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RAG 142

*i*SCSI GbE to SATA II with Multi-Lane Expansion RAID System

User Manual

Version 1.0 (March 2007)

Important Safeguards

Please read all of these instructions carefully before you use the device. Save this manual for future reference.

What the warranty does not cover

- Any product, on which the serial number has been defaced, modified or removed.
- Damage, deterioration or malfunction resulting from:
  - ☐ Accident, misuse, neglect, fire, water, lightning, or other acts of nature, unauthorized product modification, or failure to follow instructions supplied with the product.
  - ☐ Repair or attempted repair by anyone not authorized by us.
  - ☐ Any damage of the product due to shipment.
  - ☐ Removal or installation of the product.
  - ☐ Causes external to the product, such as electric power fluctuation or failure.
  - ☐ Use of supplies or parts not meeting our specifications.
  - ☐ Normal wear and tear.
  - ☐ Any other causes which does not relate to a product defect.
- Removal, installation, and set-up service charges.

Regulatory Notice

Legal Information

First English printing, October 2002
Information in this document has been carefully checked for accuracy; however, no guarantee is given to the correctness of the contents. The information in this document is subject to change without notice. We are not liable for any injury or loss that results from the use of this equipment.

Safety Instructions

- Unplug equipment before cleaning. Don't use liquid or spray detergent; use a moist cloth.
- Keep equipment away from excessive humidity and heat. Preferably, keep it in an air-conditioned environment with temperatures not exceeding 40º Celsius (104º Fahrenheit).
- When installing, place the equipment on a sturdy, level surface to prevent it from accidentally falling and causing damage to other equipment or injury to persons nearby.
- When the drawer is in an open position, do not cover, block or in any way obstruct the gap between it and the power supply. Proper air convection is necessary to keep it from overheating.
- Arrange the equipment's power cord in such a way that others won't trip or fall over it.
- If you are using a power cord that didn't ship with the equipment, ensure that it is rated for the voltage and current labeled on the equipment's electrical ratings label. The voltage rating on the cord should be higher than the one listed on the equipment's ratings label.
- Observe all precautions and warnings attached to the equipment.
- If you don't intend on using the equipment for a long time, disconnect it from the power outlet to prevent being damaged by transient over-voltage.
- Keep all liquids away from the equipment to minimize the risk of accidental spillage. Liquid spilled on to the power supply or on other hardware may cause damage, fire or electrical shock.
- Only qualified service personnel should open the chassis. Opening it yourself could damage the equipment and invalidate its warranty.
- If any part of the equipment becomes damaged or stops functioning, have it checked by qualified service personnel.

Regulatory Notices Federal Communications Commission (FCC)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.
Any changes or modifications made to this equipment may void the user's authority to operate this equipment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.
However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-position or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Preface

About this Manual

Thank you for using **Synergy Global Technology Inc.** products; if you have any question, please e-mail to **"sales@rackmountmart.com"**. We will answer your question as soon as possible.

This manual is designed and written for users of the **RAG 142** . Users should ideally be familiar and have some experience with RAID planning and data storage operations. However, this manual will provide instructions and education for those who have little or no experience in RAID to install and setup the **RAG 142** .

Notice

Product features and specifications described in this manual are subject to change without notice.

The manufacturer shall not be liable for any damage, or for the loss of information resulting from the performance or use of the information contained herein.

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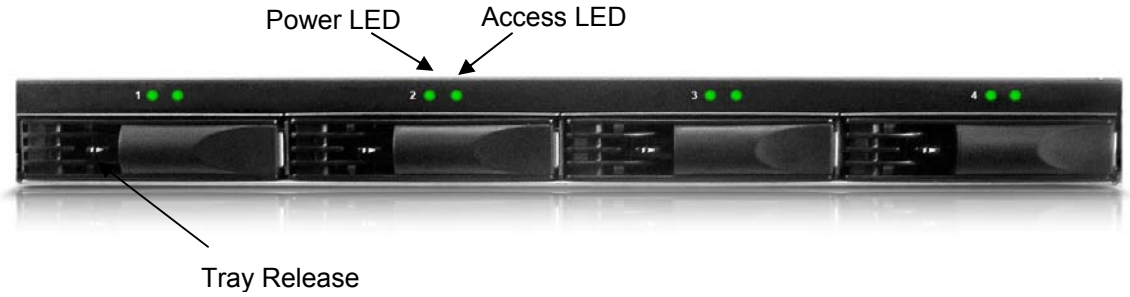
Chapter 1 RAID introduction

1.1 Features

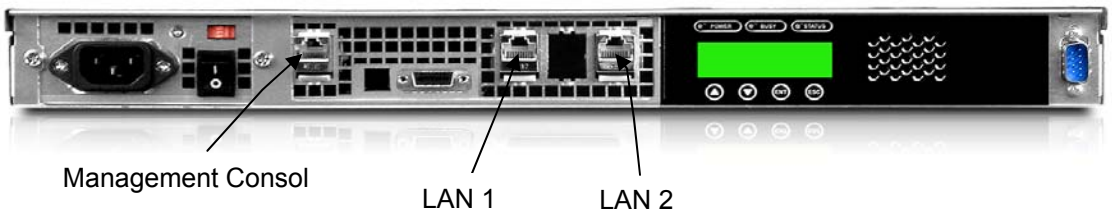
RAG 142 controller has the features listed below:

- RAID 6 ready.
- Snapshot-on-the-box / rollback (optional).
- SATA II support with SATA I backward compatible.
- N-way mirror.
- On-line volume expansion and RAID level migration.
- Global/dedicated cache configurable by volume.
- S.M.A.R.T. enabled.
- Support SES. LAN 2
- Support Microsoft VDS (Virtual Dis tional).
- Disk roaming.
- MPIO ready (initiator driver support is needed).
- Support iSCSI header and data digest.
- Support CHAP authentication.
- Support Link aggregation/Trunking

Front view



Rear view



When properly configured, **RAG 142** controller can provide non-stop service with a high degree of fault tolerance through the use of RAID technology and advanced array management features.

RAG 142 controller connects to the host system through an iSCSI interface. It can be configured to any RAID level. It provides reliable data protection for servers and offers a new technology to implement the **RAID 6** function. The RAID 6 function allows two HDD failures without impact on the existing data. Data can be reconstructed from the remaining data and parity drives.

Snapshot-on-the-box is a point-in-time volume replication. It makes consistent and instant copies of data volumes without any system downtime. It can keep up to 32 snapshots for all data volumes. **Rollback** feature is provided so users can easily restore the previously-snapshotted data easily while continuing using the volume for further data access. The data access is just regular as before including read and write without any impact on end users. The "on-the-box" terminology implies the fact that it does not require any proprietary agents installed at host side. The snapshot is taken at volume level. It will not consume any host CPU cycles thus the server is dedicated to the specific application. The snapshot copies can be taken manually or by schedule such as hourly and daily.

RAG 142 RAID controller is the most cost-effective disk array controller with completely integrated high-performance and data-protection capabilities that meet or exceed the highest industry standards, **the best data solution for small to medium size business user.**

Caution
Snapshot/rollback features need **512MB** RAM or more. Please refer RAM certification list in Appendix A.

1.2 Terminology

This document uses the terms as follows:

RAID	RAID is the abbreviation of **"R**edundant **A**rray of **I**ndependent **D**isks**"**. There are different RAID levels with different degree of the data protection.
PD	The **P**hysical **D**isk belongs to the member disk of one specific volume group.

VG	**V**olume **G**roup. One VG consists of a set of UDVs and owns one RAID level attribute.
UDV	**U**ser **D**ata **V**olume. Each VG could be divided into different UDVs. The UDVs from one VG share the same RAID level, but may own the different volume capacity.
CV	**C**ache **V**olume. Each UDV will be associated with one specific CV to execute the data transaction. Each CV could own the different cache memory size.
LUN	**L**ogical **U**nit **N**umber. LUN is the logical volume, which the users could access by using the SCSI commands.
GUI	**G**raphic **U**ser **I**nterface.
RAID width, RAID copy, RAID row (RAID cell in one row)	RAID width, copy and row are used to describe one VG. E.g.: 1. One 4-disk RAID 0 volume: RAID width= 4; RAID copy=1; RAID row=1. 2. One 3-way mirroring volume: RAID width=1; RAID copy=3; RAID row=1. 3. One RAID 10 volume over 3 4-disk RAID 1 volume: RAID width=1; RAID copy=4; RAID row=3.
WT	**W**rite-**T**hrough cache write policy. Each data is synchronized in both data cache and the accessed physical disks.
WB	**W**rite-**B**ack cache write policy. Will speed up system write performance but needs to bear the risk where data may be inconsistent between data cache and the physical disks in one short time interval.
RO	Set the volume to be **R**ead-**O**nly.
DS	**D**edicated **S**pare disks. The spare disks only belong to one specific VG. Others could not use the spare disks for any rebuilding purpose.
GS	**G**lobal **S**pare disks. If some VGs are using the global spare disks to do rebuilding, they could get the spare disks out from the common spare disks pool for such requirement.

DC	**D**edicated **C**ache.
GC	**G**lobal **C**ache.
DG	**D**e**G**rade mode.
S.M.A.R.T.	**S**elf-**M**onitoring **A**nalysis and **R**eporting **T**echnology.
WWN	**W**orld **W**ide **N**ame.
HBA	**H**ost **B**us **A**dapter.
MPIO	**M**ulti-**P**ath **I**nput/**O**utput.
S.E.S	**S**CSI **E**nclosure **S**ervices.
NIC	**N**etwork **I**nterface **C**ard.
iSCSI	**I**nternet **S**mall **C**omputer **S**ystems **I**nterface.
LACP	**L**ink **A**ggregation **C**ontrol **P**rotocol.
MTU	**M**aximum **T**ransmission **U**nit.
CHAP	**C**hallenge **H**andshake **A**uthentication **P**rotocol. An optional security mechanism to control access to an iSCSI storage system over the iSCSI data ports.
iSNS	**I**nternet **S**torage **N**ame **S**ervice.

1.3 RAID levels

Describe RAID levels as follows:

RAID 0	Disk striping. RAID 0 needs at least one hard drive.
RAID 1	Disk mirroring over two disks. RAID 1 needs at least two hard drives.
N-way mirror	Extension to RAID 1 level. It has N copies of the disk.

RAID 3	Striping with parity on the dedicated disk. RAID 3 needs at least three hard drives.
RAID 5	Striping with interspersed parity over the member disks. RAID 3 needs at least three hard drives.
RAID 6	2-dimensional parity protection over the member disks. RAID 6 needs at least four hard drives.
RAID 0+1	Mirroring of the member RAID 0 volumes. RAID 0+1 needs at least four hard drives.
RAID 10	Striping over the member RAID 1 volumes. RAID 10 needs at least four hard drives.
RAID 30	Striping over the member RAID 3 volumes. RAID 30 needs at least six hard drives.
RAID 50	Striping over the member RAID 5 volumes. RAID 50 needs at least six hard drives.
RAID 60	Striping over the member RAID 6 volumes. RAID 60 needs at least eight hard drives.
JBOD	The abbreviation of **"J**ust a **B**unch **O**f **D**isks**"**. JBOD needs at least one hard drive.

Chapter 2 Getting started

2.1 Before starting

Before starting, prepare as follows.

