUN Specifications

Parameter	Mainframe	Open Systems
Track format	3390	OPEN-3, OPEN-8, OPEN-9, OPEN-E
Emulation type	3390-3, -3A, -3B, -3C, -3R, -9, -L	OPEN-3, OPEN-8, OPEN-9, OPEN-E
Ability to intermix emulation type	Yes, for 3390. No, for open-system volumes.	Yes, by track geometry (except for AIX® systems). No, for S/390® volumes.
Maximum number of volumes (normal and Virtual LVI/LUN) per VDEV	256	256
Maximum number of volumes (normal and Virtual LVI/LUN) per subsystem	8,192	8,192
Minimum size for one Virtual LVI/LUN volume	1 user cylinder (+ control cylinders)	35 MB (+ control area)
Maximum size for one Virtual LVI/LUN volume	See Table 1.5	See Table 1.5
Size increment	1 user cylinder	1 MB
Disk location for Virtual LVI/LUN volumes	Anywhere	Anywhere

Note: VLL functions are not applicable to OPEN-L volumes.

Table 1.4 Minimum and Maximum Virtual LUN Volume Capacities (Open Systems)

Setting size (MB)	Actual Size (MB)	Notes
35	35.15625	Minimum VLL volume capacity
500	500.625	
1000	1000.546875	
2000	2000.390625	
2347	2347.03125	Maximum OPEN-3 volume size
7007	7007.34375	Maximum OPEN-8 volume size
7042	7042.5	Maximum OPEN-9 volume size
13893	13893.04688	Maximum OPEN-E volume size

Table 1.5 Control Cylinders/Control Area for Each LVI/LU Type

LVI Type	Control Cylinders	Maximum User Cylinders	LU Type	Maximum User MB	Control Area (MB)
3390-3 (A/B/C)	6	3339	OPEN-3	2347	5
3390-3R	6	3339	OPEN-8	7007	19
3390-9	25	10017	OPEN-9	7042	19
3390-L	23	32,760	OPEN-E	13893	13
			OPEN-L	Not applicable	

Note: VLL functions are not applicable to OPEN-L volumes. The **Free LDEVs** table displays the free LDEVs that are eligible to become part of a LUSE volume

1.2.2 Virtual LVI/LUN Size Calculation

The Virtual LVI/LUN Storage Navigator function enables you to configure LDEVs by dividing them into several devices. You can assign a specific number of physical cylinders or MB to each VLL volume for maximum control over the volume size.

S/390® Size Calculation

For S/390® systems, each Virtual LVI volume contains the user-specified number of user cylinders plus a predetermined number of control cylinders (see Table 1.5), which is calculated as follows:

If the RAID configuration for the LDEV is RAID5 (3D+1P) or RAID1:

Number or tracks for boundary control = ↑ (Number of cylinders specified by the user + Number of control cylinders) × 15 ÷ 48 ↑ × 48 − (Number of cylinders specified by the user + Number of control cylinders) × 15

Note: ↑ ↑ indicates that you round up decimal digits, e.g., ↑ 3.96 ↑ = 4.00

If the RAID configuration for the LDEV is RAID5 (7D+1P)

Number or tracks for boundary control = ↑ (Number of cylinders specified by the user + Number of control cylinders) × 15 ÷ 56 ↑ × 56 − (Number of cylinders specified by the user + Number of control cylinders) × 15

Note: ↑ ↑ indicates that you round up decimal digits, e.g., ↑ 3.96 ↑ = 4.00

For example, if you specify 1015 user cylinders for a 3390-3 Virtual LVI volume, the total number of physical cylinders allocated for that device is 1015 × 15 + 6 × 15 + 45 = 15360 tracks (1024 cylinders).

Open Systems Size Calculation

In open systems, the size of the Virtual LUN volume is expressed in MB. The total size of the Virtual LUN volume consists of the user-specified size plus an amount for the control area (refer to Table 1.5). The Virtual LUN software automatically assigns the amount for the control area. The size calculation is as follows:

X = User specified MB × 1024 ÷ 720 (Any remainder is rounded up to the next whole number).
Y = (X × 96 × 15 × 512) ÷ 1024 ÷ 1024

X is a value of converting the capacity specified by user into number of cylinders.
Y is a value of converting value X into capacity (MB).

For example, if an open-systems user specifies a Virtual LUN volume size of 100 MB, the software calculates the actual size of the volume. X is calculated as follows:
100 × 1024 ÷ 720 = 142.2222 (rounded up to 143).
Once you have the value for X, Y is calculated as follows:
$(143 \times 96 \times 15 \times 512) \div 1024 \div 1024$ = 100.546875 (MB).

1.2.3 SSID Requirements

The 9900V subsystem is configured with one SSID for each of 256 devices and up to four SSIDs per CU image. Each SSID must be unique within each host system. Table 1.6 shows the relationship between emulation types of controllers and SSIDs.

Table 1.6 SSID Requirements

Controller emulation type	SSID requirement	LVI/LUN Support
3990-6, 3390-6E	$(0104)_x$ - $(FFFD)_x$	3390, OPEN-3, OPEN-8 and OPEN-9 volumes
2105-F20	$(0104)_x$ - $(FFFD)_x$	3390, OPEN-3, OPEN-8 and OPEN-9 volumes

Chapter 2 Preparing To Use LUN Expansion or Virtual LVI/LUN

2.1 Preparing the 9900V Subsystem and Storage Navigator Computer(s)

Before launching LUN Expansion or Virtual LVI/LUN, take several preliminary steps. These include the following:

- Install the 9900V subsystem.
- Install the computer(s) that you intend to use as Storage Navigators, and connect them to the 9900V internal LAN.
- Enable LUN Expansion and/or Virtual LVI/LUN on each subsystem where you intend to use these options.

For detailed instructions, please refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console – Storage Navigator User's Guide* (MK-92RD101).

2.2 Launching LUN Expansion or Virtual LVI/LUN

To use LUN Expansion or Virtual LVI/LUN, first log on to the primary SVP. For detailed instructions on the login process, see *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console – Storage Navigator User's Guide* (MK-92RD101).

If you successfully log on to the primary SVP, the Storage Navigator main panel opens (see Figure 2.1). The option buttons are displayed on the left side of the panel. **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** ( ) opens the LUSE/VLL panel.

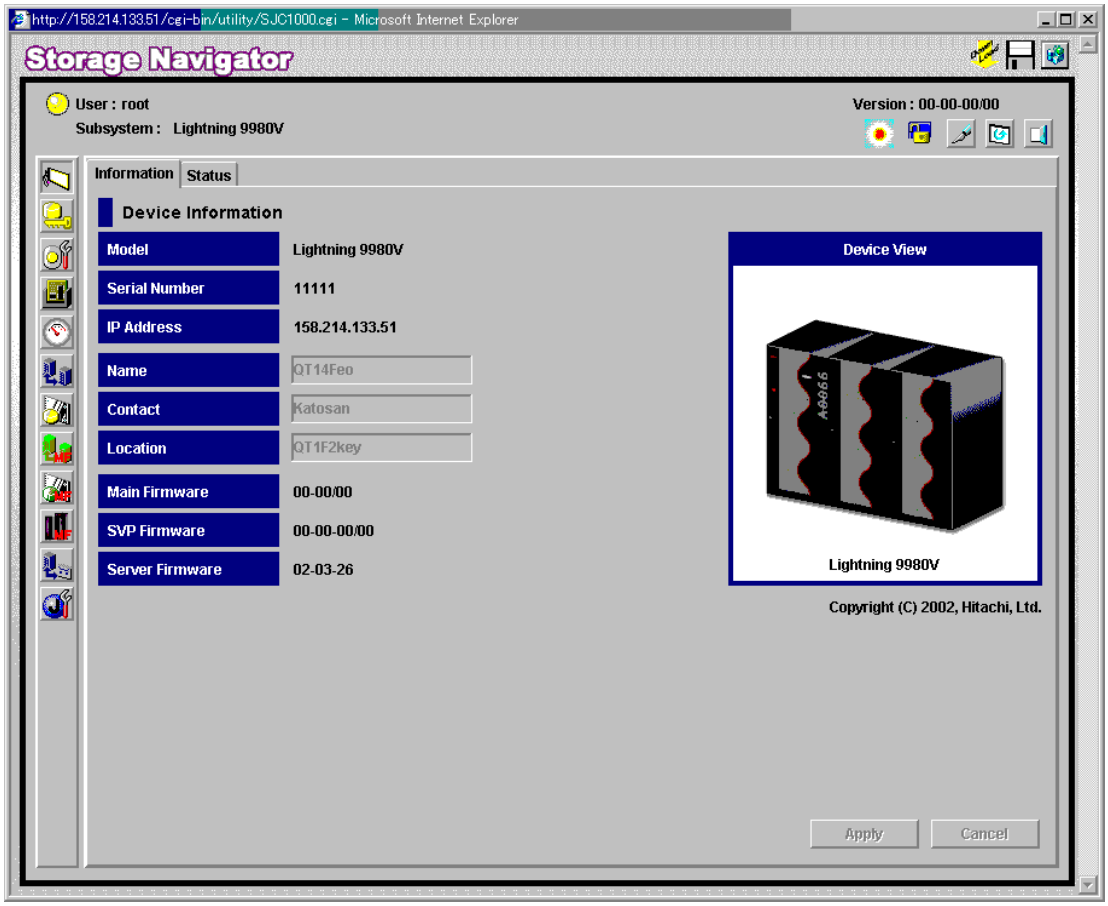


Figure 2.1 Storage Navigator Main Panel, Information Tab

2.3 Changing to Modify Mode

If you are going to implement any changes for LUN Expansion or Virtual LVI/LUN, you must be in **Modify** mode. The subsystem information icons (see Figure 2.2) are on the upper right corner. These icons are described in detail in *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console – Storage Navigator* (MK-92RD101). If you want to change from **View** mode to **Modify** mode and back, two of the icons are important:

- Exclusive lock icons indicate the operation mode of all currently logged-in users. If all users are operating in **View** mode, the **Unlocked** icon ( ) is displayed. If a user is operating in **Modify** mode, or if subsystem maintenance or SNMP operations are being performed, the **Locked** icon ( ) is displayed.
- **Mode-Changing** buttons allow users to change the operation mode between **View** mode ( ) and **Modify** mode ( ). ***Note*:** Only one user at a time can be in **Modify** mode.

To change between View and Modify modes:

1. You must have administrator or write access for the option that you want to use. For details on assigning user access, see *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console – Storage Navigator* (MK-92RD101).
2. Verify that the subsystem is unlocked. If all users are operating in **View** mode, the **Unlocked** icon ( ) and the **View** Mode icon ( ) are displayed (see Figure 2.2). If a user is operating in **Modify** mode, or if subsystem maintenance is being performed, the **Locked** icon ( ) is displayed, and you cannot change to **Modify** mode.
3. Select the **Mode Changing** icon ( ), which should be in **View** mode. A confirmation message displays (see Figure 2.3). Select **OK**.
4. The **Mode Changing** icon changes from **View** mode to **Modify** mode ( ). The **Locked** icon ( ) displays (see Figure 2.4).
5. Change back to **View** mode once you have applied the change.
6. Select the **Mode Changing** icon ( ). The confirmation message displays (see Figure 2.3).
7. Select **OK** (or **Cancel**), and you are returned to **View** mode.

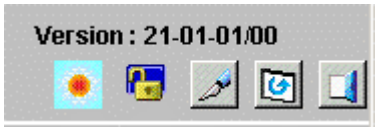


Figure 2.2 Icons Showing View Mode

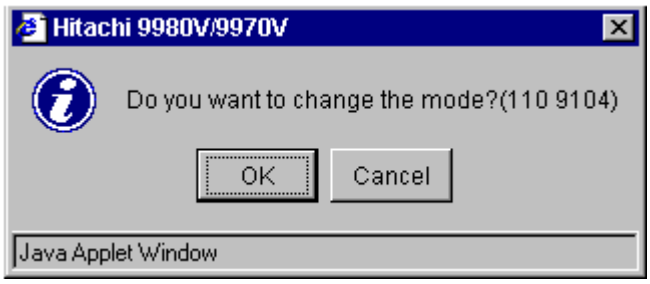


Figure 2.3 Mode Changing Confirmation Message

Figure 2.4 Icons Showing Modify Mode

Chapter 3 LUN Expansion (LUSE) Operations

3.1 LUN Expansion Panels

3.1.1 LUSE/VLL Main Panel, LUSE Tab

LUN Expansion (LUSE)/Virtual LVI/LUN (VLL) ( ) opens the LUSE/VLL panel. The **LUSE** tab is the default view (see Figure 3.1).

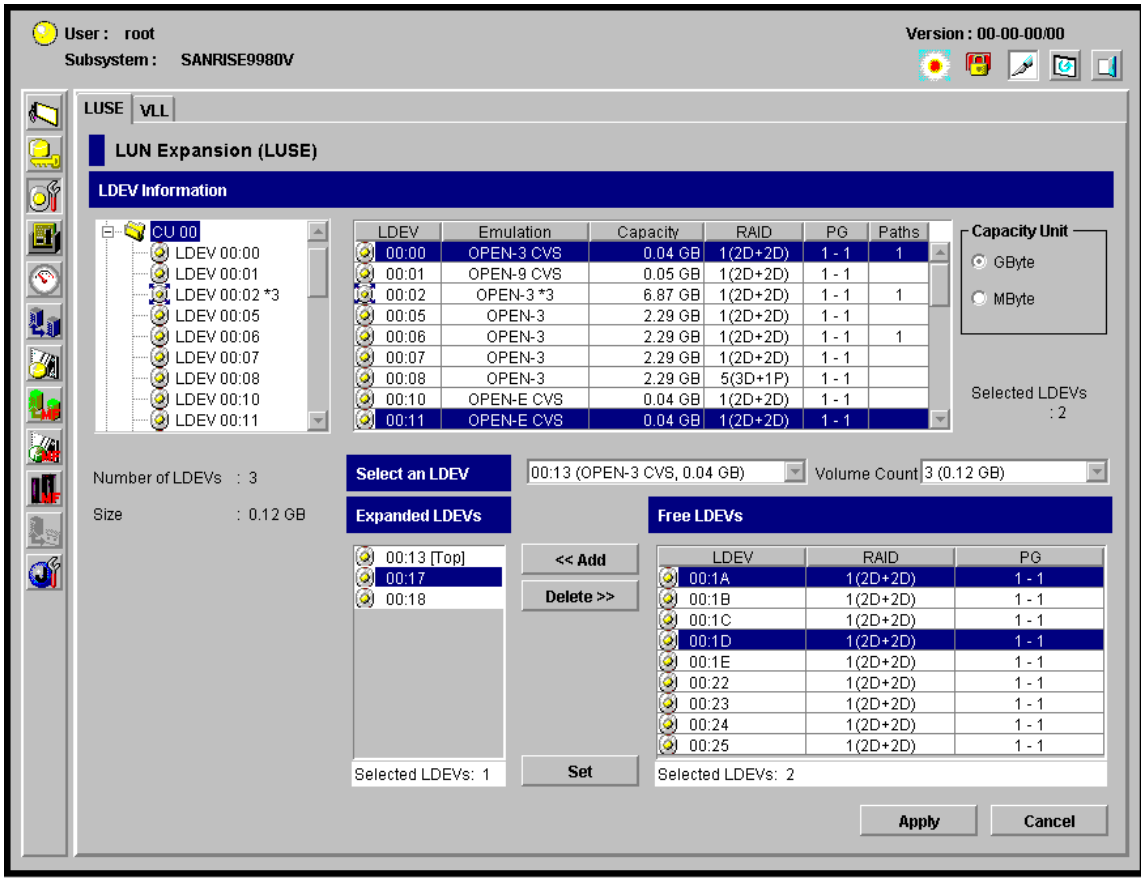


Figure 3.1 LUSE/VLL Main Panel, LUSE Tab

3.1.2 LDEV Information Outline

The LDEV Information outline is on the upper left of the panel (see Figure 3.2).