- Review the **"Certification list"** in Appendix A to confirm that the hardware is fully supported.
- Read the latest release notes before upgrading. Release notes will accompany with release firmware.
- A server with a NIC or iSCSI HBA.
- CAT 5, CAT 5e, or CAT 6 network cables for management port and iSCSI data ports. Recommend CAT 6 cables for best performance.
- Prepare storage system configuration plan.
- Management and iSCSI data ports network information. If using static IP, please prepare static IP addresses, subnet mask, and default gateway.
- Gigabit LAN switches. (Recommended) or Gigabit LAN switches with VLAN/LCAP/Trunking functions. (Optional)
- CHAP security information, including CHAP usernames and secrets. (Optional)

2.2 *i*SCSI introduction

*i*SCSI (Internet SCSI) is a protocol that encapsulates SCSI (Small Computer System Interface) commands and data in TCP/IP packets for linking storage devices with servers over common IP infrastructures. *i*SCSI can supply high performance SANs over standard IP networks like LAN, WAN or the Internet.

IP SANs are true SANs (Storage Area Networks) that allow a few of servers to attach to an infinite number of storage volumes using *i*SCSI over TCP/IP networks. IP SANs can scale the storage capacity with any type and brand of storage system. In addition, using any type of network (Ethernet, Fast ethernet, Gigabit ethernet) and combine operating systems (Microsoft Windows, Linux, Solaris, …etc.) within the SAN network. IP-SANs also include mechanisms for security, data replication, multi-path and high availability.

Storage protocol, such as *i*SCSI, has two "ends" in the connection. These ends are the initiator and the target. In *i*SCSI we call them *i*SCSI initiator and *i*SCSI target. The *i*SCSI initiator requests or initiates any *i*SCSI communication. It requests all SCSI operations like read or write. An initiator is usually located on the host/server side (either an *i*SCSI HBA or *i*SCSI SW initiator).

The *i*SCSI target is the storage device itself or an appliance that controls and serves volumes or virtual volumes. The target is the device that performs the SCSI command or bridges it to an attached storage device. *i*SCSI targets can be disks, tapes, RAID arrays, tape libraries, etc.

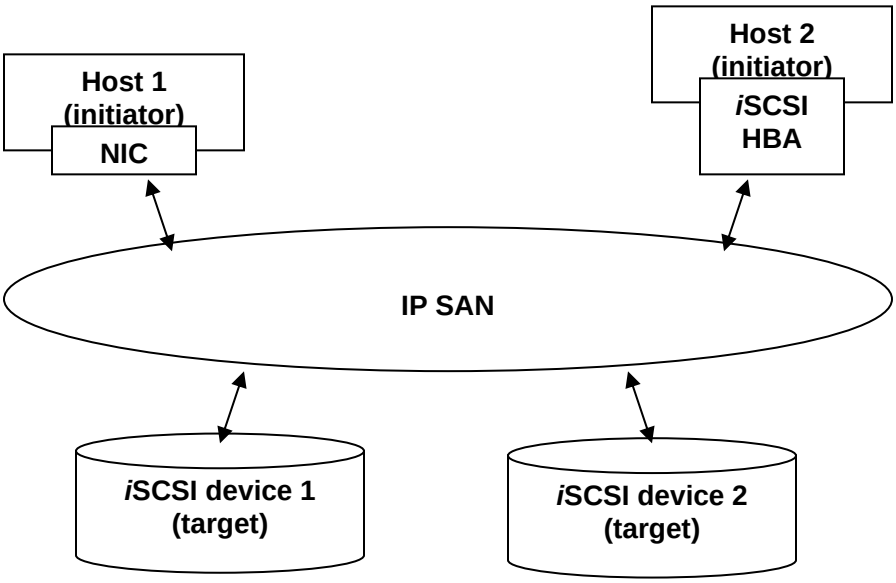


Figure 2.2.1

On the host side, it needs to use an *i*SCSI initiator. The initiator is a driver that handles the SCSI traffic over *i*SCSI. The initiator can be software or hardware (HBA). Please refer to the certification list of *i*SCSI HBA(s) in Appendix A. OS native initiators or other software initiators use the standard TCP/IP stack and Ethernet hardware while *i*SCSI HBA(s) use their own *i*SCSI and TCP/IP stacks on board.

Hardware *i*SCSI HBA(s) would provide its initiator tool. Please refer to their user manual. Microsoft *i*SCSI initiator is a software initiator driver. It is available at the following web site:

Link to download the Microsoft iSCSI software initiator:
http://www.microsoft.com/downloads/details.aspx?FamilyID=12cb3c1a-15d6-4585-b385-befd1319f825&DisplayLang=en

Microsoft *i*SCSI initiator installation procedure is in Appendix D

2.3 Management methods

There are three management methods to manage controller, describe on the following:

RAG 142

2.3.1 Web GUI

RAG 142 controller supports web based user interface to manage the system. Be sure to connect LAN cable. The default IP is **192.168.0.200**; open up the browser and type:

http://192.168.0.200

Click any function at the first time; it will pop up a dialog to authenticate.

Login name: **admin**
Default password: **1234**

2.3.2 RS-232 serial port

Use NULL modem cable to connect console port.
Default baud rate: **115200**, 8 bits, 1 stop bit, and no parity.
Terminal type: **vt100**
Login name: **admin**
Default password: **1234**

2.3.3 Remote control – secure shell

ssh (secure shell) is required for **RAG 142** controller to remote login. The ssh client software is available at the following web site:

SSHWinClient WWW: http://www.ssh.com/

Host name: **192.168.0.200**
Login name: **admin**
Default password: **1234**

Tips
It does not support telnet to connect for remote control, only ssh. Using ssh, the IP address has to be setup and the password is required for login.

2.4 Enclosure

2.4.1 LCM

There are four buttons to control LCM (LCD Control Module), including: ▲ (up), ▼ (down), **ESC** (Escape), and **ENT** (Enter).

After booting up the system, the following screen will be shown:

```
Enhance
EnhanceRAID R4IP←
```

Press **"ENT"**, the LCM functions **"Alarm Mute"**, **"Reset/Shutdown"**, **"Quick Install"**, **"View IP Setting"**, **"Change IP Config"** and **"Reset to Default"** will be rotate by pressing ▲ (up) and ▼ (down).

The following table is function description.

Alarm Mute	Mute alarm when error occurs.
Reset/Shutdown	Reset or shutdown controller.
Quick Install	Three steps to create a volume. Please refer to section 3.3 for operation in web UI.
View IP Setting	Display current IP address, subnet mask, and gateway.
Change IP Config	Set IP address, subnet mask, and gateway. There are 2 selections, DHCP (Get IP address from DHCP server) or set static IP.
Reset to Default	Reset to default will set password to default: **1234**, and set IP address to default. Default IP address: **192.168.0.1** Default subnet mask: **255.255.255.0** Default gateway: **192.168.0.254**

The following is LCM menu hierarchy.

Enhance EnhanceRAID R4IP ▲▼	[Alarm Mute]	[▲Yes No▼]		
	[Reset/Shutdown]	[Reset]	[▲Yes No▼]	
		[Shutdown]	[▲Yes No▼]	
	[Quick Install]	RAID 0 (RAID 1/RAID 3/ RAID 5/RAID 6) xxxxxx MB	Volume Size (xxxxxx M)	Adjust Volume Size
			Apply The Config	[▲Yes No▼]
	[View IP Setting]	[IP Config] [Static IP]		
		[IP Address] [192.168.000.200]		
		[IP Subnet Mask] [255.255.255.0]		
		[IP Gateway] [192.168.000.1]		
	[Change IP Config]	[DHCP]	[▲Yes No▼]	
		[Static IP]	[IP Address]	Adjust IP address
			[IP Subnet Mask]	Adjust Submask IP
			[IP Gateway]	Adjust Gateway IP
			[Apply IP Setting]	[▲Yes No▼]
	[Reset to Default]	[▲Yes No▼]		

Caution
Before power off, it is better to execute **"Shutdown"** to flush the data from cache to physical disks.

2.4.2 System buzzer

The system buzzer features are describing on the following:

1. The system buzzer will alarm 3 seconds when system boots up successfully.
2. The system buzzer will alarm continuously when there are error level events happened in the system. The alarm will be stopped after pressing mute.

Chapter 3 Web GUI guideline

3.1 EnhanceRAID RS GUI hierarchy

Quick Install → Step 1 / Step 2 / Step 3 / Confirm

System Config

System name → System name
IP address → DHCP / Static
***i*SCSI** *i*SNS / Authentication / Link aggregation or Multi-homed / IP settings / Default gateway / Set MTU
Password → Old password / Password / Confirm
Date → Date / Time / Time zone / Daylight saving
Mail → Mail-from address / Mail-to address / SMTP relay / Authentication / Send test mail
SNMP → SNMP trap address / Community
Event log → Mute / Clear

Volume config

Physical disk → Free disc / Global spares / Dedicated spares / More information
Volume group → Create / Delete / More information / Rename / Migrate
User data volume → Create / Delete / Attach LUN / Snapshot / More information / Rename / Extend / Set read/write mode / Set priority / Resize Snapshot space / Auto Snapshot
Cache volume → Create / Delete / More information / Resize
Logical unit → Attach / Detach

Enclosure management

Voltage & Temperature → Auto shutdown
S.M.A.R.T. → S.M.A.R.T. for physical disks
UPS → UPS Type / Shutdown Battery Level / Shutdown Delay / Shutdown UPS

Maintenance

Upgrade → Browse the firmware to upgrade
Info → System information
Shutdown → Reboot / Shutdown

Logout

3.2 Login

EnhanceRAID RS controller supports graphic user interface to manage the system. Be sure to connect LAN cable. The default IP is **192.168.0.200**; so open the browser and type:

http://192.168.0.200

Click any function at the first time; it will pop up a dialog to authenticate.

Login name: **admin**
Default password: **1234**

After login, the selections listed on the left can be operated.

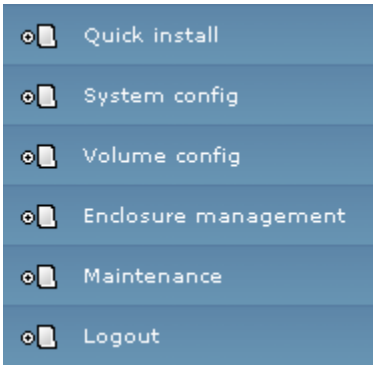


Figure 3.2.1

There are three indicators at the top-right corner.

1. **Voltage light:** Green is normal. Red represents abnormal voltage status. Please refer to section 4.6.2 for more detail.

2. **Temperature light:** Green is normal. Red represents abnormal temperature.

3. **RAID light:** Green means RAID works fine. Red represents RAID failed happens.

3.3 Quick install

It is easy to use **"Quick install"** function to create a volume. Depend on how many physical disks or how many residual spaces on created VGs are free, the system will calculate maximum spaces on RAID levels 0/1/3/5/6. **"Quick install"**

function will occupy all residual VG space for one UDV, and it has no space for snapshot. If snapshot function is needed, please create volumes by manual, and refer to section 4.4 for more detail.

Step 1: Select **"Quick install"** then choose the RAID level to set. Please refer to Figure 3.3.1. After choosing the RAID level, click " NEXT ", it will be linked to another page required to set up the "LUN".

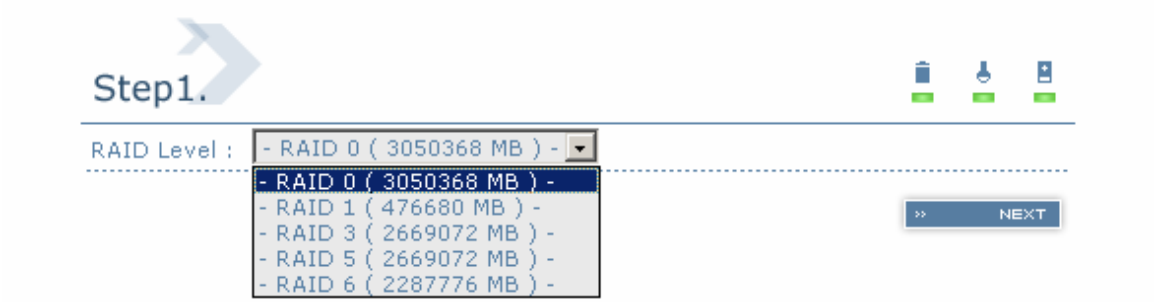


Figure 3.3.1

Step 2: Please select a LUN number. Access control of host would be shown as a wildcard **"*"**, which means every host can access this volume. In this page, the "Volume size" can be changed. The maximum volume size is shown. To re-enter the size be sure it has to be less or equal to maximum volume size. Then click " NEXT ".

Step 3: Confirm page. Click " CONFIRM " if all setups are correct. Then a page with the "User data volume" just been created will be shown as Figure 3.3.2.

Done. It can be used as a disk.

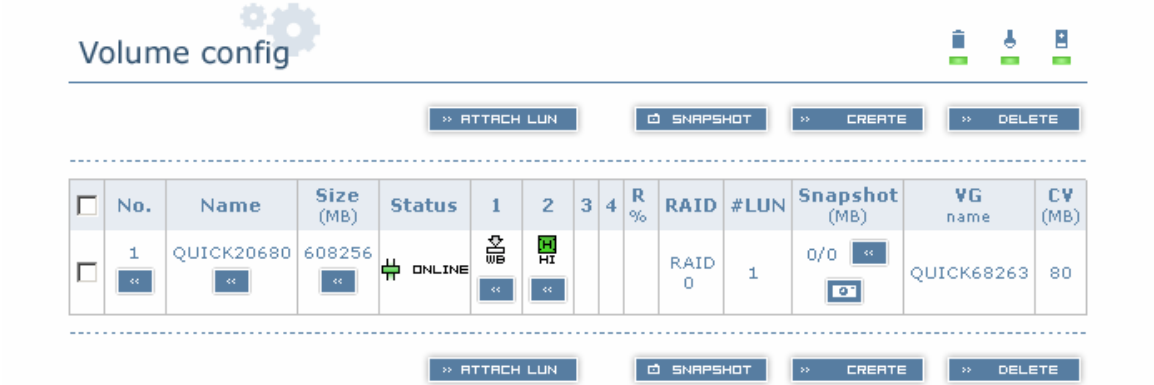


Figure 3.3.2

(Figure 3.3.2: A RAID 0 user data volume with the UDV name "QUICK20680", named by the system itself, with the total available volume size 608256MB.)

3.4 System configuration

"System config" selection is for the setup of **"System name"**, **"IP address"**, **"iSCSI"**, **"Password"**, **"Date"**, **"Mail"**, **"SNMP"** and view **"Event log"**.

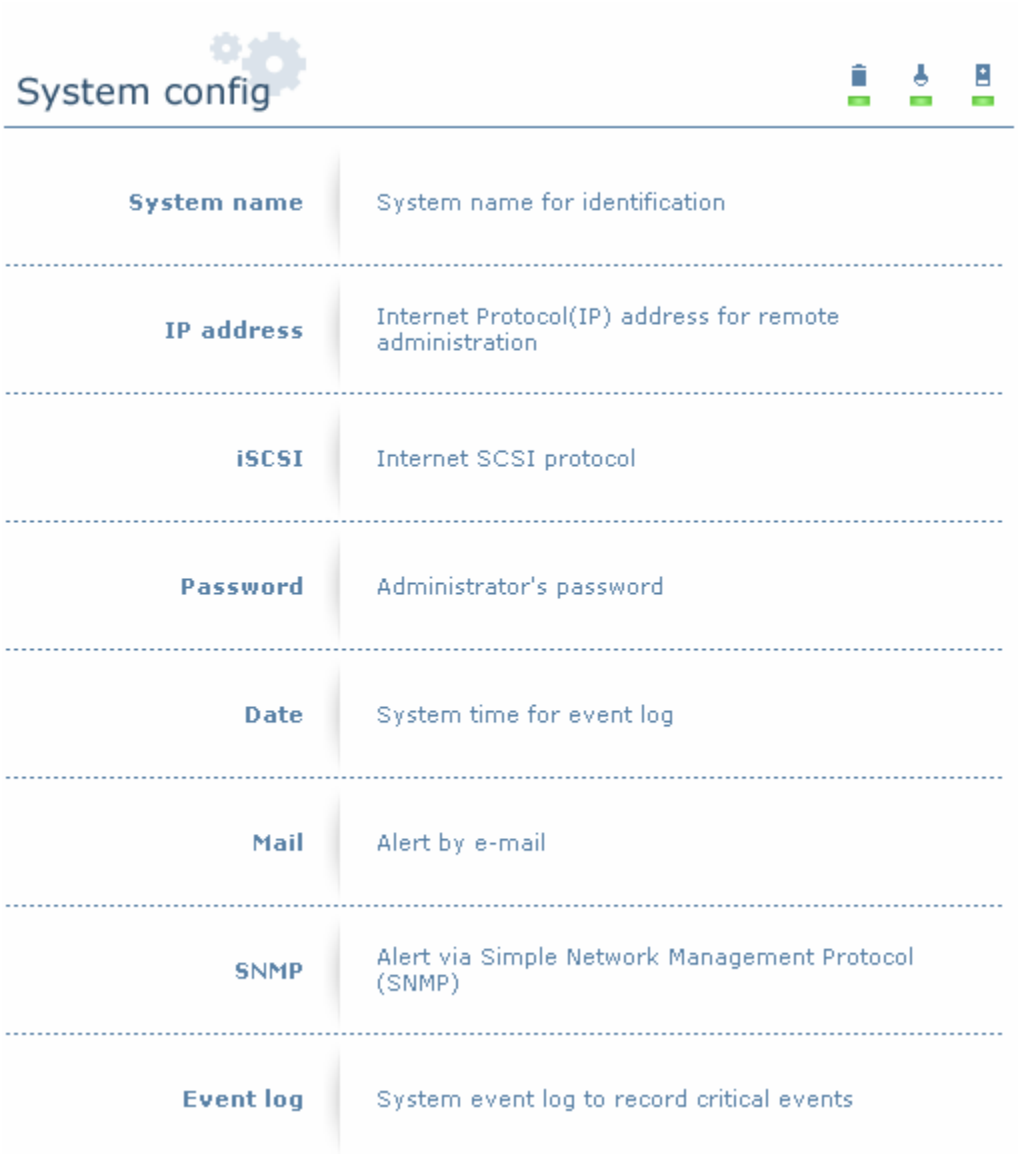


Figure 3.4.1

3.4.1 System name

Select **"System name"** to change system name. Default system name composed by model name and serial number of this system, ex: R4IP-000001.

Figure 3.4.1.1

3.4.2 IP address

Select **"IP address"** to change IP address for remote administration usage. There are 2 selections, DHCP (Get IP address from DHCP server) or set static IP.

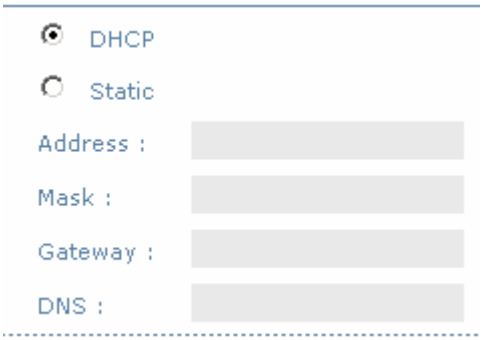


Figure 3.4.2.1

3.4.3 iSCSI

Select **"iSCSI"** to change IP addresses of iSCSI data ports. There are two Gigabit LAN ports to transmit data. Each of them must be assigned one IP address in multi-homed mode unless the link aggregation or trunking mode has been selected. If they are set in link aggregation or trunking mode, the second line will disappear.

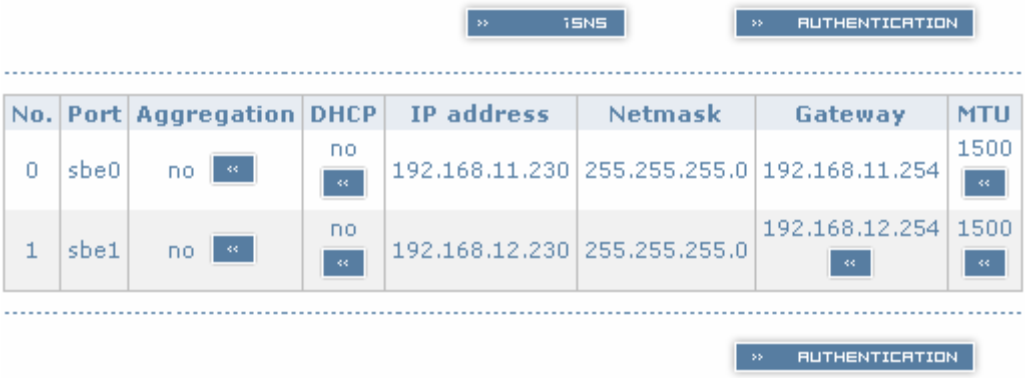


Figure 3.4.3.1

(Figure 3.4.3.1: Each of iSCSI data ports is set to static IP. MTU is 1500.)

IP address can be changed by clicking the blue square button "" in the **"DHCP"** column. There are 2 selections, DHCP (Get IP address from DHCP server) or set static IP.

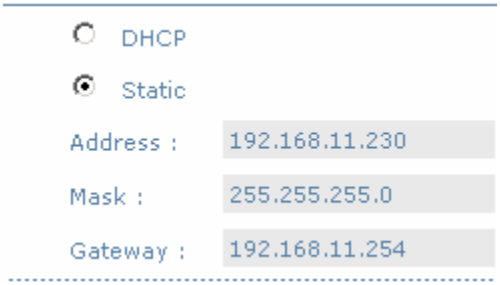


Figure 3.4.3.2

Default gateway can be changed by clicking the blue square button "" in the **"Gateway"** column. There is only one default gateway. The row of **No. 0** would be the default gateway.

MTU (**M**aximum **T**ransmission **U**nit) size can be changed by clicking the blue square button "" in the **"MTU"** column.

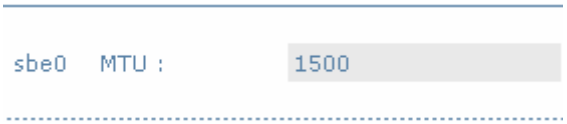


Figure 3.4.3.3

The range of MTU size is between **1500** to **9000**. Default MTU size is 1500. If it is changed, the setting of MTU size on switching hub and LAN card should be set the same. Otherwise, the LAN will be disconnected.