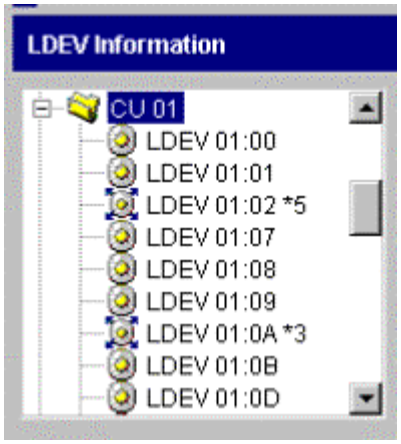


Figure 3.2 LDEV Information Outline (From the LUSE/VLL Panel, LUSE Tab)

LDEV Information outline is on the upper left corner of the **LUSE** tab and displays an outline view of the CU and LDEV numbers installed on the subsystem (for example, CU 01 has a number of LDEVs, including 01:00). The format of the LDEV number changes if the LDEV is an expanded (LUSE) volume (for example, if LDEV volume 01:00 consists of five concatenated LDEVs, its number is 01:00*5).

One of the following icons appear:

- Normal (free) LDEV
- Expanded (LUSE) volume

3.1.3 LDEV Detail Table

The **LDEV Detail** table is on the upper right corner of the **LUSE** tab, and displays data for the LDEV that you select in the LDEV Information outline (see Figure 3.3).

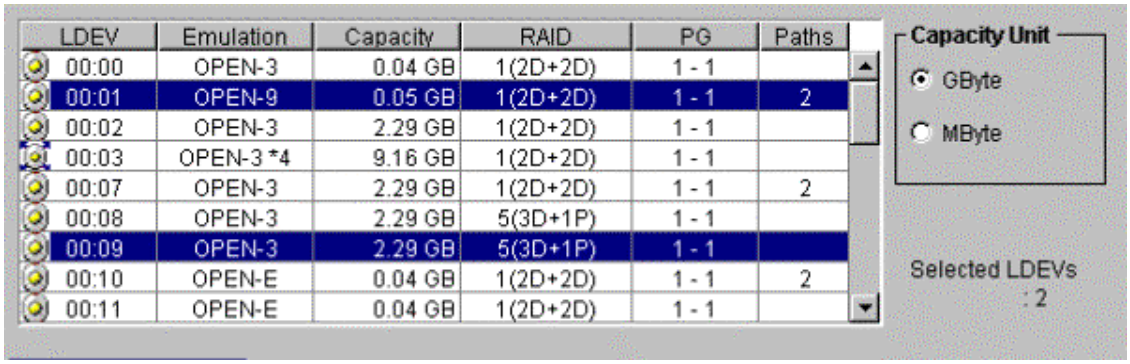


Figure 3.3 LDEV Detail Table (From the LUSE/VLL Panel, LUSE Tab)

The **LDEV Detail** table displays detailed information for all open-system LDEVs in the selected CU. If you have selected a normal LDEV, the information in this section is for the top LDEV. If you have selected a LUSE volume, the information in this table is for all of the LDEVs in the LUSE volume. The table displays the following information:

- **LDEV** - LDEV status icon, and the CU and LDEV number. If the selected LDEV is a LUSE volume, the LDEV number of the top LDEV in the LUSE volume is displayed. The icons indicate:
  - Normal (free) LDEV
  - Expanded (LUSE) volume
- **Emulation** - Emulation type. If the selected LDEV is a LUSE volume, the emulation type is displayed together with an asterisk and the number of volumes in the LUSE volume (for example, OPEN-E*5).
- **Capacity** - LDEV capacity, displayed in either MB or GB, depending on which unit is selected in the **Capacity Unit** box.
- **RAID** - RAID level.
- **PG** - Combination of the disk group and the parity group. If the LDEV extends over two or more parity groups, the **PG** column displays the smaller parity group number.
- **Paths** - Number of paths that are set for the LDEV. A notation of **(n)** indicates that no paths are set.
- **Selected LDEVs** - Number of LDEVs selected in this table.
- The **Capacity Unit** box - Capacity of the LDEV for display in the **Capacity** column, in either **GByte** (default view) or **MByte**.

3.1.4 LDEV Operation Detail

The **LDEV Operation** detail is on the lower half of the **LUSE** tab (see Figure 3.4).

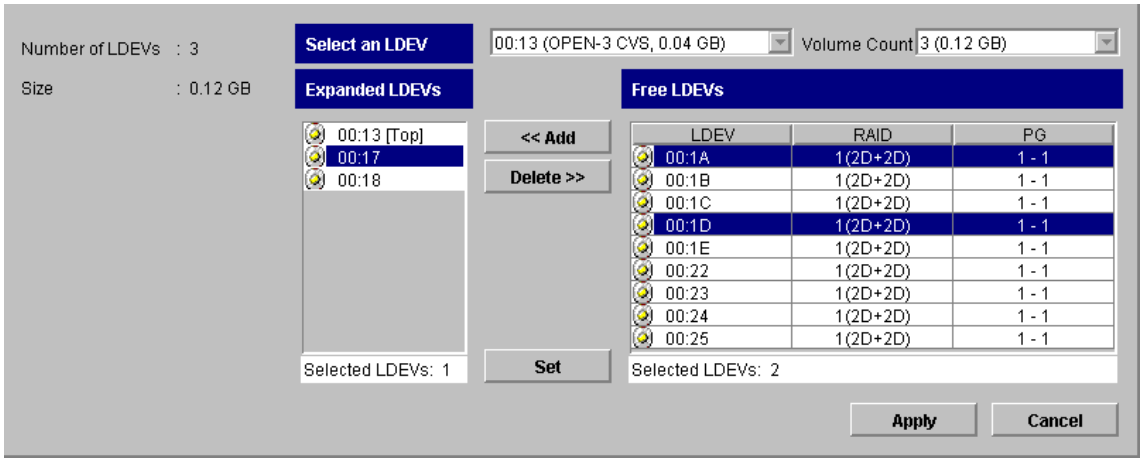


Figure 3.4 LDEV Operation Detail (From the LUSE/VLL Panel, LUSE Tab)

The LDEV Operation Detail has the following features:

- **Number of LDEVs** - Number of LDEVs displayed in the Expanded LDEVs list.
- **Size** - Total capacity of the LDEVs displayed in the Expanded LDEVs list.
- **Select an LDEV** drop-down box - Free LDEVs of the selected CU.
- **Expanded LDEVs** list - LDEVs that are selected as LUSE volume components. An LDEV is added to this list when the **<<Add** button is selected (see below).
  - **<<Add**: Moves a selected LDEV from the **Free LDEVs** list to the **Expanded LDEVs** list.
  - **Delete>>**: Moves a selected LDEV from the **Expanded LDEVs** list to the **Free LDEVs** list.
  - **Set**: Creates a LUSE volume consisting of the free volumes currently in the **Expanded LDEVs** list. The new LUSE is displayed in blue on the **LDEV Detail** table (on the upper right corner of the **LUSE** tab), but is not actually created until you select the **Apply** button.
- **Volume Count** drop-down window - Number of LDEVs that form a LUSE volume.
- **Free LDEVs** table - Free LDEVs that are eligible to become part of a LUSE volume.
  - **LDEV**: LDEV status icon and the CU and LDEV number. If the selected LDEV is a LUSE volume, the LDEV number of the top LDEV in the LUSE volume is displayed. The icons indicate:
    -  Normal (free) LDEV
    -  Expanded (LUSE) volume
  - **RAID**: RAID level.
  - **PG**: Combination of the disk group and the parity group. If the LDEV extends over two or more parity groups, the **PG** column displays the smaller parity group number.
- **Apply** - Implements the settings to the subsystem.
- **Cancel** - Cancels the settings.

3.2 LUSE Operations

LUSE operations include the following:

- Viewing Concatenated Parity Groups (see section 3.2.1)
- Creating LUSE volumes (see section 3.2.2)
- Releasing LUSE volumes (see section 3.2.3)
- Changing LUSE capacities (see section 3.2.4)

3.2.1 Viewing Concatenated Parity Groups

In the 9900V subsystem, data can be written to an LDEV that extends over concatenated parity groups. Concatenation of parity groups enables faster access to data.

To view a concatenated parity group:

1. Change to **Modify** mode.
2. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)**  to open the LUSE/VLL panel. The **LUSE** tab is the default view.
3. Select a CU number from the **LDEV Information** outline. The **LDEV Detail** table displays all LDEVs in the selected CU.
4. In the **LDEV Detail** table, select and right click the free LDEVs that you want to form the LUSE volume. If parity groups are concatenated, this displays the **Concatenation List** Pop-Up Menu (see Figure 3.5).
5. Select **Concatenation List** to display the Concatenation List panel (see Figure 3.6).
6. When you are finished viewing the list, select **OK** (or **Cancel**) to return to the **LUSE** tab.

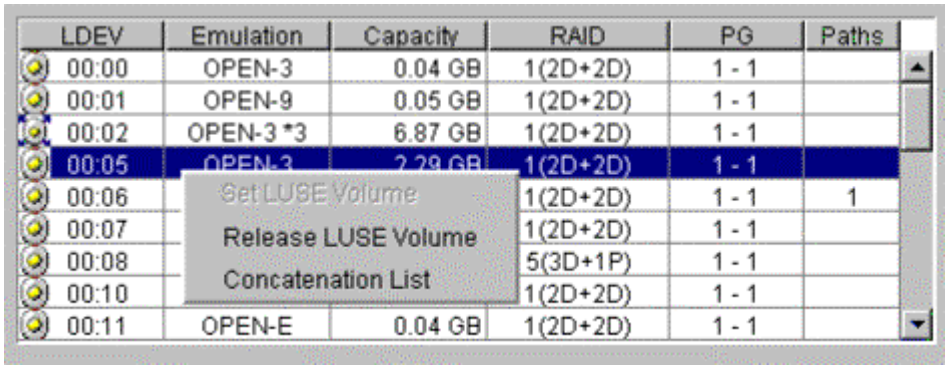


Figure 3.5 Concatenation List Pop-Up Menu

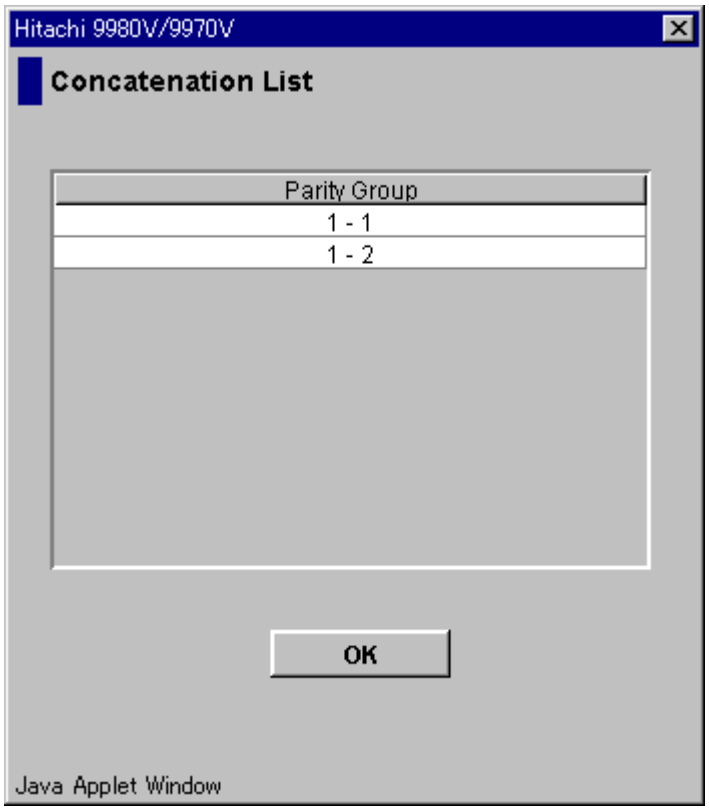


Figure 3.6 Concatenation List Panel

3.2.2 Creating a LUSE Volume

> ***WARNING:*** LUSE creation is a destructive operation. Move and/or back up your data before proceeding.

There are three ways to create a LUSE volume:

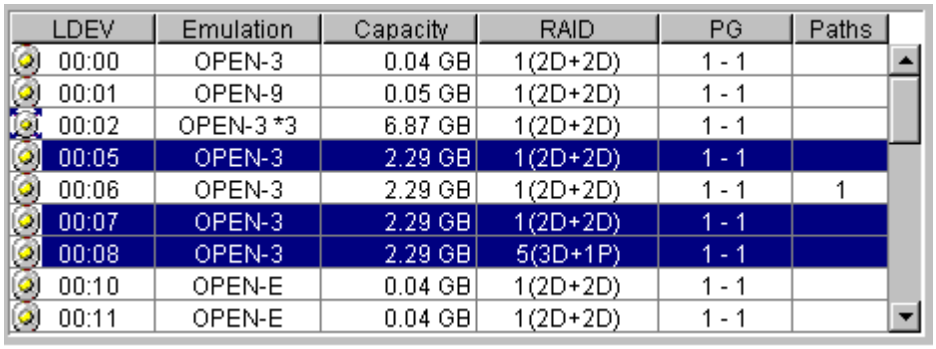
- Using the **LDEV Detail** table (see section 3.2.2.1)
- Using the **LDEV Operation** detail (see section 3.2.2.2)
- Using the **Volume Count** combo box (see section 3.2.2.3)

3.2.2.1 Creating a LUSE Volume From the LDEV Detail Table

To create a LUSE volume from the LDEV detail table:

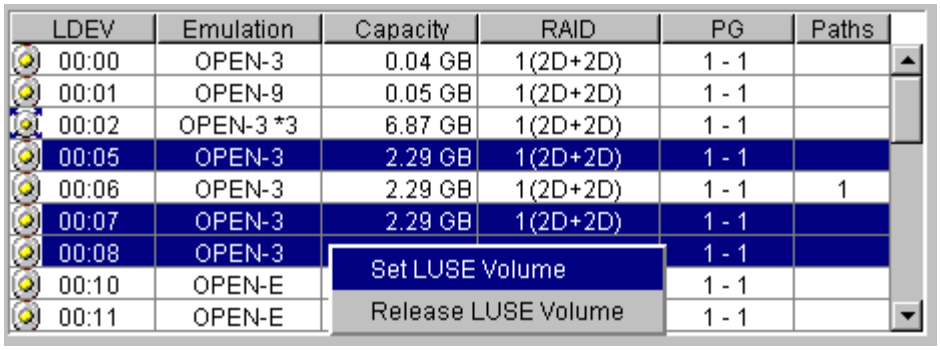
1. Change to **Modify** mode.
2. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** () to open the LUSE/VLL panel. The **LUSE** tab is the default view.
3. Select a CU number from the **LDEV Information** outline. The **LDEV Detail** table displays all LDEVs in the selected CU.
4. In the **LDEV Detail** table, select and right-click the free LDEVs that you want to form the LUSE volume (see Figure 3.7). This displays the **Set LUSE Volume** pop-up menu (see Figure 3.8).
5. Select **Set LUSE Volume** to display the Set LUSE Confirmation panel (see Figure 3.9).
6. Select **OK** to create the LUSE volume (or **Cancel**).