Link aggregation setting can be changed by clicking the blue square button "" in the **"Aggregation"** column.

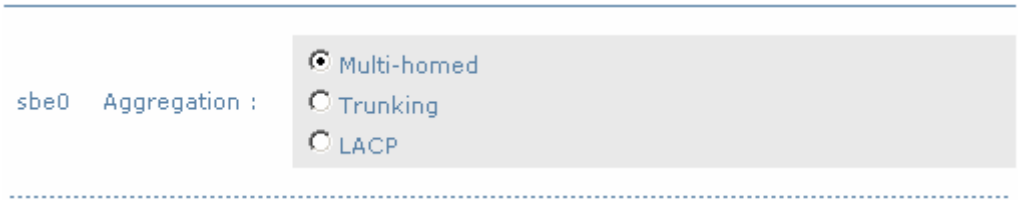


Figure 3.4.3.4

1. **Multi-homed**: The two LAN ports are connected to two different networks. Multi-homed is default.
2. **Trumping**: Link 2 LAN ports together to form a single link. Trunking could multiply the bandwidth. They will be aggregated to one IP. If clicking the blue square button "«" at "No. 0" row, the IP setting will be the default after setting trunking, and vice versa.
3. **LACP**: Link aggregation control protocol as active side. LACP could balance the bandwidth. IP setting concept is the same as trunking.

Caution
Each of gigabit LAN ports must be set the IP address in different subnet.

CHAP is the abbreviation of Challenge Handshake Authorization Protocol. CHAP is a strong authentication method used with point-to-point for user login. It's a type of authentication in which the authentication server sends the client program a key to be used to encrypt the username and password. This enables the username and password to be transmitted in an encrypted form to protect them.

To use CHAP authentication, please follow the procedures.

Figure 3.4.3.5

1. Click "» AUTHENTICATION".
2. Select **"CHAP"** in **"Authentication"** field.
3. Input **"Account"** and **"Password"**.
4. Done.

Tips
After setting CHAP, the initiator in host/server should set the same Account/Password. Otherwise, it cannot login.

Select **"None"** to disable the authentication method.

iSNS represents Internet Storage Name Service. Add the IP address of an iSNS server to the list of iSNS servers that the iSCSI initiator service queries to discover.

To use iSNS service, please follow the procedures.

Figure 3.4.3.6

1. Click " » iSNS ".
2. Input IP address of iSNS server.
3. Done.

3.4.4 Password

Select **"Password"** is for changing administrator password.

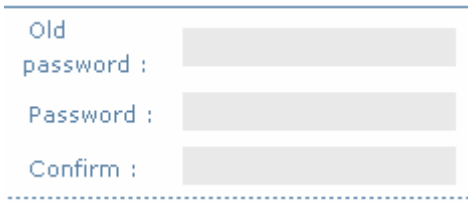


Figure 3.4.4.1

3.4.5 Date

Select **"Date"** to set up the current date and time before using.

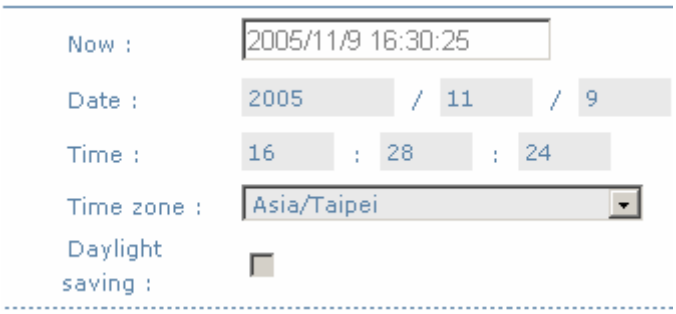


Figure 3.4.5.1

3.4.6 Mail

Select **"Mail"** to enter at most 3 mail addresses for receiving the event notification. Some mail servers would check **"Mail-from address"** and need authentication for anti-spam. Please fill the necessary fields and select **"Send test mail"** to check whether the email works fine.

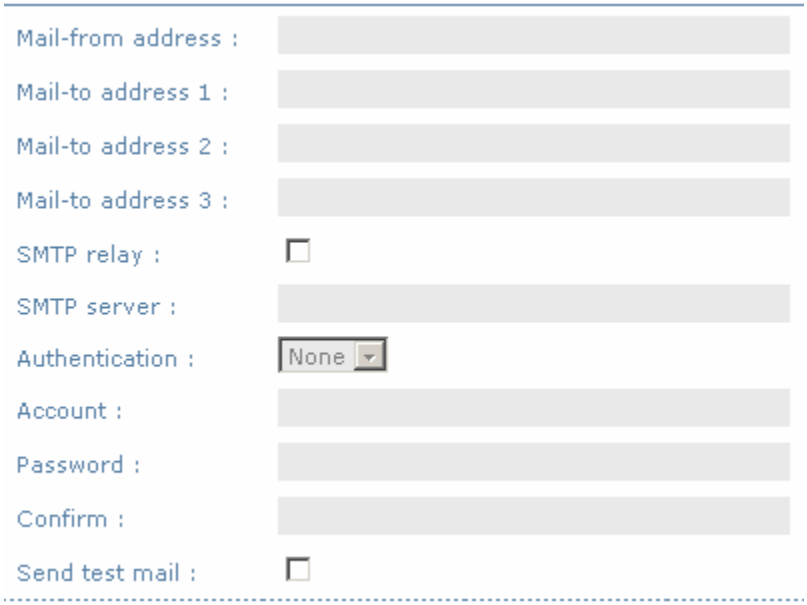


Figure 3.4.6.1

3.4.7 SNMP

Select **"SNMP"** to set up SNMP trap for alert via SNMP. It allows up to 3 SNMP trap addresses can be set for receiving SNMP trap. Default community setting is "public".

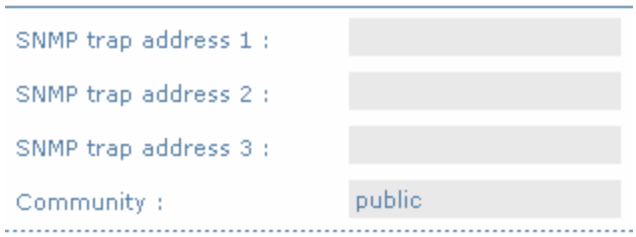


Figure 3.4.7.1

3.4.8 Event log

Select **"Event log"** to view the event messages. Press **"Clear"** button will clear event log. Press **"Mute"** button will stop alarm if system alerts.

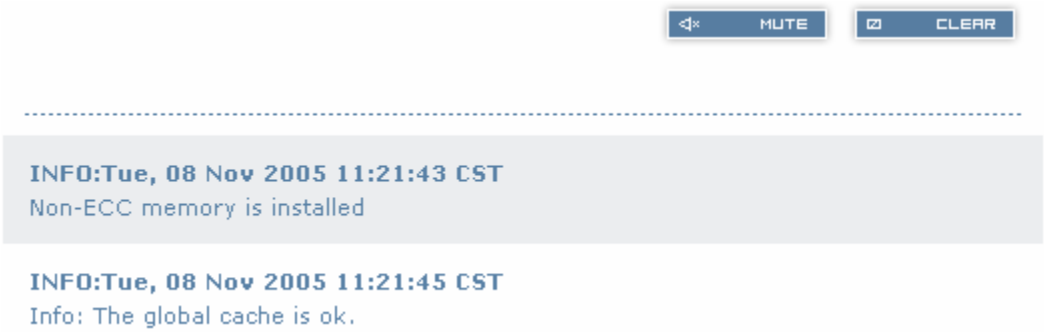


Figure 3.4.8.1

3.5 Volume configuration

"Volume config" selection is for the setup of volume configurations including **"Physical disk"**, **"Volume group"**, **"User data volume"**, **"Cache volume",** and **"Logical unit"** functions.

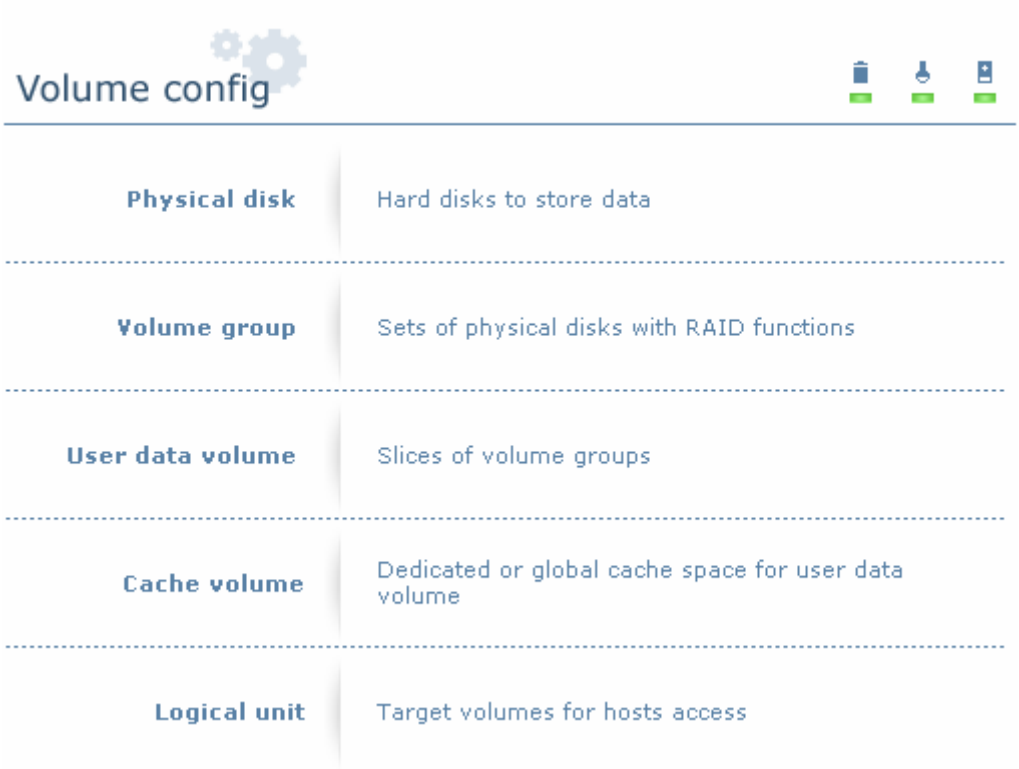
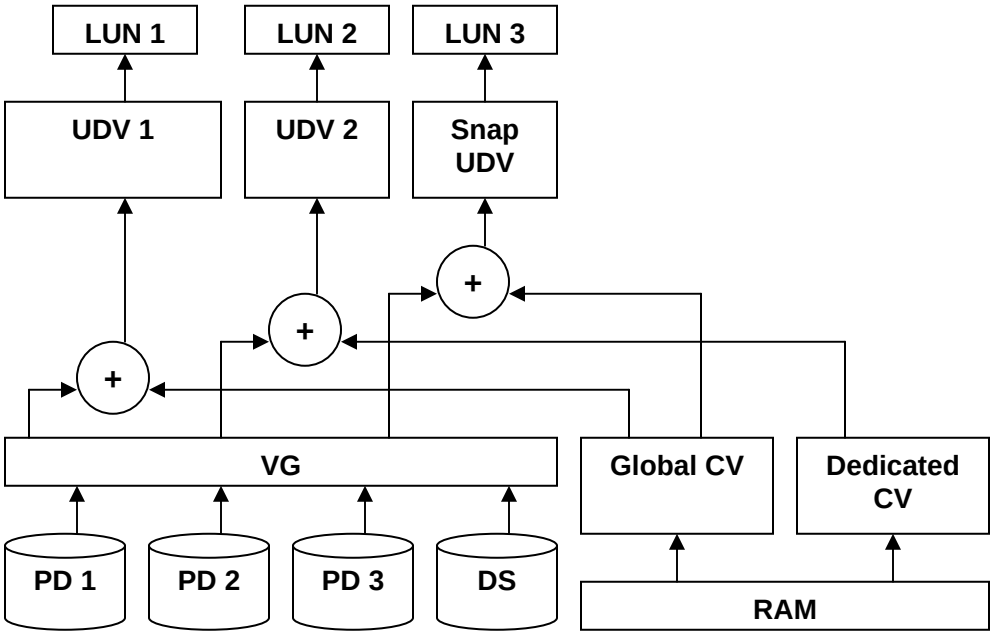


Figure 3.5.1

3.5.1 Volume relationship diagram



The above diagram describes the relationship of RAID components. One VG (Volume Group) consists of a set of UDVs (User Data Volume) and owns one

RAID level attribute. Each VG could be divided into different UDVs. The UDVs from one VG share the same RAID level, but may own the different volume capacity. Each UDV will be associated with one specific CV (Cache Volume) to execute the data transaction. Each CV could own the different cache memory size. LUN is the logical volume, which the users could access by using the SCSI commands.