   Note: The settings appear in blue on the panel but are not yet applied (see Figure 3.10).
7. Select **Apply** (or **Cancel**).
8. Select **OK** (or **Cancel**).



LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:07	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:08	OPEN-3	2.29 GB	5(3D+1P)	1 - 1	
00:10	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.7 Selecting Free LDEVs for LUSE Volume From the LDEV Detail Table



LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:07	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:08	OPEN-3			1 - 1	
00:10	OPEN-E			1 - 1	
00:11	OPEN-E			1 - 1	

Figure 3.8 Set LUSE Volume Pop-Up Menu

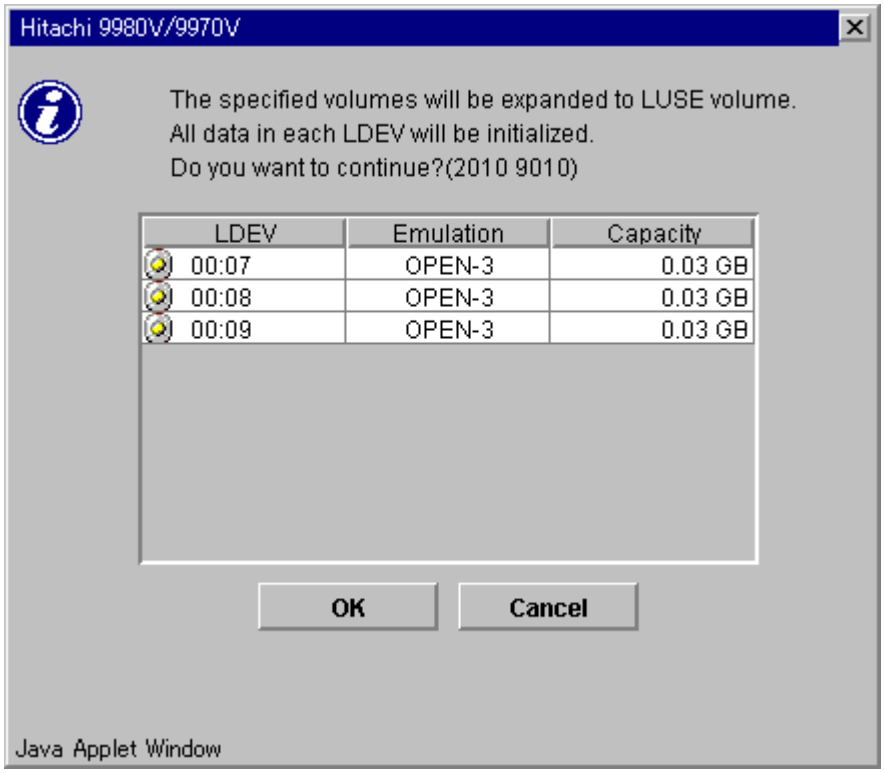
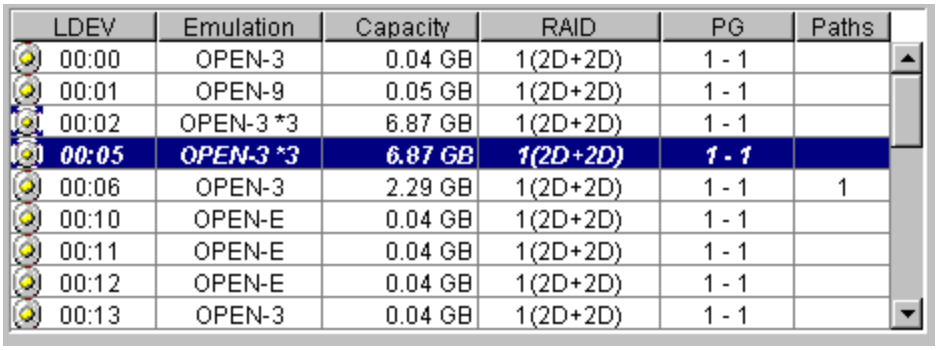


Figure 3.9 Set LUSE Confirmation Panel



LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	***OPEN-3 *3***	***6.87 GB***	***1(2D+2D)***	***1 - 1***	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:10	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:12	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:13	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.10 New LUSE Volume Displayed

3.2.2.2 Creating a LUSE Volume From the LDEV Operation Detail

To create a LUSE volume from the LDEV operation detail panel:

1. Change to **Modify** mode.
2. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** ( ) to open the LUSE/VLL panel. The **LUSE** tab is the default view.
3. Select a CU number from the **LDEV Information** outline (on the upper left corner of the **LUSE** tab).
4. Select the **arrow** button in the **Select an LDEV** drop-down box (on the lower right of the panel). For the LUSE, select the first LDEV from the **Free LDEVs** list (see Figure 3.11).
5. Select one or more additional LDEVs for the LUSE volume. Select **<<Add** to move the selected LDEVs from the **Free LDEVs** list to the **Expanded LDEVs** list (see Figure 3.11).
6. If you want to delete an LDEV from the **Expanded LDEVs** list, and move it back to the **Free LDEVs** list, select one or more volumes. Select **Delete>>**.
7. Select **Set** to display the **Set LUSE Confirmation** panel.
8. Select **OK** (or **Cancel**).

   Note: The new settings appear on the panel in blue but are not yet implemented.
9. Select **Apply** (or **Cancel**).
10. Select **OK** (or **Cancel**).

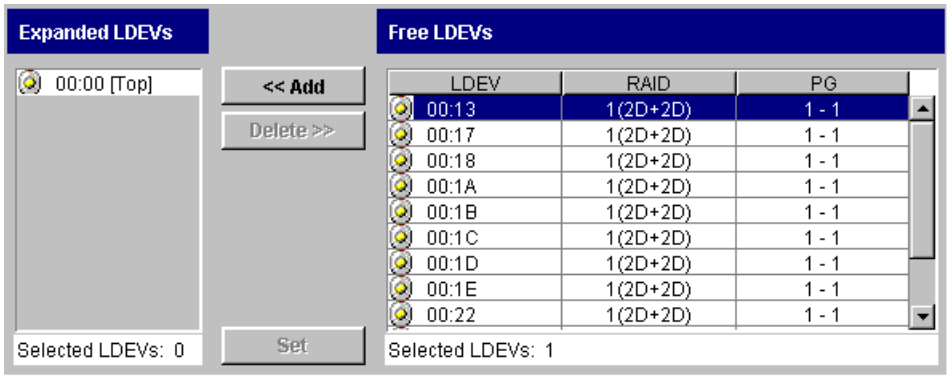


Figure 3.11 Selecting Free LDEVs

3.2.2.3 Creating a LUSE Volume using the Volume Count window

This drop-down window lists the number of LDEVs that form a LUSE volume (see Figure 3.12).

To create a LUSE volume using the Volume Count window:

1. Select **View Mode/Modify Mode** ( ) on the LUSE operation panel to set the **Modify** mode.
2. Select **OK**.
3. Select a CU number to create a LUSE volume from the LDEV information tree.
4. Select the arrow button in **Select an LDEV**. Select a top LDEV of the LUSE volume from the drop-down list.

   The selected top volume appears in the **Expanded LDEVs** list. Free LDEVs that can be used for a LUSE volume are displayed in the **Free LDEVs** list.
5. Select the number of LDEVs needed to form a LUSE volume from the **Volume Count** box.

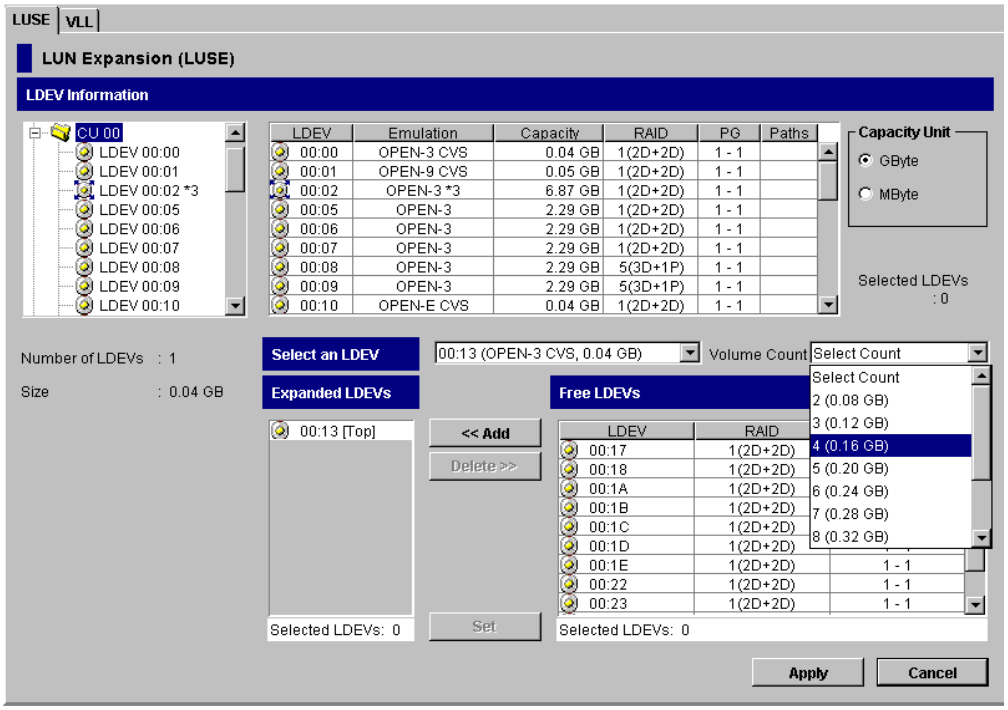


Figure 3.12 Creating a LUSE volume using Volume Count

The **Expanded LDEVs** list displays as many LDEVs as specified in the **Volume Count** box. For example, if **3** is specified in **Volume Count**, three LDEVs appear in **Expanded LDEVs**.

a) Select LDEVs from **Free LDEVs** to add more LDEVs to the **Expanded LDEVs** list.

c) Select **<<Add**.

d) To delete LDEVs from the **Expanded LDEVs** list, select the LDEVs from the **Expanded LDEVs** list. Select **Delete>>**.

6. Select **Set**.
7. To create the LUSE, select **OK**. The selected top LDEV is displayed (in blue) as a LUSE volume in the LDEV list.
8. Select **Apply.**
9. Select **OK** (or **Cancel**).

The setting by this LUSE operation is registered for the disk subsystem.

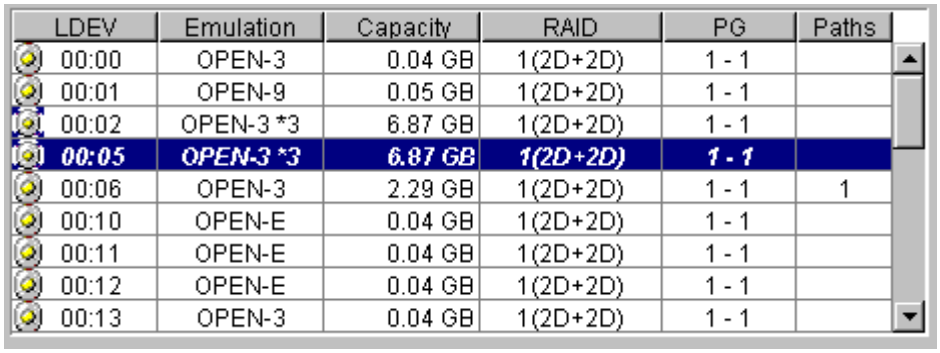
3.2.3 Releasing a LUSE Volume

WARNING: Releasing LUSE volumes is a destructive operation. Move and/or back up your data before proceeding.

To release a LUSE volume:

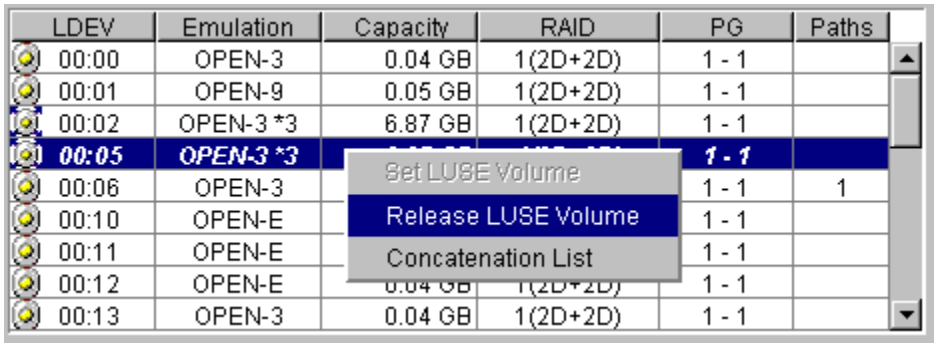
1. Delete all SCSI paths to the LUSE volume that you want released.
2. Change to **Modify** mode.
3. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** () to open the LUSE/VLL panel. The **LUSE** tab is the default view.
4. Select a CU number from the **LDEV Information** outline (on the upper left corner of the **LUSE** tab). The **LDEV Detail** table (on the upper right corner of the **LUSE** tab) displays all LDEVs in the selected CU (see Figure 3.13).
5. Select a LUSE volume in the **LDEV Detail** table (on the upper right corner of the **LUSE** tab). Right-click the LUSE volume to display the **Release LUSE Volume** pop-up menu (see Figure 3.14).
6. Select **Release LUSE Volume**.
7. The Release LUSE Volume confirmation panel displays (see Figure 3.15). Verify that the LUSE volumes(s) listed in the confirmation panel are the one(s) that you want released.
8. Select **OK** (or **Cancel**).

   Note: The new settings appear on the **LUSE** tab in blue but are not yet implemented (see Figure 3.16).
9. Select **Apply** on the **LUSE** tab (or **Cancel**).
10. Select **OK** (or **Cancel**).



LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	***OPEN-3 *3***	***6.87 GB***	***1(2D+2D)***	***1 - 1***	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:10	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:12	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:13	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.13 Selecting LUSE Volume(s) To Be Released



LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	***OPEN-3 *3***			***1 - 1***	
00:06	OPEN-3			1 - 1	1
00:10	OPEN-E			1 - 1	
00:11	OPEN-E			1 - 1	
00:12	OPEN-E			1 - 1	
00:13	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.14 Release LUSE Volume Pop-Up Menu

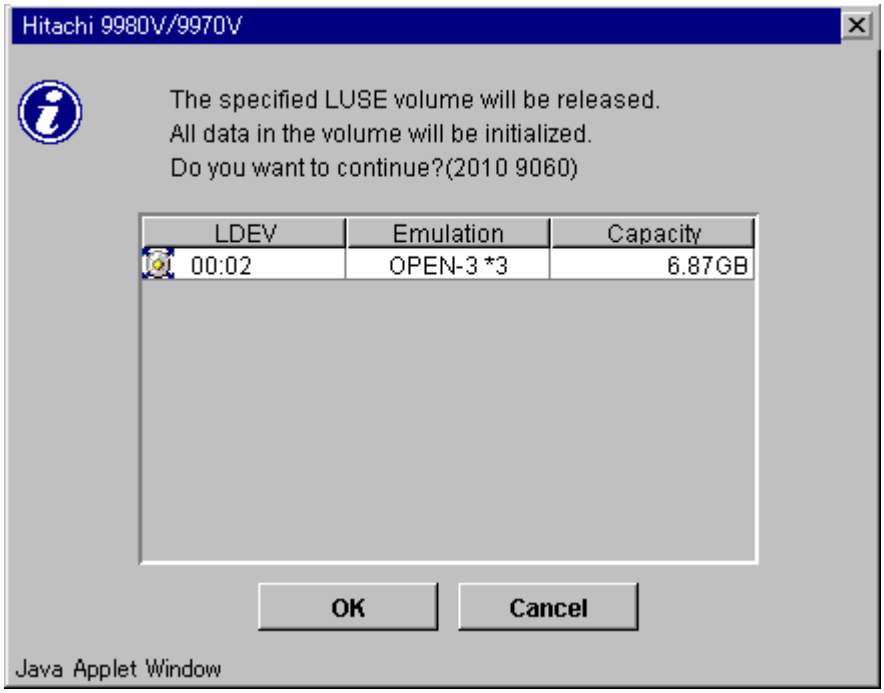
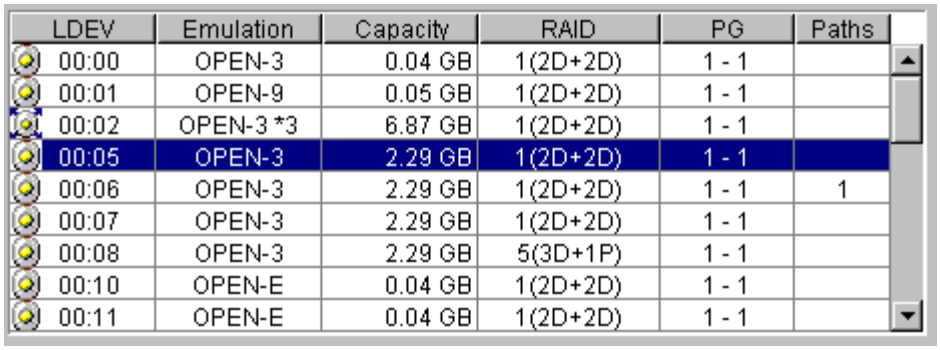


Figure 3.15 Release LUSE Confirmation Panel



LDEV	Emulation	Capacity	RAID	PG	Paths
00:00	OPEN-3	0.04 GB	1(2D+2D)	1 - 1	
00:01	OPEN-9	0.05 GB	1(2D+2D)	1 - 1	
00:02	OPEN-3 *3	6.87 GB	1(2D+2D)	1 - 1	
00:05	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:06	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	1
00:07	OPEN-3	2.29 GB	1(2D+2D)	1 - 1	
00:08	OPEN-3	2.29 GB	5(3D+1P)	1 - 1	
00:10	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	
00:11	OPEN-E	0.04 GB	1(2D+2D)	1 - 1	

Figure 3.16 Displaying Newly Released LUSE Volume

3.2.4 Changing LUSE Capacities

You cannot change the capacity of an existing LUSE volume. If you want a LUSE volume to define a different capacity, first release the LUSE volume (refer to section 3.2.3). Redefine the LUSE volume (refer to section 3.2.1).

Chapter 4 Virtual LVI/LUN (VLL) Operations

4.1 Virtual LVI/LUN Panels

4.1.1 LUSE/VLL Panel, VLL Tab

LUN Expansion (LUSE)/Virtual LVI/LUN (VLL) ( ) opens the LUSE/VLL panel. The **LUSE** tab is the default view. Select the **VLL** tab (see Figure 4.1).

Note: The option buttons (along the left side of the panel) and the subsystem information icons (in the top right corner of the panel) have been omitted from the screen shot.

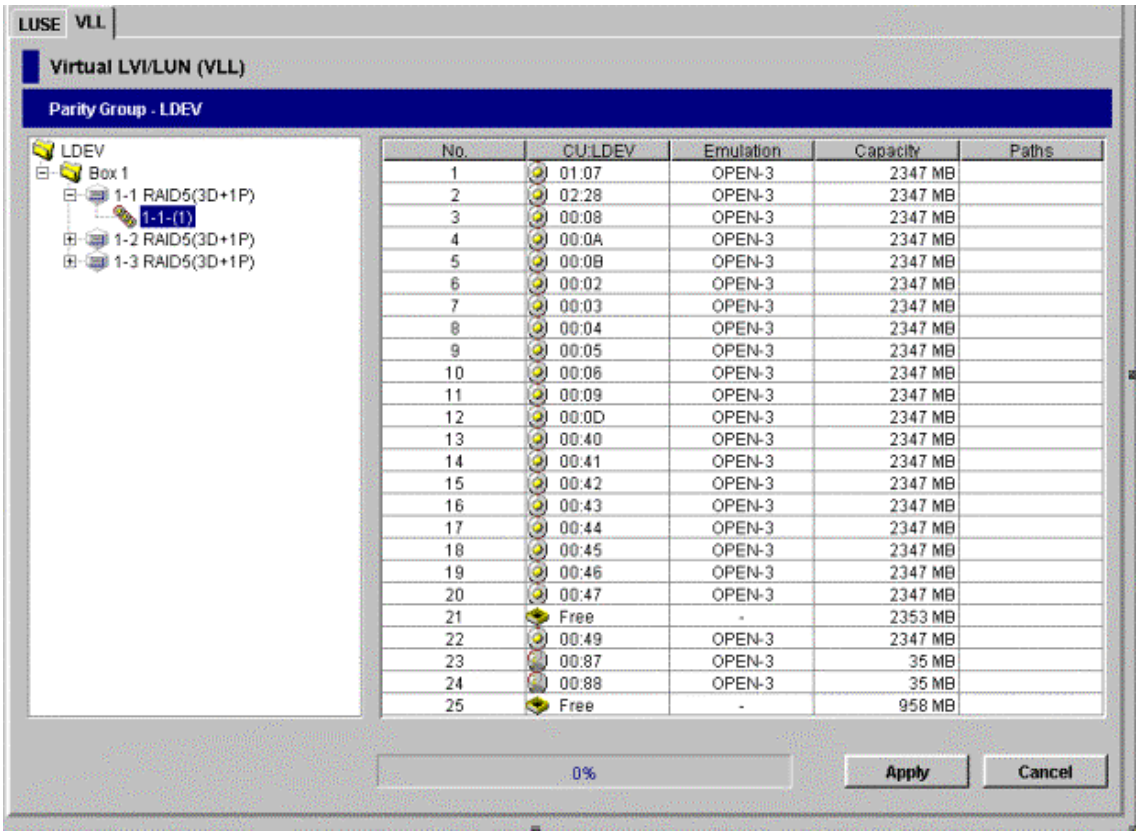


Figure 4.1 LUSE/VLL Panel, VLL Tab

4.1.2 Parity Group - LDEV Outline

The **Parity Group - LDEV** outline (on the upper left of the **VLL** tab) displays the hierarchical structure of the subsystem (see Figure 4.2).

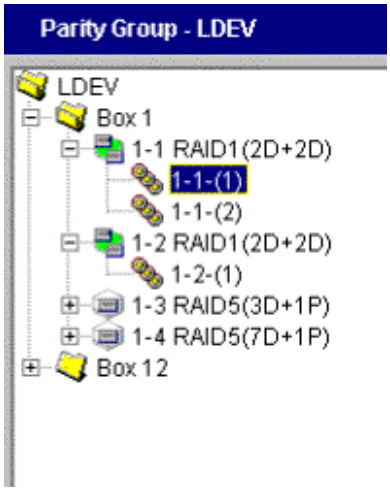


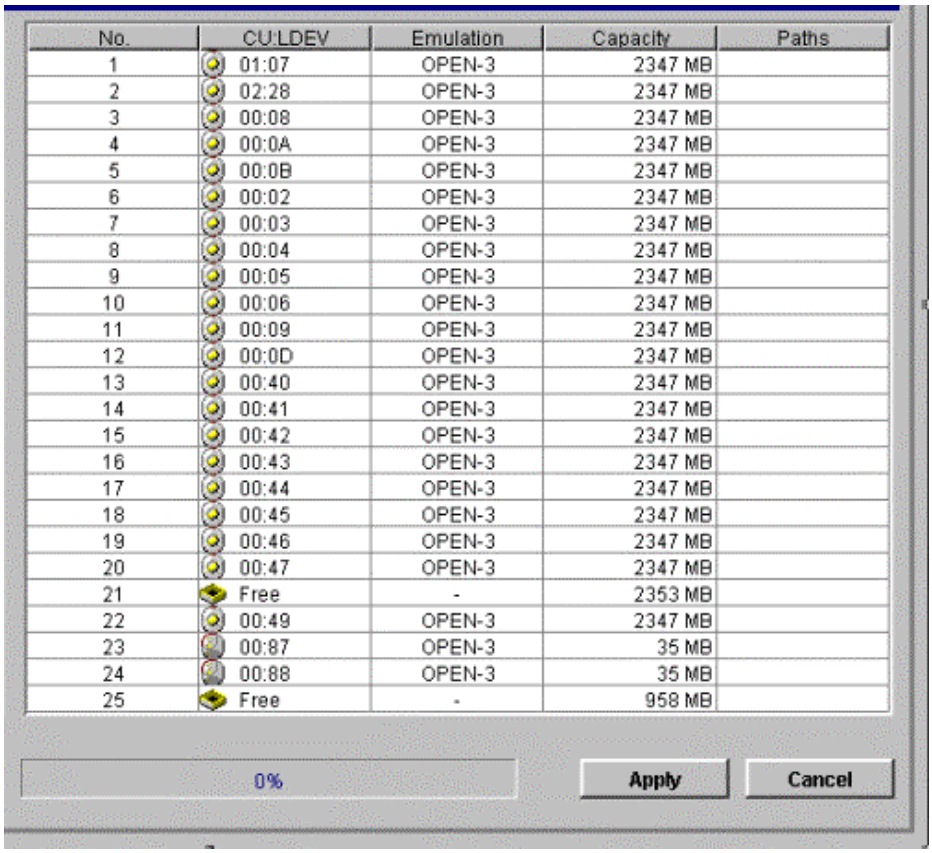
Figure 4.2 Parity Group - LDEV Outline (From the LUSE/VLL Panel, VLL Tab)

Icon Indicators

- No pending VLL actions
- VLL actions have been stored, but not yet implemented on the subsystem
- Parity group
- Set of parity groups that are concatenated

4.1.3 LDEV Information Table

When you select a VDEV in the **Parity Group - LDEV** outline, the **LDEV Information** table (on the upper right of the **VLL** tab) displays information about the logical volumes in that VDEV (see Figure 4.3).



No.	CU:LDEV	Emulation	Capacity	Paths
1	01:07	OPEN-3	2347 MB	
2	02:28	OPEN-3	2347 MB	
3	00:08	OPEN-3	2347 MB	
4	00:0A	OPEN-3	2347 MB	
5	00:0B	OPEN-3	2347 MB	
6	00:02	OPEN-3	2347 MB	
7	00:03	OPEN-3	2347 MB	
8	00:04	OPEN-3	2347 MB	
9	00:05	OPEN-3	2347 MB	
10	00:06	OPEN-3	2347 MB	
11	00:09	OPEN-3	2347 MB	
12	00:0D	OPEN-3	2347 MB	
13	00:40	OPEN-3	2347 MB	
14	00:41	OPEN-3	2347 MB	
15	00:42	OPEN-3	2347 MB	
16	00:43	OPEN-3	2347 MB	
17	00:44	OPEN-3	2347 MB	
18	00:45	OPEN-3	2347 MB	
19	00:46	OPEN-3	2347 MB	
20	00:47	OPEN-3	2347 MB	
21	Free	-	2353 MB	
22	00:49	OPEN-3	2347 MB	
23	00:87	OPEN-3	35 MB	
24	00:88	OPEN-3	35 MB	
25	Free	-	958 MB	

Figure 4.3 LDEV Information Table (From the LUSE/VLL Panel, VLL Tab)

- **No.** - Volume number.
- **CU:LDEV** - Icon and the CU:LDEV number. Free indicates free space. The icons indicate:

  Normal LDEV
  LUSE volume
  LDEV reserved for Hitachi CruiseControl
  VLL volume
  VLL volume reserved for Hitachi CruiseControl
  Free space
  LDEV secured by Hitachi SANtinel - S/390®

- **Emulation** - Emulation type.
- **Capacity** - Capacity of the volume for open-system volumes (in MB) and for mainframe volumes in cylinders (Cyl).
- **Paths** - Number of LU paths. Blank indicates no LU paths.
- **Apply** - Implements the settings that have been made in this panel.
- **Cancel** - Cancels the settings that have been made in this panel.

4.1.4 Set SSID Panel

The **Set SSID** panel displays during the creation of VLL volumes if the boundary area of the selected LDEV number does not have an SSID (see Figure 4.4). See section 4.2.3 for more information.