3.5.2 Physical disk

Enter **"Physical disk"** to view the status of hard drives inserted in the system. The following are operation tips:

1. Multiple select can be done. Select one or many checkboxes in front of the slot number. Or select the checkbox at the top left corner will select all. Check again will select none.
2. The list box will disappear if there is no VG or only VG of RAID 0, JBOD. Because these RAID levels cannot be set as dedicated spare disk.
3. These three functions **"Free disc"**, **"Global spares**", **"Dedicated spares"** can execute multiple selects.
4. The operations of the other web pages (e.g.: volume config of VG, UDV, CV, LUN pages) are similar.

Figure 3.5.2.1

(Figure 3.5.2.1: Physical disks of slot 1, 2 have been created for a VG named "VG-R0". Physical disks of slot 3, 4, 5 have been created for a VG named "VG-R5". Slot 6 has been

set as global spare disk. Slot 7 has been set as dedicated spare disk of VG named "VG-R5". Slot 8 is a free disk.)

- **PD column description:**

Slot	The position of hard drives. The number of slot begins from left to right at the front side. The blue square button next to the number of slot is **"More Information"** indication. It shows the details of the hard drive.
WWN	**W**orld **W**ide **N**ame.
Size (MB)	Capacity of hard drive.
VG Name	Related volume group name.
Status	The status of hard drive. **"GOOD"** → the hard drive is good. **"DEFECT"** → the hard drive has the bad blocks. **"FAIL"** → the hard drive cannot work in the respective volume.
Status 1	**"RD"** → **R**AID **D**isk. This hard drive has been set to RAID. **"FR"** → **FR**ee disk. This hard drive is free for use. **"DS"** → **D**edicated **S**pare. This hard drive has been set to the dedicated spare of the VG. **"GS"** → **G**lobal **S**pare. This hard drive has been set to a global spare of all VGs. **"RS"** → **R**e**S**erve. The hard drive contains the VG information but cannot be used. It may be caused by an uncompleted VG set, or hot-plug this disk in the running time. In order to protect the data in the disk, the status changes to reserve. It can be reused after setting it to "FR" manually.
Status 2	**"R"** → **R**ebuild. The hard drive is doing rebuilding. **"M"**→ **M**igration. The hard drive is doing migration.

- **PD operations description:**

FREE DISC	Make this hard drive to be free for use.
GLOBAL SPARES	Set this hard drive(s) to global spare of all VGs.
DEDICATED SPARES	Set hard drive(s) to dedicated spare of selected VGs.

3.5.3 Volume group

Enter **"Volume group"** to view the status of each volume group.

- **VG column description:**

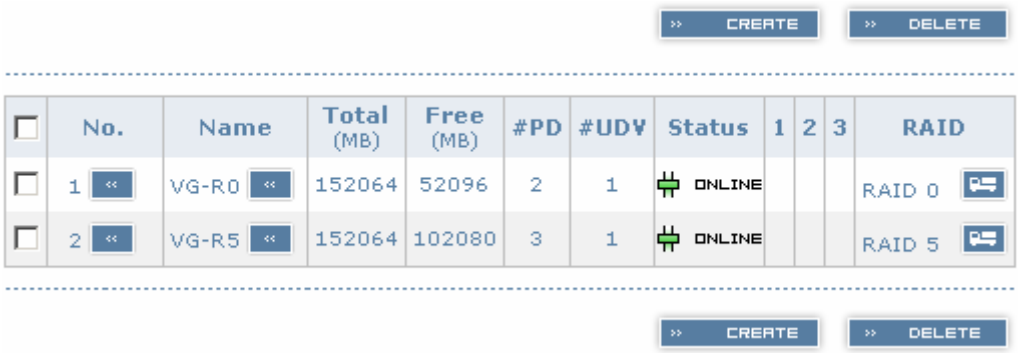


Figure 3.5.3.1

(Figure 3.5.3.1: There is a RAID 0 with 2 physical disks, named "VG-R0", total size is 152064MB, free size is 52096MB, related to 1 UDV. Another is a RAID 5 with 3 physical disks, named "VG-R5".)

No.	Number of volume group. The blue square button next to the No. is **"More Information"** indication. It shows the details of the volume group.
Name	Volume group name. The blue square button next to the Name is **"Rename"** function.
Total(MB)	Total capacity of this volume group.

Free(MB)	Free capacity of this volume group.
#PD	The number of physical disks, which the volume group is using.
#UDV	The number of user data volumes related to this volume group.
Status	The status of volume group. **"Online"** → volume group is online. **"Fail"** → volume group is fail.
Status 1	**"DG"** → **D**e**G**rade mode. This volume group is not completed. The reason could be lack of one disk or failure of disk.
Status 2	**"R"** → **R**ebuild. This volume group is doing rebuilding.
Status 3	**"M"** → **M**igration. This volume group is doing migration.
RAID	The RAID level, which this volume group is using. The blue square button next to the RAID level is **"Migrate"** function. Click **"Migrate"** can add disk(s) to do expansion or change the RAID level of the Volume group.

- **VG operations description:**

CREATE	Create a volume group
DELETE	Delete this volume group

3.5.4 User data volume

Enter **"User data volume"** function to view the status of each user data volume.

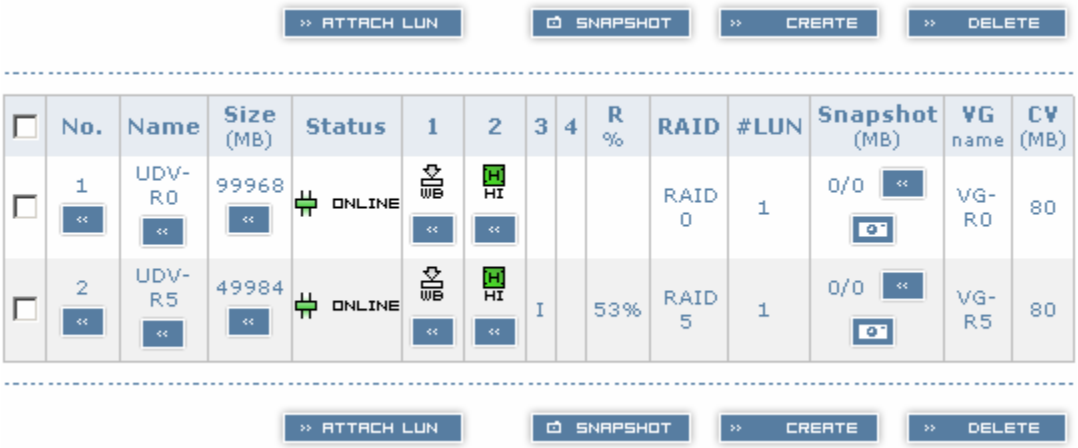


Figure 3.5.4.1

(Figure 3.5.4.1: Create a UDV named "UDV-R0", related to "VG-R0", size is 99968MB, status is online, write back, high priority, related to 1 LUN, with cache volume 80MB, no snapshot space. The other UDV is named "UDV-R5", initializing to 53%)

- **UDV column description:**

No.	Number of this user data volume. The blue square button in below to the UDV No. is **"More Information"** indication. It shows the details of the User data volume.
Name	Name of this user data volume. The blue square button in below to the UDV Name is **"Rename"** function.
Size(MB)	Total capacity of this user data volume. The blue square button in below to the size is **"Extend"** function.
Status	The status of this user data volume. **"Online"** → user data volume is online. **"Fail"** → user data volume is failed.
Status 1	**"WT"** → **W**rite **T**hrough. **"WB"** → **W**rite **B**ack. The blue square button in below to the status1 is **"Set read/write mode"** function.

Status 2	**"HI"** → **HI**gh priority. **"MD"** → **MiD** priority. **"LO"** → **LO**w priority. The blue square button in below to the status2 is **"Set Priority"** function.
Status 3	**"I"** → user data volume is doing initializing. **"R"** → user data volume is doing rebuilding.
Status 4	**"M"** → user data volume is doing migration.
R %	Ratio of initializing or rebuilding.
RAID	The RAID levels that user data volume is using.
#LUN	Number of LUN(s) that data volume is attaching.
Snapshot(MB)	The user data volume size that used for snapshot. The blue square button next to the snapshot is **"Resize"** function to decide the snapshot space. The blue square button next to the resize function is **"Auto snapshot"** function to setup how often snapshots take. The number means **"Free snapshot space" / "Total snapshot space"**. If the snapshot UDV has been created, this column will be the creation time.
VG name	The VG name that this user data volume belongs.
CV (MB)	The cache volume that user data volume is using.

- **UDV operations description:**

ATTACH LUN	Attach to a LUN.
SNAPSHOT	Choose a UDV to execute snapshot.
CREATE	Create a user data volume function.
DELETE	Delete this user data volume function.

3.5.5 Cache volume

Enter **"Cache volume"** function to view the status of cache volume.

The global cache volume is a default cache volume, which has been created after power on automatically, and cannot be deleted. The size of global cache is base on the RAM size. It will be total memory size minus that system uses.

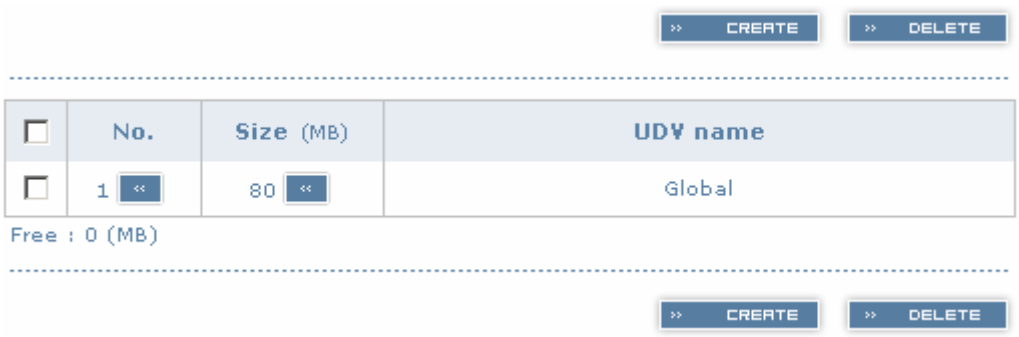


Figure 3.5.5.1

- **CV column description:**

No.	Number of this Cache volume. The blue square button next to the CV No. is **"More Information"** indication**.** It shows the details of the cache volume.
Size(MB)	Total capacity of this cache volume The blue square button next to the CV size is **"Resize"** function. The CV size can be adjusted.
UDV Name	Name of the UDV.

- **CV operations description:**

CREATE	Create a cache volume function.
DELETE	Delete this cache volume function.

3.5.6 Logical unit number

Enter **"Logical unit"** function to view the status of attached logical unit number of each UDV.

It can be attached LUN by clicking the " » ATTACH ". Please refer to Figure 3.5.6.1. **"Host"** must input a initiator node name for access control, or fill-in wildcard **"*",** which means every host can access this volume. Choose LUN and permission, then click " » CONFIRM ". Please refer to Figure 3.5.6.2.

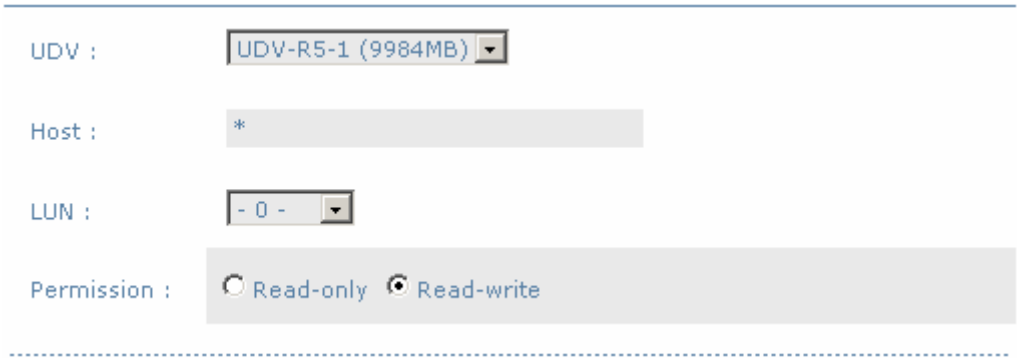


Figure 3.5.6.1

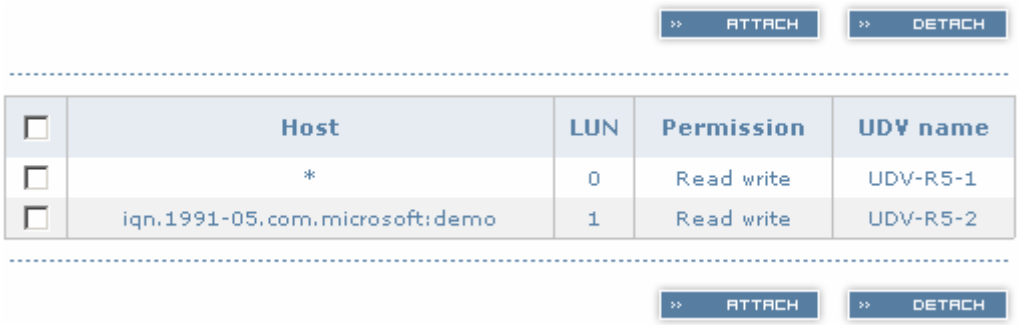


Figure 3.5.6.2

(Figure 3.5.7.2: UDV-R5-1 is attached to LUN 0 with any hosts can access. UDV-R5-2 is attached to LUN 1 with only initiator note named "iqn.1991-05.com.Microsoft:demo" can access.)

- **LUN operations description:**

ATTACH	Attach a logical unit number to a user data volume.
DETACH	Detach a logical unit number from a user data volume.

The matching rules of access control are from top to down by sequence. For example: there are 2 rules for the same UDV, one is "*", LUN 0; the other is "iqn.host1", LUN 1. The other host "iqn.host2" can login because it matches the rule 1.

The access will be denied if there is no matching rule.

3.5.7 Examples

Take 2 examples to create volumes. Example 1 is to create two UDVs shared the same CV (global cache volume) and set a global spare disk. Example 2 is to create two UDVs. One shares global cache volume, the other uses dedicated cache volume. Set a dedicated spare disk.

- **Example 1**

Example 1 is to create two UDVs in one VG, each UDV uses global cache volume. Global cache volume has been created after system boots up. So it doesn't do anything about CV. Then set a global spare disk. The last, delete all of them.

Step 1: Create VG (Volume Group).

To create the volume group, please follow the procedures:

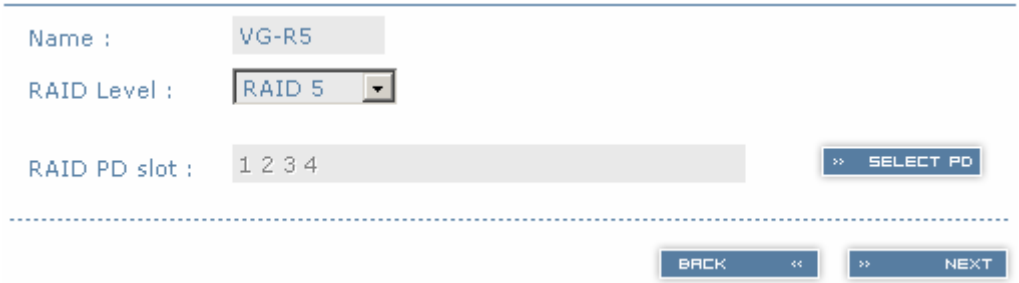


Figure 3.5.7.1

1. Select **"/ Volume config / Volume group"**.
2. Click " CREATE ".
3. Input a VG Name, choose a RAID level from the draw, press " SELECT PD " to choose the RAID PD slot, then press " NEXT ".
4. Check the outcome. Press " CONFIRM " if all setups are correct.
5. Done. A VG has been created.

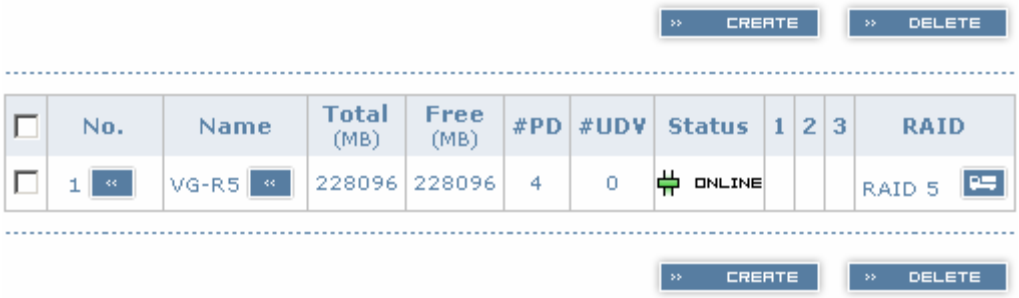


Figure 3.5.7.2

(Figure 3.5.7.2: Creating a RAID 5 with 4 physical disks, named "VG-R5". The total size is 228096MB. Because of no related UDV there, free size still remains 228096MB.)

Step 2: Create UDV (User Data Volume).

To create a data user volume, please follow the procedures.

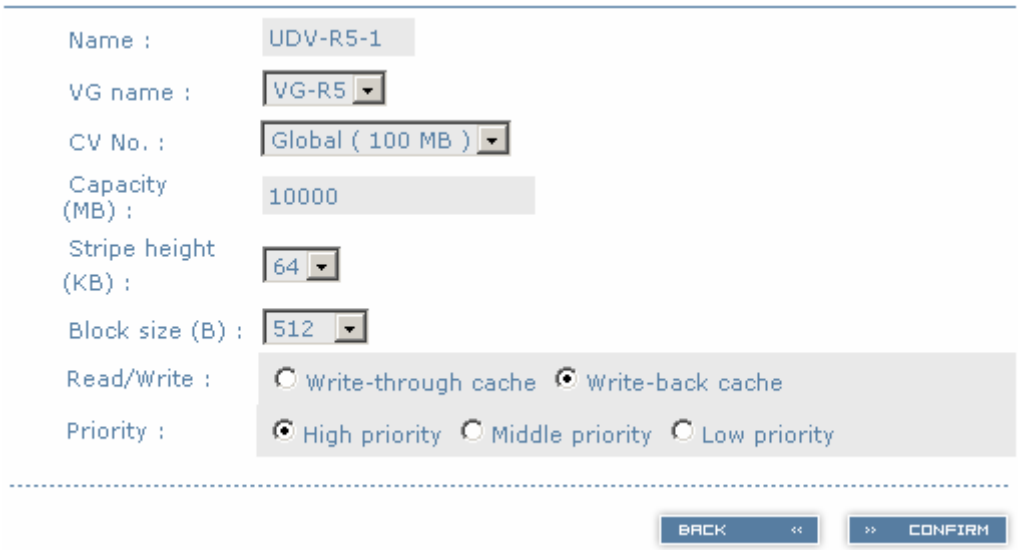


Figure 3.5.7.3

1. Select **"/ Volume config / User data volume"**.
2. Click " CREATE ".
3. Input a UDV name, choose a VG Name and input a size to be used; decide the stripe high, block size, read/write mode and set priority, finally click " CONFIRM ".
4. Done. A UDV has been created.
5. Do one more to create another UDV.

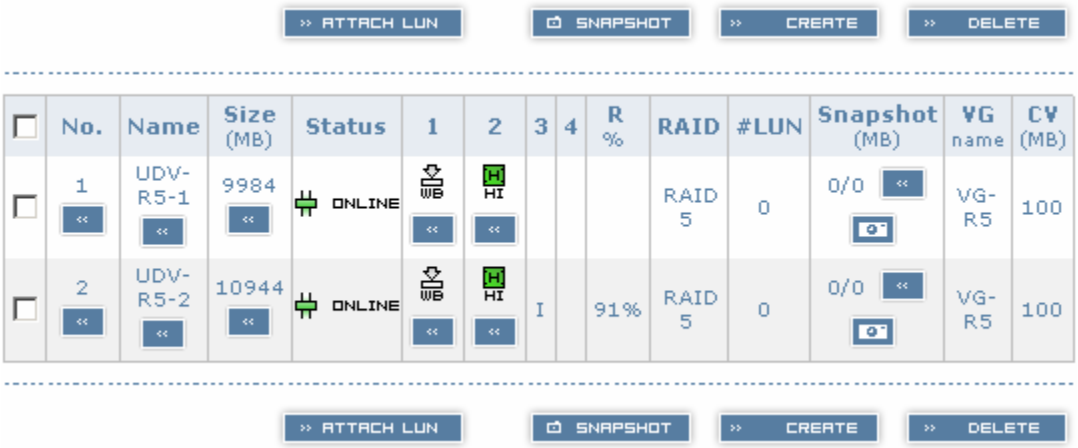


Figure 3.5.7.4

(Figure 3.5.7.4: Create UDVs named "UDV-R5-1" and "UDV-R5-2", related to "VG-R5", the size of "UDV-R5-1" is 9984MB (it's multiple of base stripe height, so the number may not be the same as the setting size.), the size of "UDV-R5-2" is 10944MB. The status of these UDVs are online, write back, high priority with cache volume 100MB. "UDV-R5-2" is initialing about 91%. There is no LUN attached.)