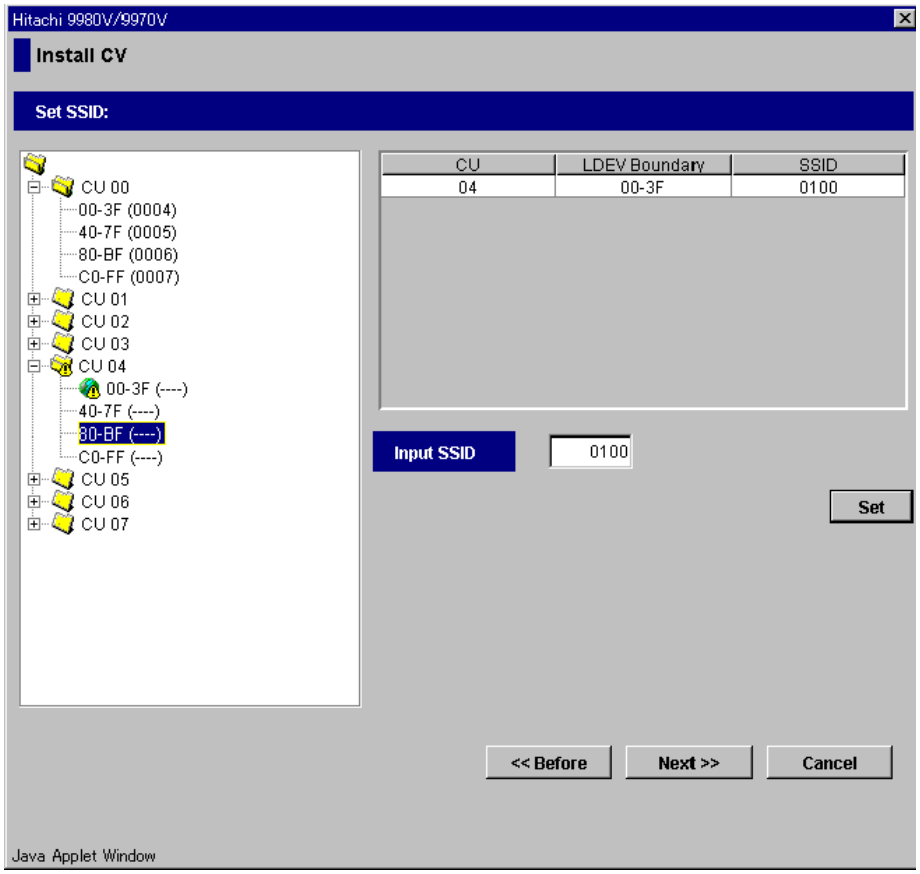


Figure 4.4 Set SSID Panel

- Icon Indicators
  - ---- Boundary area with no SSID
  -  CU number is not extracted
  -  CU number is extracted
  -  LDEV boundary area
- The **SSID table** is used to set the SSID boundary area.
  - **CU**: CU number that contains an LDEV boundary with no SSID
  - **LDEV boundary**: Boundary area of the LDEV number with no SSID
  - The **SSID** field: Specified SSID, the initial value is blank
- The **Input SSID** box allows you to enter the desired SSID.
- **<<Before** - Cancels the SSID setting, and returns you to one of the following:
  - If you are installing VLL volumes, the Install CV Panel (2) displays (see Figure 4.15).
  - If you are initializing VLL volumes, the Volume Initialize Panel displays (see Figure 4.21).
- **Next>>** - Opens one of the following panels:
  - If you are installing VLL volumes, the Install CV Confirmation Panel displays (see Figure 4.17).
  - If you are initializing VLL volumes, the Volume Initialize Confirmation Panel displays (see Figure 4.24).
- **Cancel** - Cancels the SSID setting, and returns you to the **VLL** tab.

4.2 Virtual LVI/LUN Operations

Before starting a VLL operation on a selected disk subsystem, make sure that the mainframe volumes are disconnected from the host, and/or remove the LU paths to the open volumes. For instructions on removing LU paths, please refer to *Hitachi Freedom Storage™ Lightning 9900™ V Series LUN Manager User's Guide* (MK-92RD105).

Virtual LVI/LUN operations include:

- Viewing concatenated parity groups (see section 4.2.1)
- Converting logical volumes to free space (see section 4.2.2)
- Creating VLL volumes (see section 4.2.3)
- Deleting VLL volumes (see section 4.2.4)
- Initializing VLL volumes (see section 4.2.5)

4.2.1 Viewing Concatenated Parity Groups

In the 9900V subsystem, data can be written to an LDEV that extends over concatenated parity groups. Concatenation of parity groups enables faster access to data.

To view a concatenated parity group:

1. Change to **Modify** mode.
2. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** () to open the LUSE/VLL panel. The **LUSE** tab is the default view. Select the **VLL** tab.
3. Select and right-click a set of parity groups () from the **Parity Group - LDEV** outline (on the upper left corner of the **VLL** tab). If there are parity groups that are concatenated, the **Concatenation List** Pop-Up Menu appears (refer to Figure 4.5).

   Note: If you select a parity group icon that does not indicate concatenated parity groups (), the **Concatenation List** Pop-Up Menu does not display.
4. Select **Concatenation List** to display the Concatenation List panel (see Figure 4.6).
5. Select **OK** to return to the **VLL** tab.

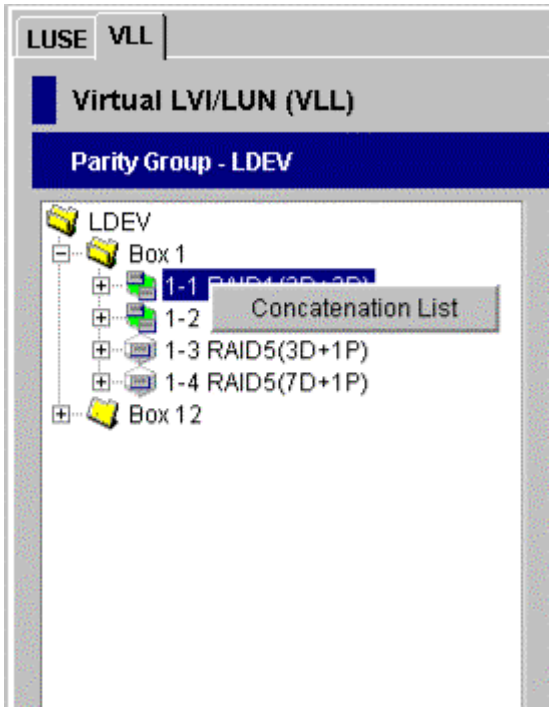


Figure 4.5 Concatenation List Pop-Up Menu

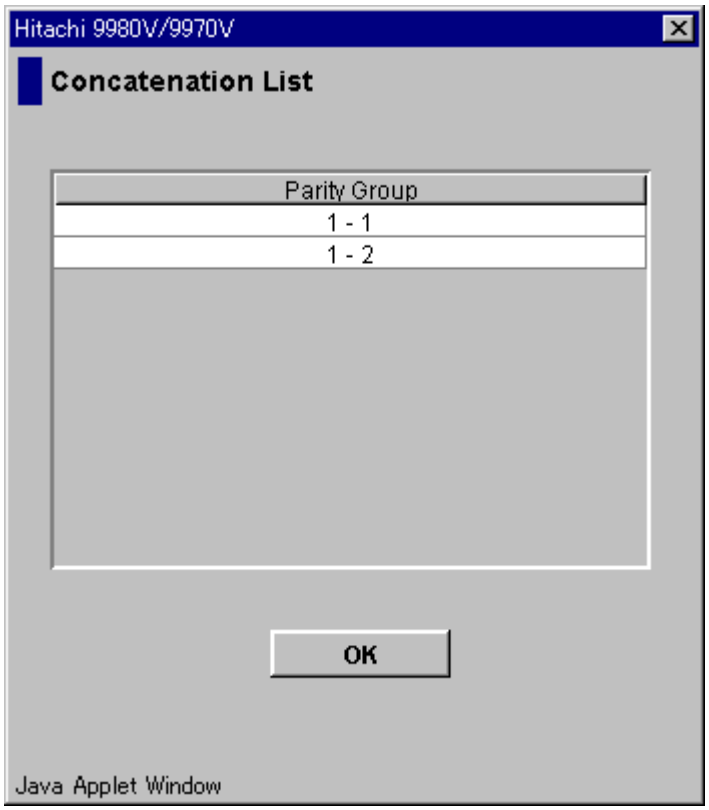


Figure 4.6 Concatenation List Panel

4.2.2 Converting Logical Volumes to Space

WARNING: The volume to space function is a destructive operation. The data on the logical volume(s) being converted is lost when the operation is complete. The user is responsible for backing up the data as needed before performing this operation.

The **Volume to Space** function allows you to convert one or more logical volumes (LDEVs) to space, which deletes the selected LDEVs from that VDEV.

Note: The deleted LDEV(s) remains as space in that VDEV. Any normal or Virtual LVI/LUN volume can be made into space. To delete the last Virtual LVI/LUN volume, use the Volume Initialize function (see section 4.2.5). You cannot convert the last normal volume into space because this defines the emulation of the VDEV.

The Volume to Space operation has the following restrictions:

- The LDEV should not have a path definition (including Hitachi TrueCopy - S/390®, Hitachi TrueCopy, ShadowImage - S/390®, and ShadowImage pair volumes).
- The LDEV should not be a component of a LUSE volume.
- The LDEV should not be reserved for Hitachi CruiseControl.

To convert a normal volume to free space:

1. Change to **Modify** mode.
2. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** () to open the LUSE/VLL panel. The **LUSE** tab is the default view. Select the **VLL** tab.
3. On the **Parity Group – LDEV** outline (on the upper left corner of the panel), select the LDEV folder to open a list of VDEVs.
4. Select a VDEV and the **LDEV Information** table (on the upper right of the panel) displays detailed information about the LDEVs of the selected VDEV.
5. Select one or more LDEVs from the CU:LDEV list.

   Note: Leave at least one normal or VLL volume on each LDEV.
6. Right-click on the selected LDEV to display the **Volume to Space** pop-up menu (see Figure 4.7). Select **Volume to Space** to display the Volume to Space Confirmation panel (see Figure 4.8).
7. If the listed volumes are correct, select **OK**.

   The change is not yet implemented in the subsystem, but the following changes appear in the **VLL** tab:

   - The selected LDEVs are listed as **Free**.
   - The figures in the **Capacity** column are not yet updated.
   - The color of the VDEV icon that you manipulated in the **Parity Group - LDEV** outline view changes from red to blue. You cannot manipulate blue VDEVs until you select **Apply** or **Cancel** but you can perform additional Volume to Space operations on VDEVs with red icons.

8. Select **Apply** (or **Cancel**).
9. Select **OK** (or **Cancel**).

   Note: A notation appears across the bottom of the panel to indicate that the change is in process (see Figure 4.9). That operation is complete (see Figure 4.10).

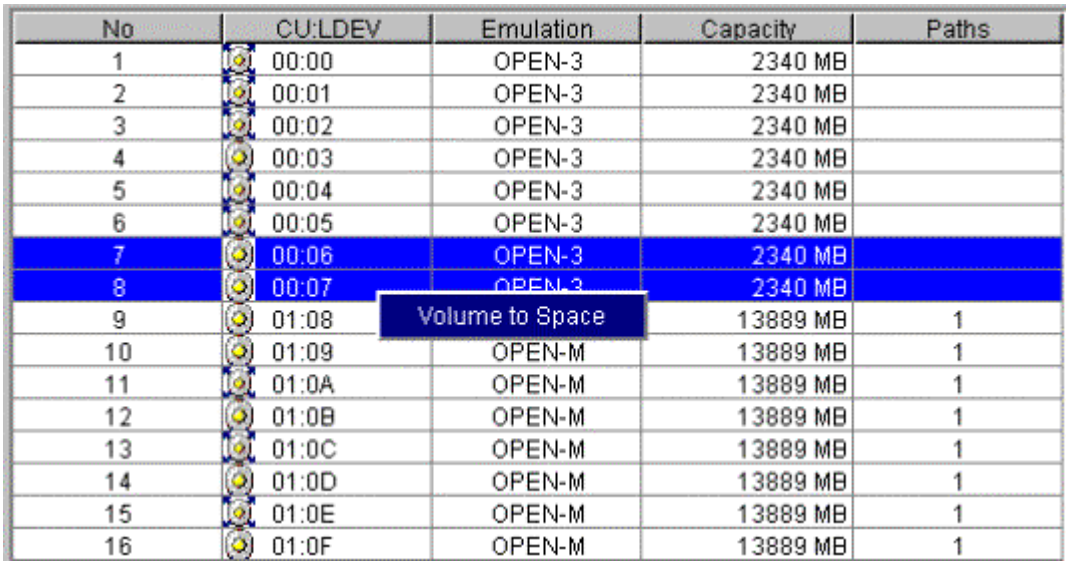


Figure 4.7 Volume to Space Pop-Up Menu

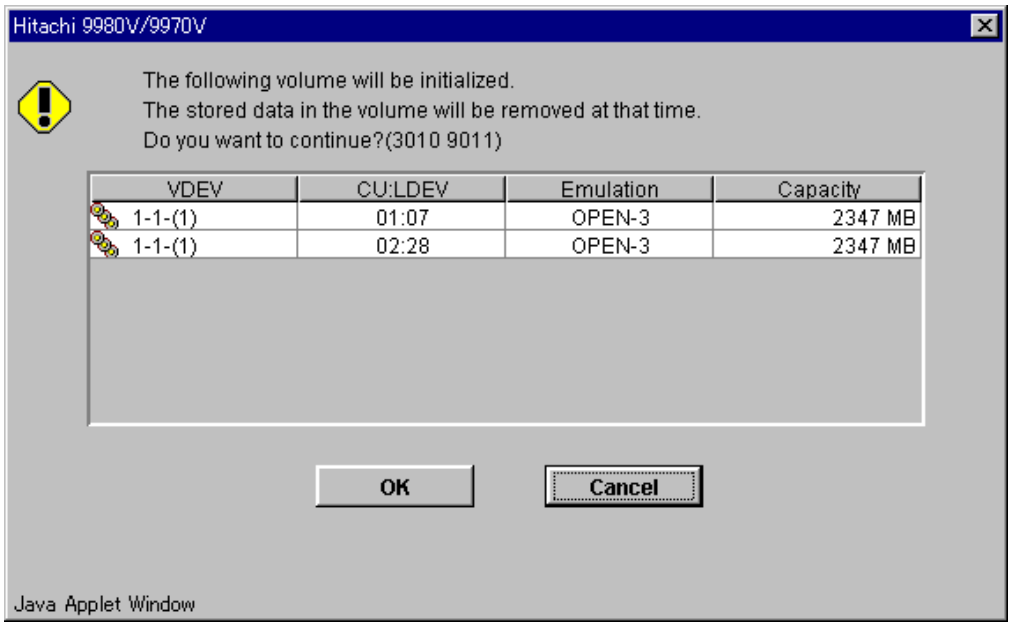


Figure 4.8 Volume to Space Confirmation Panel

Figure 4.9 Volume to Space Progress Indicator

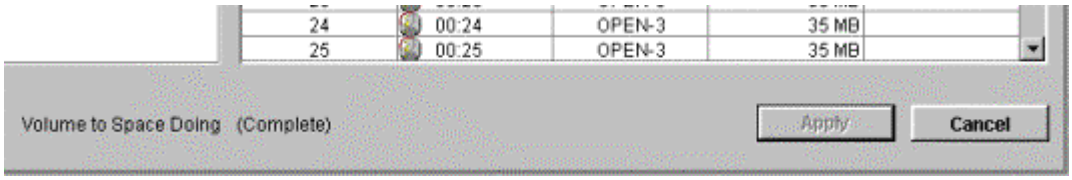


Figure 4.10 Volume to Space Operation Complete

4.2.3 Creating VLL Volumes

The Install VLL Volume function allows you to define and install one or more Virtual LVI/LUN volumes under an existing volume.

Note: The Install VLL Volume function allocates VLL volumes in the order in which the function finds sufficient free space for the VLL volumes, so for optimum space allocation you should allocate VLL volumes in descending order of capacity.

To create a VLL volume:

1. Change to **Modify** mode. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** ( ) to open the LUSE/VLL panel. The **LUSE** tab is the default view. Select the **VLL** tab.
2. On the **Parity Group – LDEV** outline (on the upper left corner of the panel) Select the LDEV folder to open a list of Control Units. Select a VDEV, and the **LDEV Information** table (on the upper right of the panel) displays detailed information about the LDEVs of the selected VDEV.
3. Right-click any part of the **Parity Group - LDEV** outline view to display the **Install CV** pop-up menu (see Figure 4.11).
4. Select **Install CV** to display the Install CV Panel (1) (see Figure 4.13). On this panel, do the following:
   a) Select the emulation type in the **Emulation Type** drop-down window.
   b) In the **Size** field enter the capacity of the VLL volume you want to create, either in MB for open systems or in cylinders (Cyl) for mainframe volumes. The available capacity range (minimum - maximum) is shown to the right of the **Size** field. The value can be incremented by one MB (open systems) or by one Cylinder (mainframe systems).
   c) Select **Set**. The selected volume displays. Repeat the above steps to create other VLL volumes. (To delete a VLL volume, select the VLL volume. Select **Delete**.)

Instructions continue on the following page.

1. Select **Next** to display the Install CV Panel (2) (see Figure 4.15), which displays the VLL volumes to be created in the table on the top. In this panel:
   a) Select one or more VLL volume numbers to assign a CU number and an LDEV number.
   b) Select a CU number from the **Select CU No.** drop-down window (see Figure 4.12)
   c) Select an LDEV number from the white LDEV numbers in the **Select LDEV Number:** table. Gray indicates LDEV numbers that are not selectable, white indicates unused LDEV numbers, and blue indicates available LDEV numbers. The CU and LDEV number appear in the **CU:LDEV** field of the VLL volume-setting information table.
   d) Repeat the above steps to set other VLL volumes.

1. After setting all CU numbers and LDEV numbers, select **Next**.
2. If the boundary area of the selected LDEV number does not have an SSID, the SSID setting panel appears (see Figure 4.16). In this panel:
   a) Select the CU number.
   b) Enter a new SSID in the **Input SSID** entry box.
   c) Select **Set**. The SSID is displayed in the **SSID** field of the SSID setting area.
   d) Repeat the above steps to set two or more SSIDs.

1. After setting all of the SSIDs, select **Next** to display the Install CV Confirmation panel (see Figure 4.17).
2. Select **OK**. The new settings are shown in blue. You are returned to the **VLL** tab.
3. The change is not yet implemented in the subsystem, but the following changes appear in the **VLL** tab (see Figure 4.18):
   a) The figures in the **Capacity** column are not yet updated.
   b) The color of the VDEV icon that you manipulated in the **Parity Group - LDEV** outline view changes from red to blue. You cannot manipulate blue VDEVs until you select **Apply** or **Cancel**, but you can install additional CVs in VDEV with red icons.
   c) The new CVs are shown in blue.

1. Select **Apply** (or **Cancel**). Select **OK** to complete the process.
2. To change a CU:LDEV number that is already assigned:
   a) Remove the CU:LDEV number.
   b) Assign a new CU:LDEV number.
   c) Select one or more VLL volume numbers corresponding to the CU:LDEV numbers that you want to remove.
   d) Right-click and select **Clear** from the pop-up menu (see Figure 4.14).

Note: When LDEV formatting is in progress, a notation appears across the bottom of the panel (see Figure 4.19).

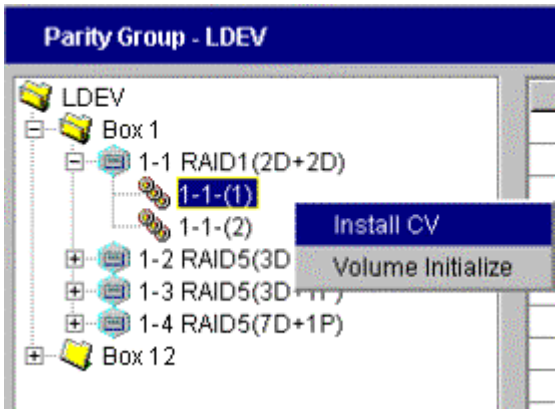


Figure 4.11 Install CV Pop-Up Menu

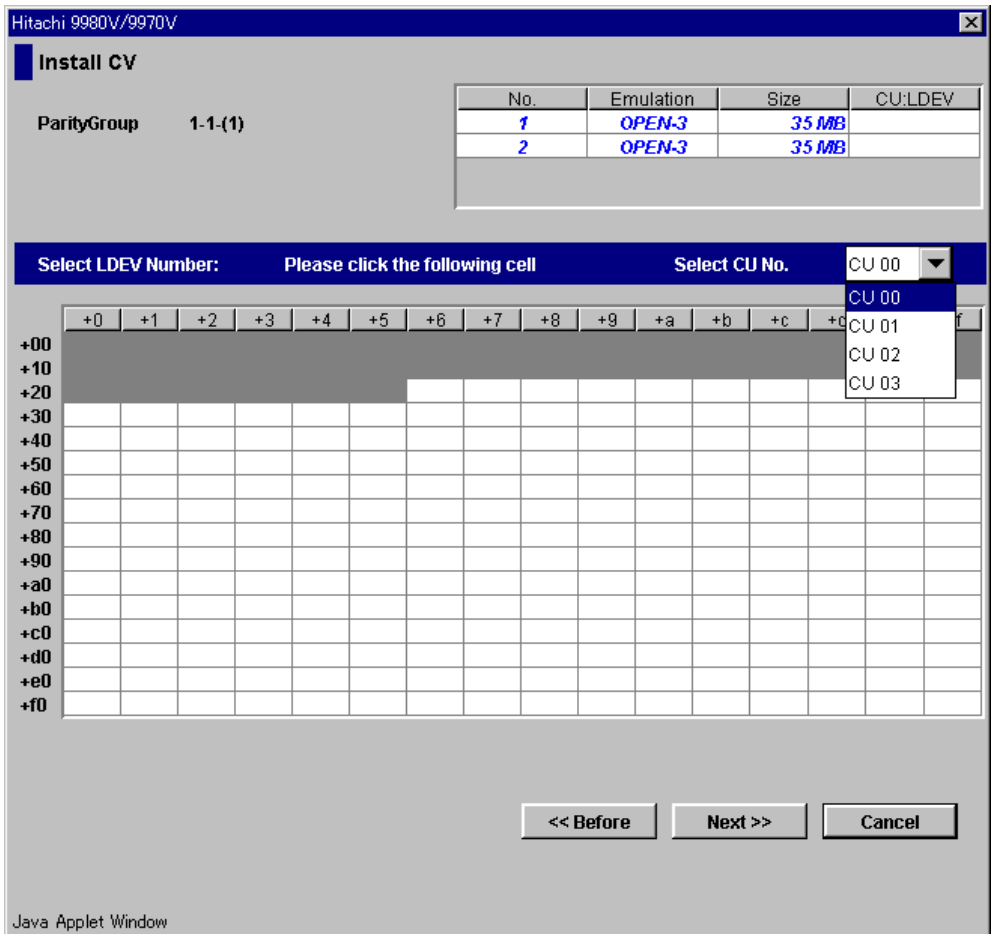


Figure 4.12 Select CU No. Drop-Down Box

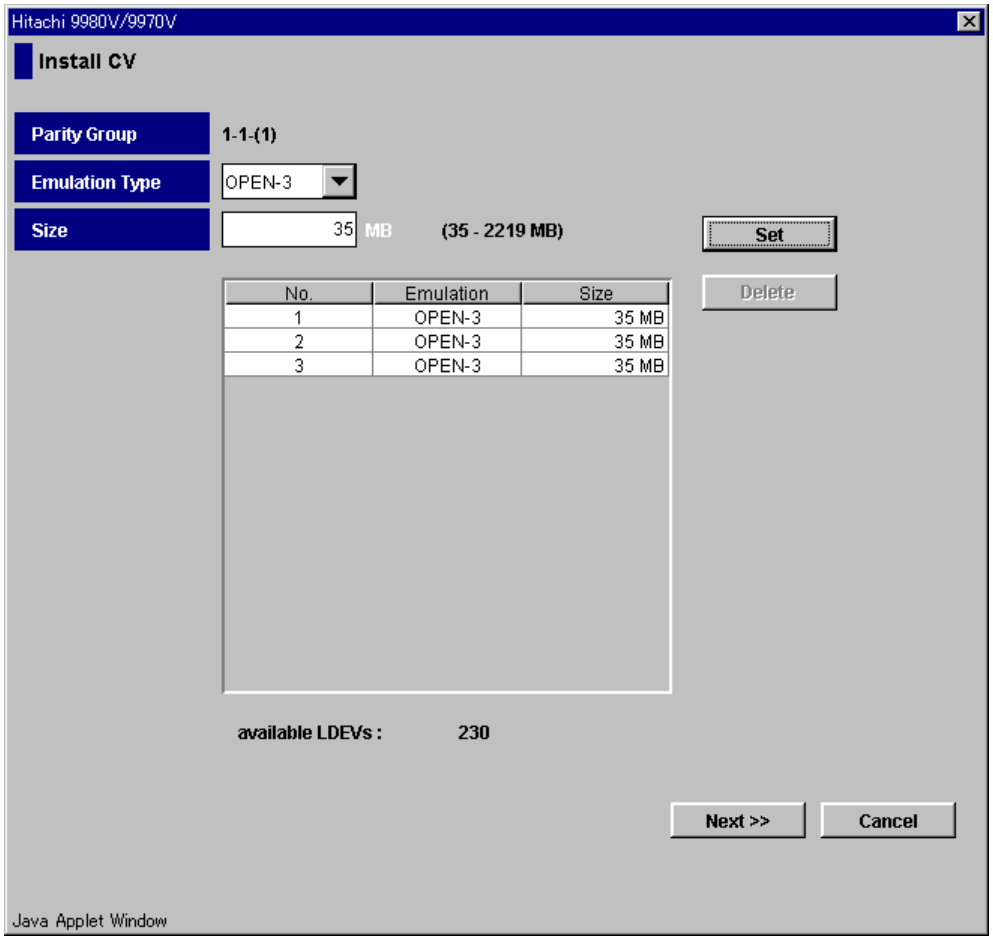


Figure 4.13 Install CV Panel (1)

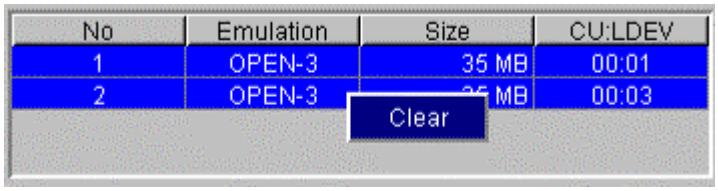


Figure 4.14 Clear Pop-Up Menu

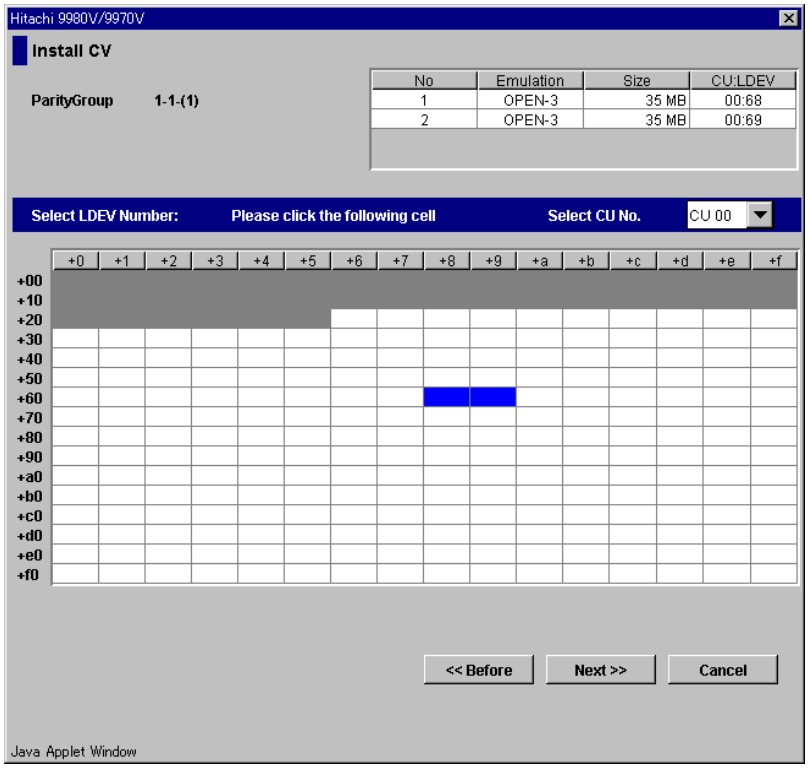


Figure 4.15 Install CV Panel (2)

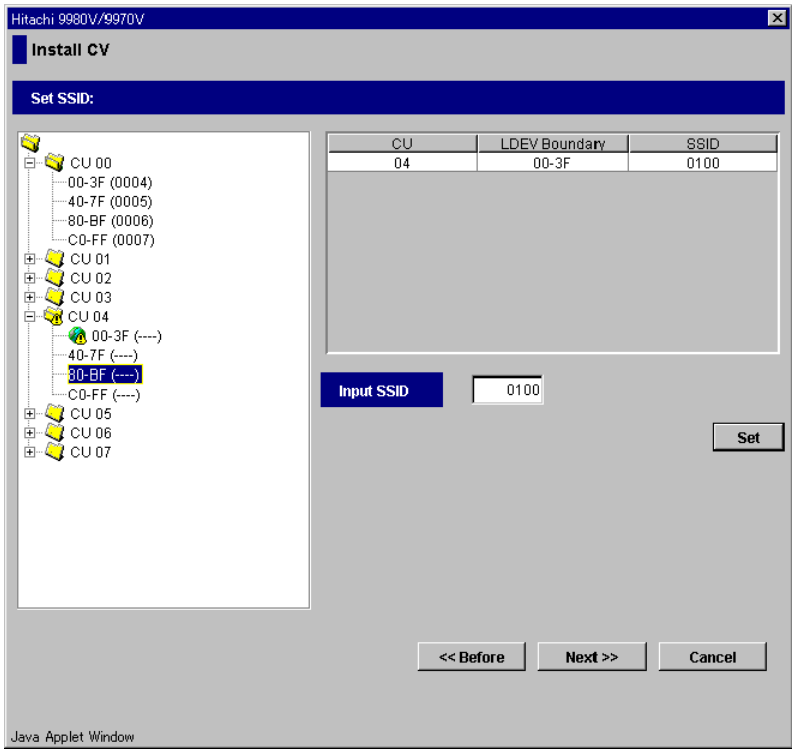


Figure 4.16 Set SSID Panel (Installing VLL Volumes)