Step 3: Attach LUN to UDV.

There are 2 methods to attach LUN to UDV.

1. In **"/ Volume config / User data volume"**, press " ATTACH LUN ".
2. In **"/ Volume config / Logical unit"**, press " ATTACH ".

The following screen will be shown, please follow the procedures:

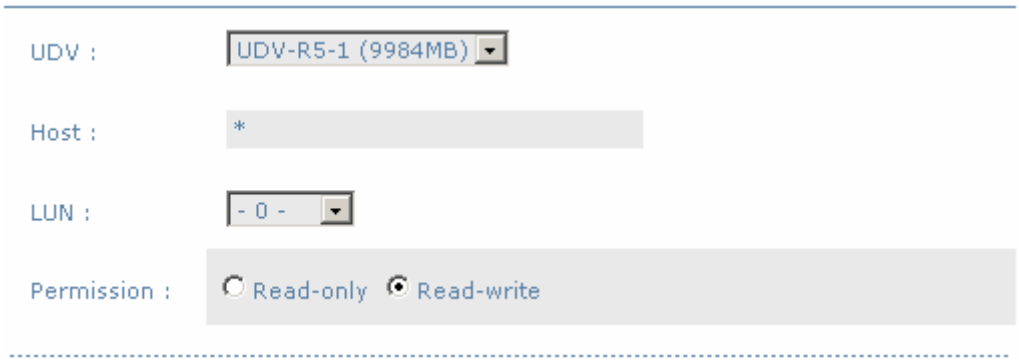


Figure 3.5.7.5

1. Select a UDV.
2. Input **"Host"**, which is an initiator node name for access control, or fill-in wildcard **"*",** which means every host can access this volume. Choose LUN and permission, then click " CONFIRM ".
3. Done.

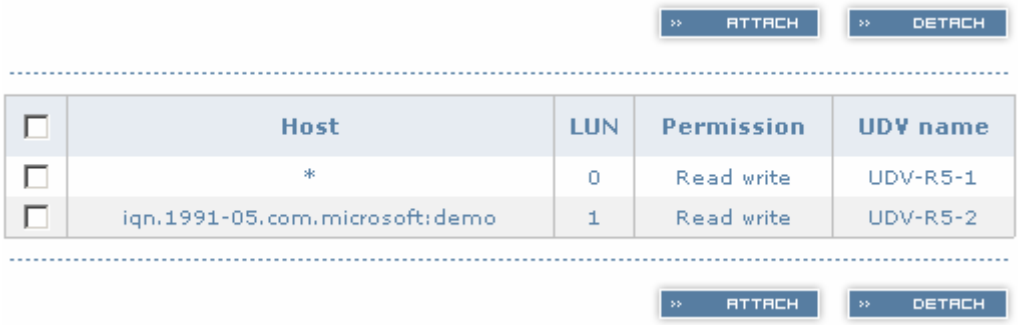


Figure 3.5.7.6

(Figure 3.5.7.6: UDV-R5-1 is attached to LUN 0 with any hosts can access. UDV-R5-2 is attached to LUN 1 with only initiator note named "iqn.1991-05.com.Microsoft:demo" can access.)

Tips
The matching rules of access control are from top to down by sequence. Please refer 3.5.6 for details.

Step 4: Set global spare disk.

To set global spare disks, please follow the procedures.

1. Select **"/ Volume config / Physical disk"**.
2. Select the free disk(s) by clicking the checkbox of the row, then click " GLOBAL SPARES " to set as global spares.
3. There is a "GS" icon shown up at status 1 column.

Figure 3.5.7.7

(Figure 3.5.7.7: Slot 5 has been set as global spare disk.)

Step 5: Done. They can be used as iSCSI disks.

Delete UDVs, VG, please follow the steps.

Step 6: Detach LUN from UDV.

In **"/ Volume config / Logical unit"**,

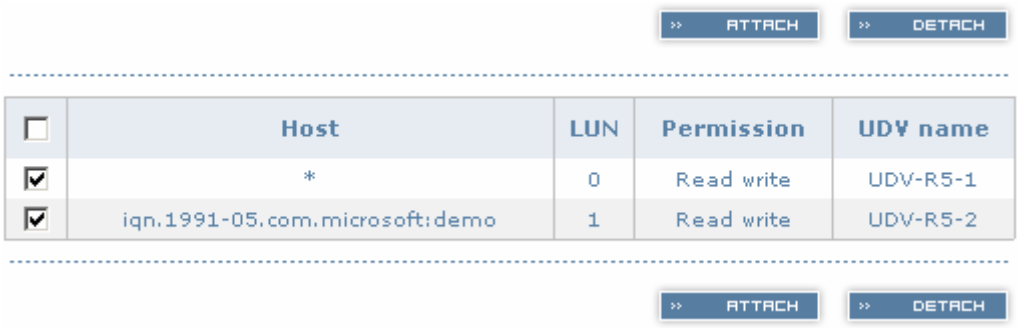


Figure 3.5.7.8

1. Select UDVs by clicking the checkbox of the row, then click " DETACH ". There will pop up a confirm page.
2. Choose "OK".
3. Done.

Step 7: Delete UDV (User Data Volume).

To delete the user data volume, please follow the procedures:

1. Select **"/ Volume config / User data volume"**.
2. Select UDVs by clicking the checkbox of the row.
3. Click " DELETE ". There will pop up a confirm page.
4. Choose "OK".
5. Done. The UDVs have been deleted.

Tips
When deleting UDV, the attach LUN(s) related to this UDV will be detached automatically.

Step 8: Delete VG (Volume Group).

To delete the volume group, please follow the procedures:

1. Select **"/ Volume config / Volume group"**.
2. Select a VG by clicking the checkbox of the row, make sure that there is no UDV on this VG, or the UDV(s) on this VG must be deleted first.
3. Click " DELETE ". There will pop up a confirm page.
4. Choose "OK"
5. Done. The VG has been deleted.

Tips
The action of deleting one VG will succeed only when all of the related UDV(s) are empty in this VG. Otherwise, it will have an error when deleting this VG.

Step 9: Free global spare disk.

To set global spare disks, please follow the procedures.

1. Select **"/ Volume config / Physical disk"**.
2. Select the global spare disk by clicking the checkbox of the row, then click " FREE DISC " to free disk.

Step 10: Done, all volumes have been deleted.

- **Example 2**

Example 2 is to create two UDVs in one VG. One UDV shares global cache volume, the other uses dedicated cache volume. First, dedicated cache volume should be created; it can be used in creating UDV. The last, delete them.

Each UDV will be associated with one specific CV (cache volume) to execute the data transaction. Each CV could own the different cache memory size. If there is no special request in UDVs, it will use global cache volume. Or it can be created a dedicated cache for indivifual UDV manually. Using dedicated cache volume, the performance would not be affected when the other UDV is excuting data access.

The total cache size will depends on the RAM size and set all to global cache. To create a dedicated cache volume, first step is to cut down global cache size and remain to dedicated. Please follow the procedures.

Step 1: Create dedicated cache volume.

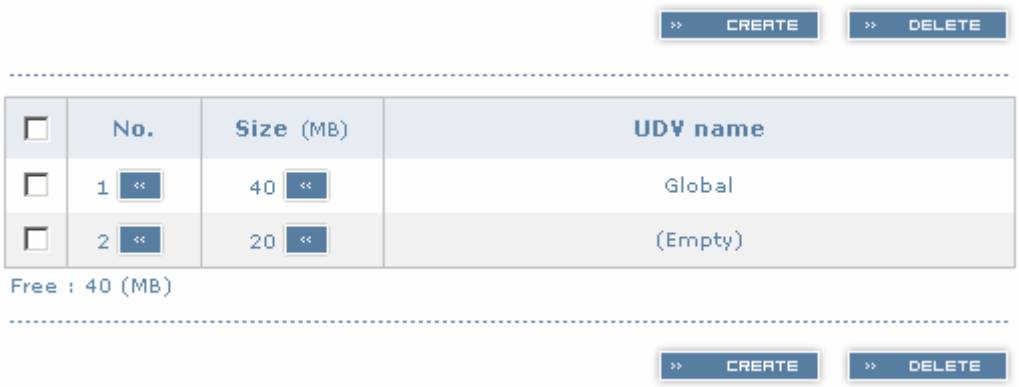


Figure 3.5.7.9

1. Select **"/ Volume config / Cache volume"**.
2. If there is no free space for creating a new dedicated cache volume, cut down the global cache size first by clicking the blue square button " « " in the size column. After resized, click " » CONFIRM " to return to cache volume page.
3. Click " » CREATE " to enter the setup page.
4. Fill in the size and click " » CONFIRM ".
5. Done. A new dedicated cache volume has been set.

Tips
The minimum size of global cache volume is **40MB**. The minimum size of dedicated cache volume is **20MB**.

Step 2: Create VG (Volume Group).

Please refer to Step 1 of Example 1 to create VG.

Step 3: Create UDV (User Data Volume).

Please refer to Step 2 of Example 1 to create UDV. To create a data user volume with dedicated cache volume, please follow the procedures.

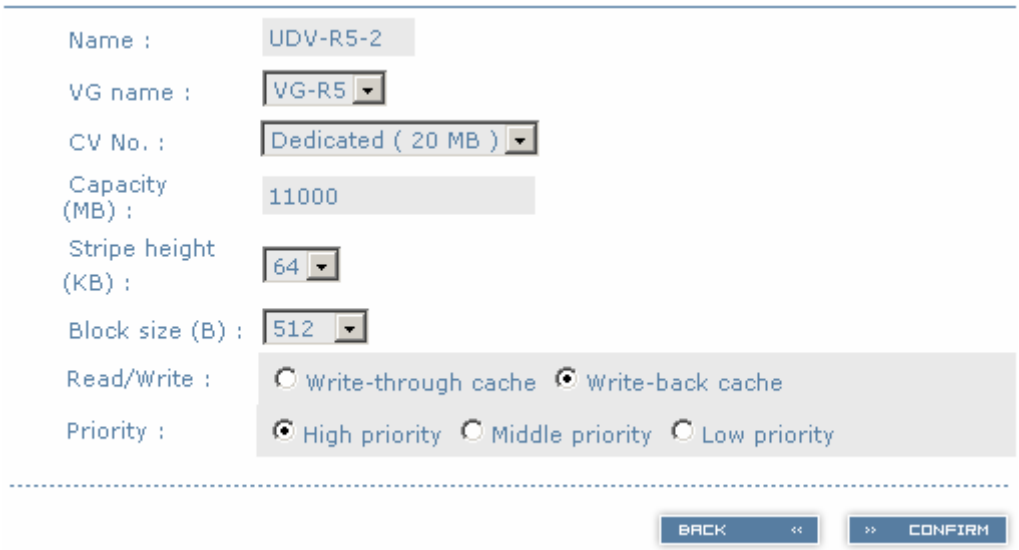


Figure 3.5.7.10

1. Select **"/ Volume config / User data volume"**.
2. Click " CREATE ".
3. Input a UDV name, choose a VG Name, select **Dedicated** cache which is created at Step 1, and input a size to be used; decide the stripe height, block size, read/write mode and set priority, finally click " CONFIRM ".
4. Done. A UDV using dedicated cache has been created.