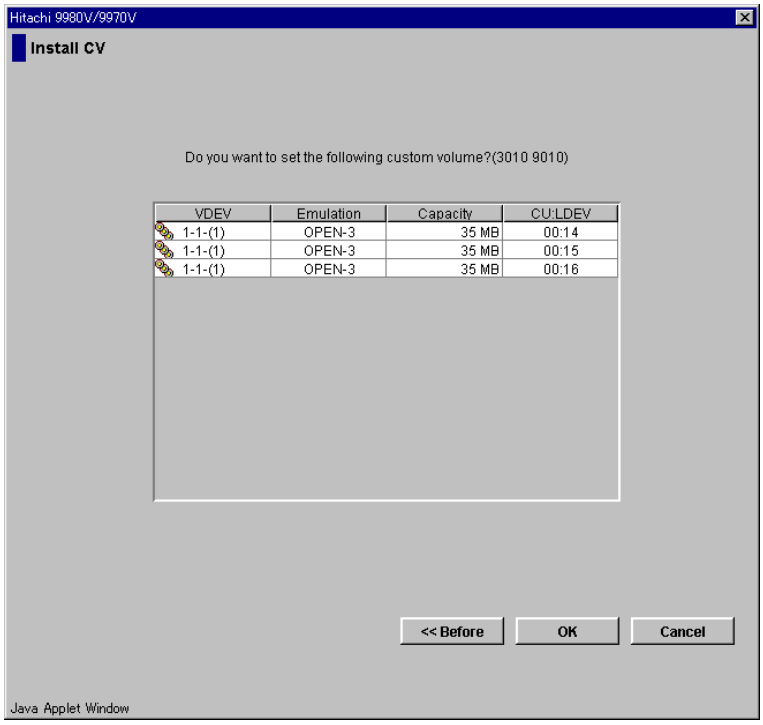


Figure 4.17 Install CV Confirmation Panel

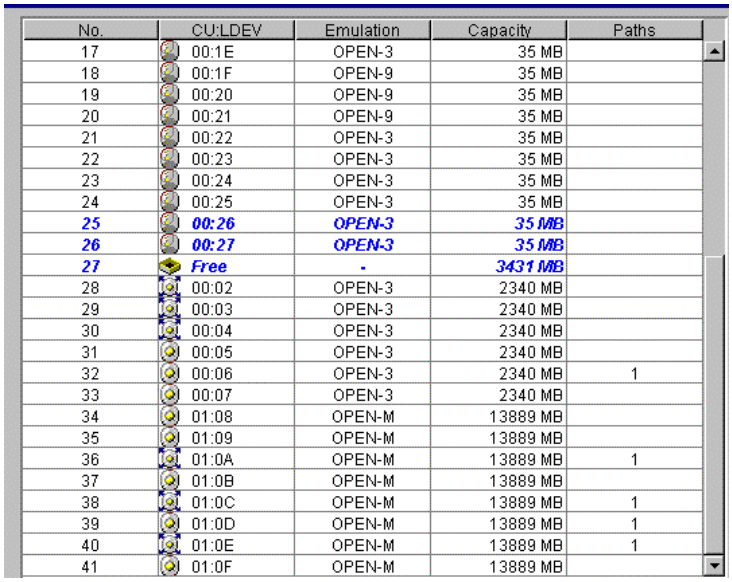


Figure 4.18 VLL Volume Created But Changes Not Yet Implemented

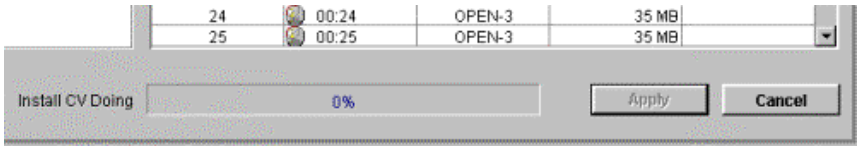


Figure 4.19 Install CV Progress Indicator

4.2.4 Deleting VLL Volumes

To delete an individual Virtual LVI/LUN volume within a VDEV, use the volume to space operation (refer to section 4.2.1).

To convert a Virtual LVI/LUN volume to a normal volume, initialize the volume (see section 4.2.5).

4.2.5 Initializing VLL Volume

> ***WARNING:*** The Volume Initialize function is a destructive operation. The data on the Virtual LVI/LUN volume being converted is lost when the operation is complete. The user is responsible for backing up the data as needed before performing this operation.

The **Volume Initialize** function allows you to convert a Virtual LVI/LUN volume back to a normal volume. This operation de-installs all variable sized volumes under a Virtual LVI/LUN volume, and reformats the Virtual LVI/LUN volume as a normal volume (example, 3390-3).

The Volume Initialize operation has the following restrictions:

- The LDEV should not have a path definition (including Hitachi TrueCopy-S/390®, Hitachi TrueCopy, ShadowImage-S/390®, and ShadowImage pair volumes).
- The LDEV should not be a component of a LUSE volume.
- The LDEV should not be reserved for Hitachi CruiseControl.

To initialize a VLL volume:

1. Change to **Modify** mode.
2. Select **LUN Expansion (LUSE)/Virtual LVI/LUN (VLL)** () to open the LUSE/VLL panel. The **LUSE** tab is the default view.
3. Select the **VLL** tab.
4. On the **Parity Group – LDEV** outline (on the upper left corner of the panel), select the LDEV folder to open a list of VDEVs.
5. Select a VDEV and the **LDEV Information** table (on the upper right of the panel) displays detailed information about the LDEVs.
6. Right-click any part of the **Parity Group - LDEV** outline view to display the Volume Initialize pop-up menu (see Figure 4.20).

Instructions continue on the following page.

7. Select **Volume Initialize** to display the **Volume Initialize** panel (see Figure 4.21). On this panel:
   a) Select one or more VLL volume numbers.
   b) Select a CU number from the **Select CU No.** drop-down list.
   c) Select an LDEV number from white LDEV numbers in the **Select LDEV Number:** table. The CU and LDEV number appear in the **CU:LDEV** field.
   d) To change a CU:LDEV number that is already assigned, select one or more volume numbers corresponding to the CU:LDEV numbers that you want to remove. Right-click to display the **Clear** Pop-Up Menu (see Figure 4.22). Select **Clear**.
8. After setting all CU numbers and LDEV numbers, select **Next**.
9. If the boundary area of the selected LDEV number does not have a SSID, the SSID setting panel displays (see Figure 4.23). On that panel:
   a) Select the CU number.
   b) Enter a new SSID in the **Input SSID** entry box.
   c) Select **Set**.
10. After setting all SSIDs, select **Next**.
11. The Volume Initialize Confirmation Panel (see Figure 4.24) displays. Verify that the information is correct (see Figure 4.25). Select **OK** (or **Cancel**).
12. A notation appears across the top of the panel to indicate that the volume has been initialized, and the color of the VDEV icon that you manipulated in the **Parity Group - LDEV** outline view changes from red to blue (see Figure 4.26).

    Note: You cannot manipulate VDEVs denoted by blue icons until you either apply the changes to the subsystem or cancel them, but you can initialize additional VLL volumes in VDEVs denoted by red icons.
13. To apply the changes to the subsystem, select **Apply** (or **Cancel**).
14. Select **OK** (or **Cancel**).

Note: When LDEV formatting is in progress, and at completion, a notation appears across the bottom of the panel to indicate the progress.

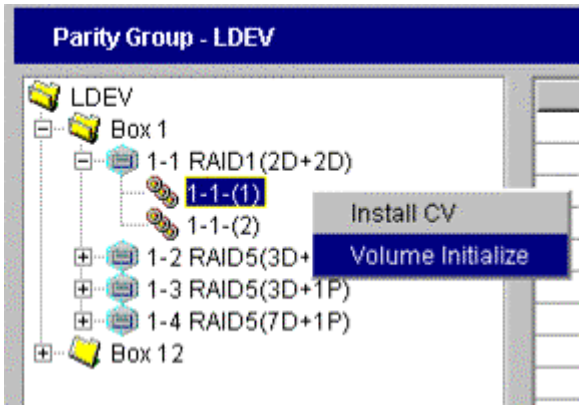


Figure 4.20 Volume Initialize Pop-Up Menu

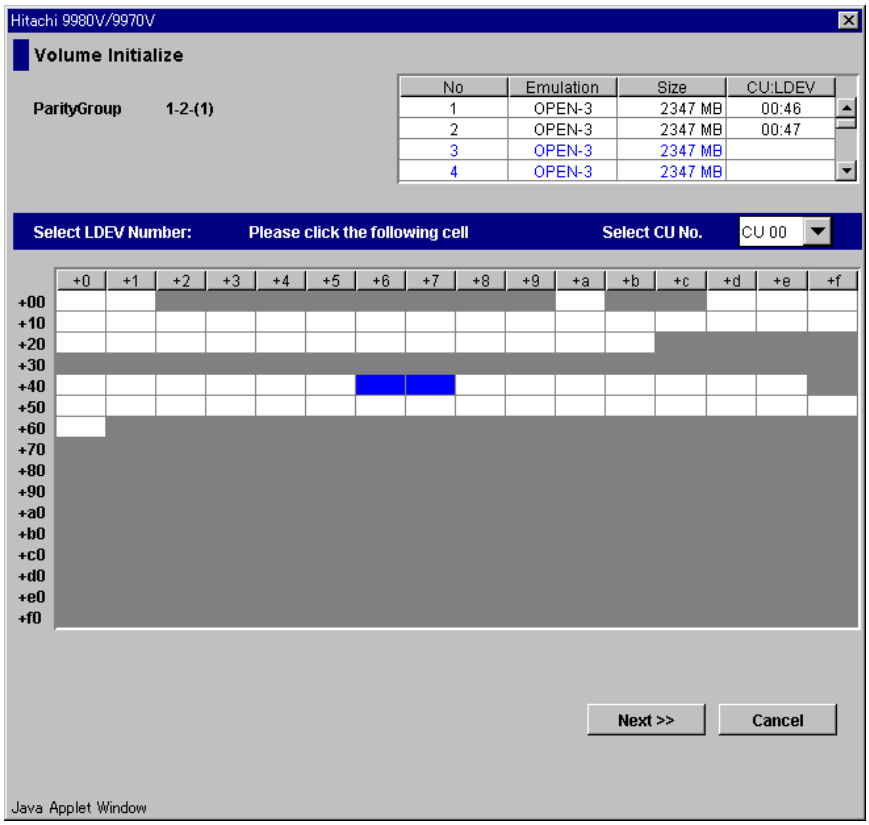


Figure 4.21 Volume Initialize Panel

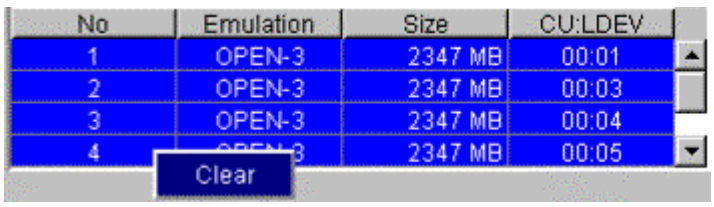


Figure 4.22 Clear Pop-Up Menu

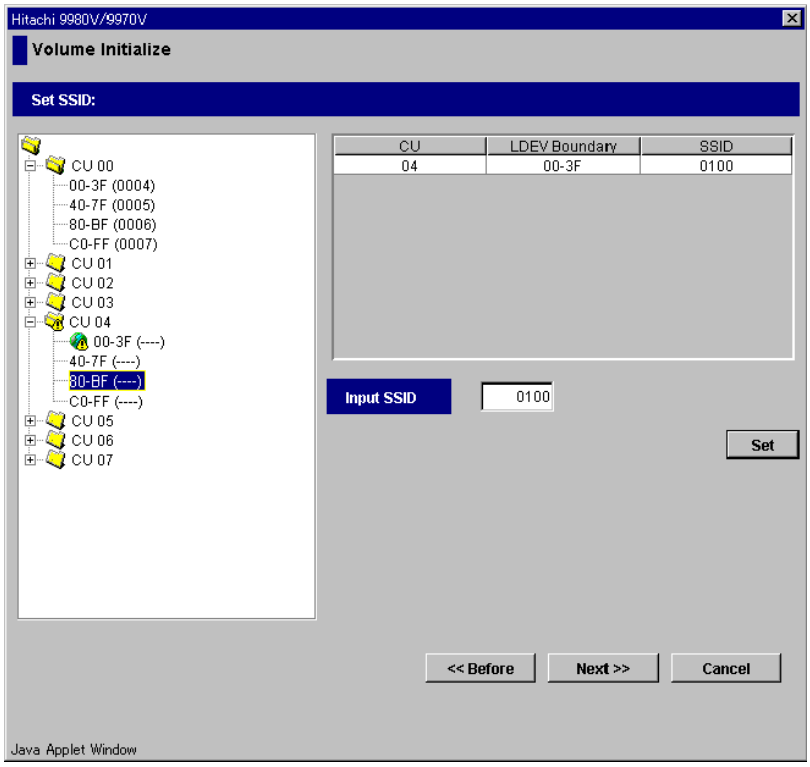


Figure 4.23 Set SSID Panel (Initializing VLL Volumes)

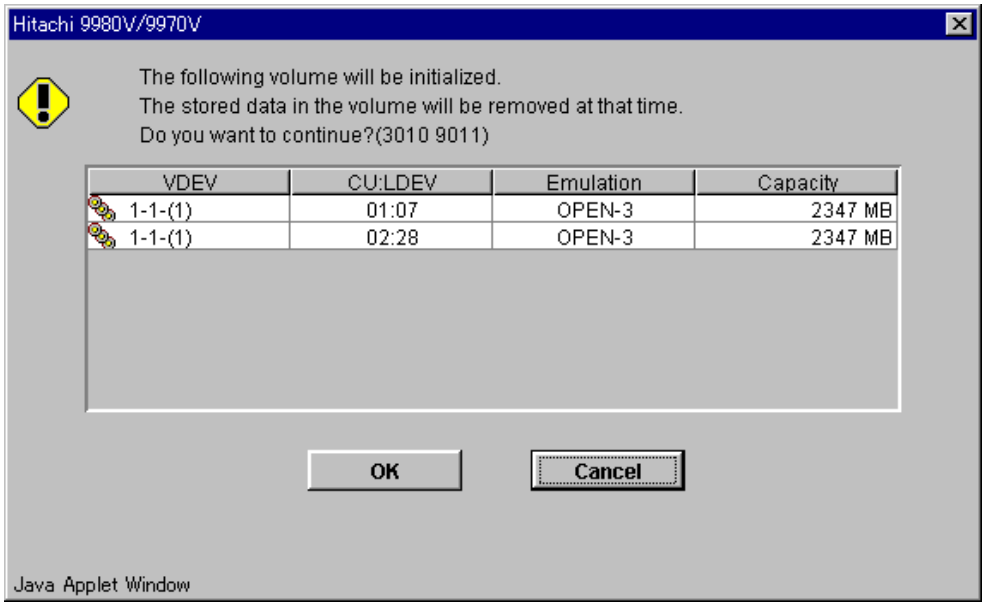
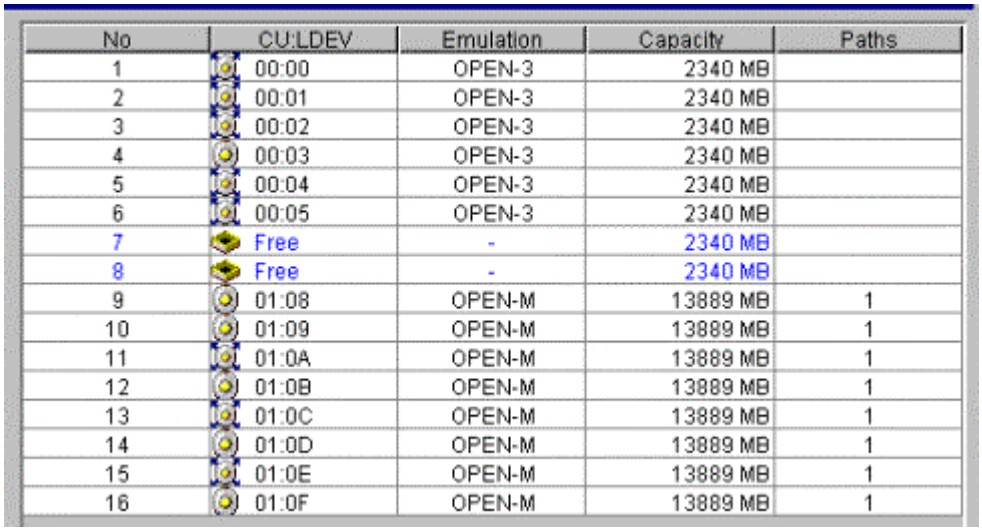


Figure 4.24 Volume Initialize Confirmation Panel



No	CU:LDEV	Emulation	Capacity	Paths
1	00:00	OPEN-3	2340 MB	
2	00:01	OPEN-3	2340 MB	
3	00:02	OPEN-3	2340 MB	
4	00:03	OPEN-3	2340 MB	
5	00:04	OPEN-3	2340 MB	
6	00:05	OPEN-3	2340 MB	
7	Free	-	2340 MB	
8	Free	-	2340 MB	
9	01:08	OPEN-M	13889 MB	1
10	01:09	OPEN-M	13889 MB	1
11	01:0A	OPEN-M	13889 MB	1
12	01:0B	OPEN-M	13889 MB	1
13	01:0C	OPEN-M	13889 MB	1
14	01:0D	OPEN-M	13889 MB	1
15	01:0E	OPEN-M	13889 MB	1
16	01:0F	OPEN-M	13889 MB	1

Figure 4.25 Verifying That the Selected Volumes Are Marked as "Free"

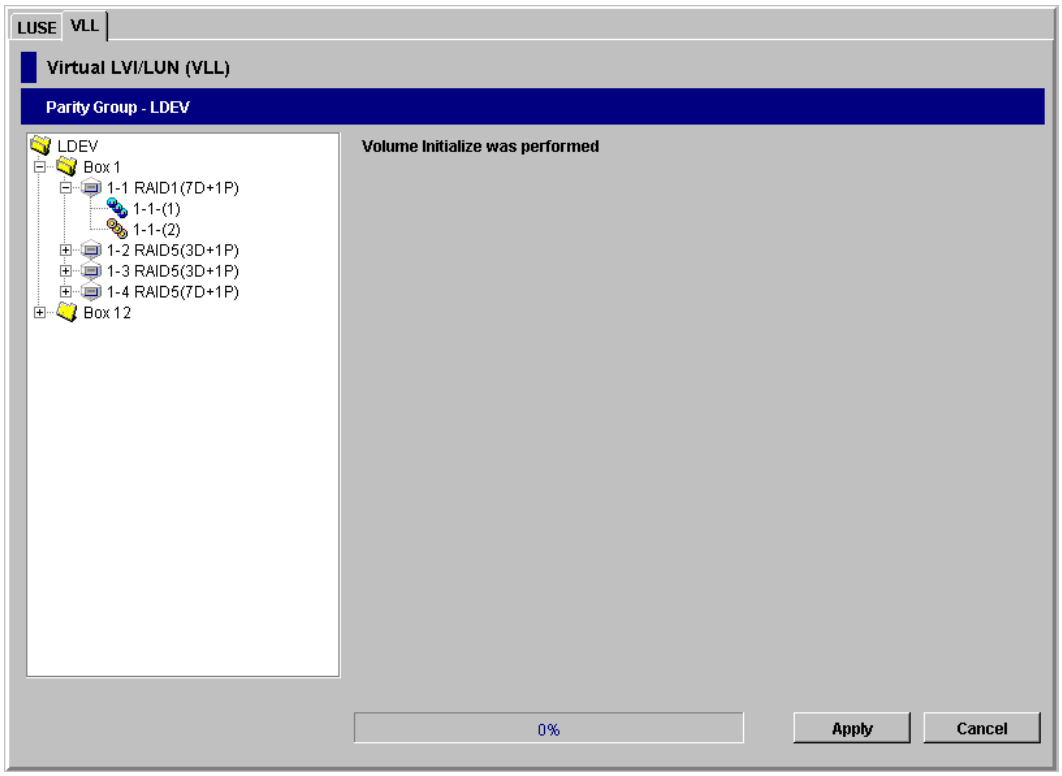


Figure 4.26 Volume Initialization Progress Indicator

Chapter 5 Troubleshooting

5.1 Troubleshooting

For troubleshooting information on the 9900V subsystem, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series User and Reference Guide* (MK-92RD100).

For information on the 9900V Storage Navigator software error codes, please refer to the *Hitachi Freedom Storage™ Lightning 9900™ V Series Hitachi Remote Console – Storage Navigator Error Codes (*MK-92RD132).

For general error conditions, see Table 5.1.

The user is responsible for the operation and normal maintenance of the computer(s) that host the 9900V Storage Navigator software.

Here are some guidelines for troubleshooting 9900V Storage Navigator software operations:

- **Check the cabling and the LAN.** Verify that both the computer and LAN cabling are firmly attached, and that the LAN is operating properly.
- **Reboot the computer.** Close any programs that are not responding. If necessary, reboot the **computer** and restart the 9900V Storage Navigator Java™ applet program.
- **Check for any General Error Conditions.** Check the troubleshooting information in the *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console – Storage Navigator User's Guide* (MK92RD101). The document lists general error conditions, and provides recommended resolution for each condition. If you are still unable to resolve an error condition, please call the Hitachi Data Systems Support Center for assistance (see section 5.2 for contact information).
- **Check the status lamp on the Storage Navigator main Panel (Status tab).** If the lamp becomes yellow () or red (), confirm the severity level of the error. If you are unable to resolve an error condition, please contact the Hitachi Data Systems Support Center (see section 5.2).
- **Download the Storage Navigator trace files using the FD Dump Tool.** If you are unable to resolve an error condition, copy the 9900V **Storage Navigator** configuration information onto a diskette using the FD Dump Tool. See *Hitachi Freedom Storage™ Lightning 9900™ V Series Remote Console – Storage Navigator User's Guide* (MK92RD101) for instructions on using the FD Dump tool. Contact the Hitachi Data Systems Support Center (see section 5.2), and give this information to the Hitachi Data Systems service personnel.

Table 5.1 General Error Conditions

Error Condition	Probable Cause / Recommended Action
The Storage Navigator experiences an error.	Save the Java™ log file on the Storage Navigator, and report to the Hitachi Data Systems Support Center. For Windows® 2000, the Java™ log file is located as follows: `c:\Documents and Settings\login user ID\plugin131.trace` Restart the Storage Navigator computer.
Only the **Exit** and **Refresh** buttons are effective when accessing the SVP from the Storage Navigator.	The SVP might not be ready or perform some write processes from the other system. Wait for a while and select **Refresh**.
Abnormal End / No Response	
An internal error occurs, or a browser ends abnormally (forcibly).	Close all panels including the Storage Device List panel. Log on to the Storage Navigator again. If the same error occurs, restart the Storage Navigator.
A network error occurred. There is no response to an operation.	Restart the Storage Navigator.
Incorrect Display/ Disoperation	
After dragging and dropping objects to another location or area, the scroll bar on that location becomes unusable.	Close all panels including the Storage Device List panel. Log on to the Storage Navigator again.
A focus disappears from the edit box.	Close all panels including the Storage Device List panel. Log on to the Storage Navigator again.
The display of the browser becomes incorrect, because some GUI items such as labels and icons cannot be downloaded properly.	Log off from the Storage Navigator, and then re-log in.
A Storage Navigator panel is closed by: – Selecting the ☒ button on the panel, – Using the commands such as **File** and **Exit** on the browser, or – Pressing the **Alt** and **F4** keys.	Wait for an RMI™ time-out (default is 1 minute). Restart the Storage Navigator.
Maintenance / Other	
The program on the SVP is updated.	Exit all browsers on the Storage Navigator. Restart the viewers. If in doubt, exit and restart the viewers.
The time of the clock on the Storage Navigator is reset.	Clear the cache (the existing temporary Internet files) of the browser before logging on to the Storage Navigator.
Storage Navigator processing is temporarily delayed.	An internal process (for example, configuration change, Program Product. check, operational information acquisition) might be in progress on the SVP (web server).
If you are unable to resolve an error condition.	Copy the 9900V Storage Navigator configuration information onto floppy disk(s) using the **FD Dump Tool**. Contact the Hitachi Data Systems Support Center (see section 5.2).

5.2 Calling the Hitachi Data Systems Support Center

When you call the Hitachi Data Systems Support Center, make sure you provide as much information about the problem as possible. Include the circumstances surrounding the error or failure, the 9900V Storage Navigator configuration information saved in the floppy diskette(s) by the **FD Dump Tool**, the exact content of any messages displayed on the Storage Navigator, and the severity levels and reference codes displayed on the **Status** tab of the Storage Navigator main panel. The worldwide Hitachi Data Systems 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

Glossary, Acronyms, and Abbreviations

Command Control Interface (CCI)	System administrators can enter Command Control Interface (CCI) commands from open-system hosts to perform Hitachi TrueCopy and ShadowImage operations on logical devices.
CruiseControl	CruiseControl performs automatic relocation of volumes to optimize performance.
CU	Control Unit. The 9900V subsystem supports a maximum of 16 logical control unit (CU) images, numbered sequentially from 0 to F. Each CU image controls up to 256 LDEVs.
Custom Access	A feature that allows a non-administrator to be assigned write access to one or more of the restricted Storage Navigator functions.
DASD	Direct-Access Storage Device
DKC	Disk Controller. The 9900V disk controller provides up to sixteen logical control unit (CU) images, and supports 3990-6, 3990-6E, and 2105-F20 disk controller emulation.
DKU	Disk Array Unit. The 9900V subsystem has up to six disk array frames containing the storage components (disk drive arrays) of the subsystem.
ESCON®	Enterprise System Connection
Export File	This function allows you to export data (example: monitoring data used by Performance Monitor or Hitachi TrueCopy) to data files.
FD	Floppy disk
FD Dump Tool	This function downloads the 9900V Storage Navigator configuration information onto a floppy diskette or a hard disk drive, and is generally used for troubleshooting purposes.
FICON™	Fibre Connection
FlashAccess	FlashAccess (Dynamic Cache Residence) enables you to store specific high-usage data directly in cache memory to provide virtually immediate data availability.
GB	Gigabyte(s)

Hi-Star™	Hierarchical Star Network architecture improves the total performance of internal data transfer by using high-speed crossbar changes.
HMBR	Hitachi Multiplatform Backup/Restore
Java™ applet program	The web client Java™ applet program runs on a browser on the Storage Navigator. When a Storage Navigator user accesses and logs on to the desired SVP, the web client Java™ applet is downloaded from the SVP to the Storage Navigator. The web client Java™ applet program runs on a browser on the Storage Navigator.
JVM™	Java Virtual Machine™ is the web client Java™ applet program that is installed in each SVP and runs using a browser to provide a user-friendly interface for the 9900V Storage Navigator functions.
KB	Kilobyte(s)
LAN	Local area network
LBA	Logical block address
LDEV	Logical device. An LDEV used by mainframe hosts can be called a device, logical volume image (LVI) or a volume. An LDEV used by open-system hosts is called a logical unit (LU).
LU	An LDEV used by open-system hosts is called a logical unit (LU). Open-system fibre interfaces access LUs that are mapped to one or more LDEVs.
LUN	Logical unit number is an identifying number for an LU.
LUN Manager	Storage Navigator software option that enables you to configure the 9900V fibre-channel ports for operational environments, and restrict host access to LUs.
LUSE	LUN Expansion. This function allows you to concatenate two or more volumes into a larger volume.
LVI	Logical Volume Image (also called device emulation)
MB	Megabyte(s)

MIB	Message information block
Open Volume Management	A suite of options that includes Virtual LVI/LUN and LUSE (LUN Expansion). Virtual LVI/LUN divides a logical volume for open-system into two or more volumes. LUN Expansion allows you to concatenate two or more volumes into a larger volume.
Parity group	A set of hard disk drives that have the same capacity, and are treated as one group. A parity group contains both user data and parity information, which allows the user data to be accessed in the event that one or more of the drives within the group are not available.
RMI™	Remote Method Invocation. RMI™ is a remote procedure call, which allows Java™ objects stored in the network to be run remotely.
R-SIM	Remote service information message (generated by the 9900V when it detects an error or service requirement).
SIM	Service information message (generated by a subsystem when it detects an error or service requirement).
ShadowImage	An option that allows you to maintain subsystem-internal copies of all user data for purposes such as data backup and duplication.
SNMP	Simple Network Management Protocol (part of the TCP/IP protocol suite)
SSID	Storage subsystem ID. The 9900V is configured with one SSID for each 64 devices, and up to four SSIDs for each CU image.
SVP	Service Processor (this is the notebook computer that is inside the 9900V).
TCP/IP	Transmission Control Protocol/Internet Protocol
TID	Target ID
Trap	An SNMP agent initiates trap operations when R-SIMs occur, in order to send the R-SIMs to the SNMP manager (see Figure 4.1). An SNMP agent can be configured to deliver traps to more than one SNMP manager.
TrueCopy	TrueCopy is an option product that allows you to perform host-free remote copy operations between 9900V subsystems in different locations for data backup and disaster recovery purposes.

UCB	Unit control block
User account list	The user account list includes user information such as user ID, password, and write permission for each 9900V option.
VLL	Virtual LVI/ LUN is an option that enables you to configure custom-size logical device images and logical units, which are smaller than standard-size devices.
Volser	Volume serial number (mainframe volume identifier, not related to the LDEV ID)
Storage Navigator	The Storage Navigator communicates directly with the service processor (SVP) of each attached subsystem to obtain subsystem configuration and status information, and send user-requested commands to the subsystem.
VDEV (Virtual Device)	A parity group can have up to 16 VDEVs. Each VDEV can have up to 256 volumes plus free space.
WWN	Worldwide Name is a unique identifier for a particular open-system host bus adapter, consisting of a 64-bit physical address (the IEEE 48-bit format with 12-bit extension and 4-bit prefix).

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