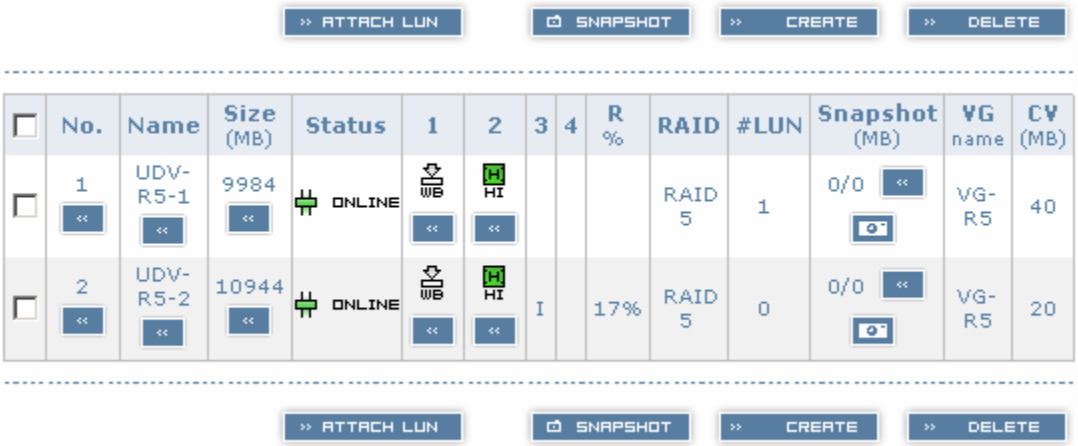


Figure 3.5.7.11

(Figure 3.5.6.11: UDV named "UDV-R5-1" uses global cache volume 40MB, and "UDV-R5-2" uses dedicated cache volume 20MB. "UDV-R5-2" is initialing about 17%.)

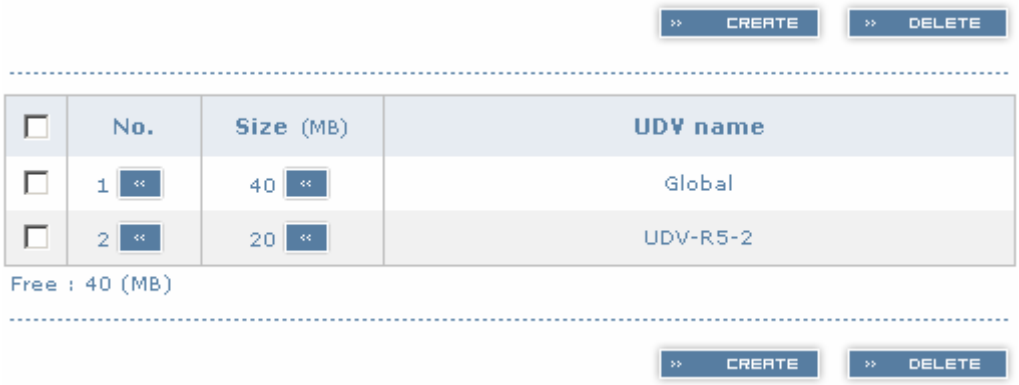


Figure 3.5.7.12

(Figure 3.5.6.12: In "/ Volume config / Cache volume", UDV named "UDV-R5-2" uses dedicated cache volume 20MB.)

Step 4: Attach LUN to UDV.

Please refer to Step 3 of Example 1 to attach LUN.

Step 5: Set dedicated spare disk.

To set dedicated spare disks, please follow the procedures:

1. Select **"/ Volume config / Physical disk"**.
2. Select a VG from the list box, then select the free disk(s), click " DEDICATED SPARES " to set as dedicated spare for the selected VG.
3. There is a "DS" icon shown up at status 1 column.

Figure 3.5.7.13

(Figure 3.5.7.13: Slot 5 has been set as dedicated spare disk of VG named "VG-R5".)

Step 6: Done. They can be used as *i*SCSI disks.

Delete UDVs, VG, please follow the steps.

Step 7: Detach LUN from UDV.

Please refer to Step 6 of Example 1 to detach LUN.

Step 8: Delete UDV (User Data Volume).

Please refer to Step 7 of Example 1 to delete UDV.

Step 9: Delete VG (User Data Volume).

Please refer to Step 8 of Example 1 to delete VG.

Step 10: Free dedicated spare disk.

To set dedicated spare disks, please follow the procedures:

1. Select **"/ Volume config / Physical disk"**.
2. Select the dedicated spare disk by clicking the checkbox of the row, then click " » FREE DISC " to free disk.

Step 11: Delete dedicated cache volume.

To delete the cache volume, please follow the procedures:

1. Select **"/ Volume config / Cache volume"**.
2. Select a CV by clicking the checkbox of the row.
3. Click " » DELETE ". There will pop up a confirm page.
4. Choose "OK".
5. Done. The CV has been deleted.

Caution
Global cache volume cannot be deleted.

Step 12: Done, all volumes have been deleted.

3.6 Enclosure management

"Enclosure management" function allows managing enclosure information including **"SES config"**, **"Voltage & Temperature"**, **"S.M.A.R.T."** and **"UPS"** functions.

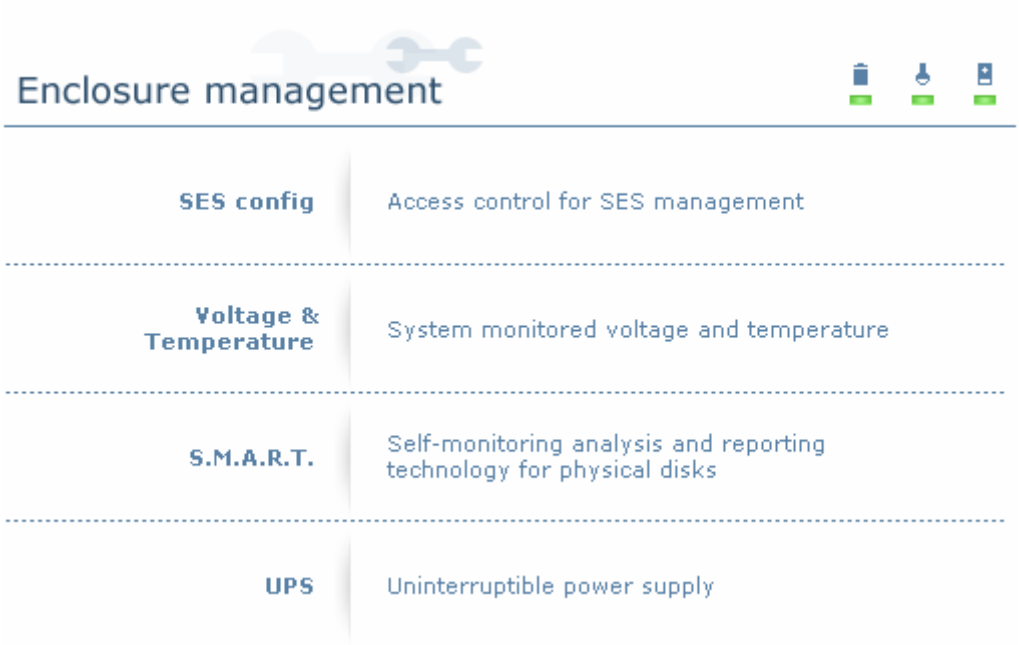


Figure 3.6.1

3.6.1 SES configuration

SES represents **S**CSI **E**nclosure **S**ervices, one of the enclosure management standards. Enter **"SES config"** function can enable or disable the management of SES.

Figure 3.6.1.1

(Figure 3.6.1.1: Enable SES in LUN 0 with any hosts can access.)

The SES client software is available at the following web site:

SANtools: http://www.santools.com/

3.6.2 Voltage and Temperature

Enter **"Voltage & Temperature"** function to view the information of current voltage and temperature.

Item	Information
+1.5V:	+1.54 V (min = +1.44 V, max = +1.63 V)
+3.3V:	+3.31 V (min = +3.10 V, max = +3.55 V)
+5V:	+5.14 V (min = +4.70 V, max = +5.35 V)
+12V:	+12.27 V (min = +11.40 V, max = +12.80 V)
+2.5V:	+2.59 V (min = +2.45 V, max = +2.75 V)
PSU +5V(Backplane):	+5.14 V (min = +4.70 V, max = +5.35 V)
PSU +12V(Backplane):	+12.23 V (min = +11.40 V, max = +12.80 V)
PSU +3.3V(Backplane):	+3.34 V (min = +3.10 V, max = +3.55 V)
Daughter Board:	+54.0 (C) (hyst = +0.0 (C), high = +70.0 (C))
PCI-X BRG:	+37.0 (C) (hyst = +0.0 (C), high = +70.0 (C))
Core Processor:	+50.0 (C) (hyst = +0.0 (C), high = +75.0 (C))
Location 1(Backplane):	+38.0 (C) (hyst = +0.0 (C), high = +45.0 (C))
Location 2(Backplane):	+36.5 (C) (hyst = +0.0 (C), high = +45.0 (C))
Location 3(Backplane):	+40.5 (C) (hyst = +0.0 (C), high = +45.0 (C))
PSU1 (Backplane):	good
PSU2 (Backplane):	good
FAN1(Backplane):	good
FAN2(Backplane):	good
FAN3(Backplane):	good

Auto shutdown : ☑

Figure 3.6.2.1

If **"Auto shutdown"** has been checked, the system will shutdown automatically when voltage or temperature is out of the normal range.

3.6.3 Hard drive S.M.A.R.T. function support

S.M.A.R.T. (**S**elf-**M**onitoring **A**nalysis and **R**eporting **T**echnology) is a diagnostic method for hard drives to give advanced warning of drive failures. Administrators wanted to know in advance if a hard drive was going to fail, because this gave them the opportunity to take steps to protect their data.

S.M.A.R.T. measures many attributes of the hard drive over time and those hard drives can be decided if they are moving out of tolerance. Knowing that each

hard drive is going to fail and doing something about it, is infinitely better than having one crash in the middle of writing data. Backing up hard drive and possibly replacing it are far better options than rebuilding a failed drive.

Enter **"S.M.A.R.T."** function will display S.M.A.R.T. information of hard drives. The number is the current value; the number in parenthesis is the threshold value. The threshold value of every hard drive vendors are different, please refer to vendors for details.

Slot	Read error rate	Spin up time	Reallocated sector count	Seek error rate	Spin up retries	Calibration retries	Temperature (C)	Status
1	200 (51)	168 (21)	200(140)	200 (51)	100 (51)	100(51)	33	GOOD
2	200 (51)	166 (21)	199(140)	200 (51)	100 (51)	100(51)	35	GOOD
3	200 (51)	166 (21)	197(140)	200 (51)	100 (51)	100(51)	31	GOOD
4	200 (51)	168 (21)	200(140)	200 (51)	100 (51)	100(51)	29	GOOD
5	200 (51)	165 (21)	198(140)	200 (51)	100 (51)	100(51)	35	GOOD
6	200 (51)	167 (21)	199(140)	200 (51)	100 (51)	100(51)	28	GOOD
7	200 (51)	165 (21)	200(140)	200 (51)	100 (51)	100(51)	31	GOOD
8	200 (51)	166 (21)	200(140)	200 (51)	100 (51)	100(51)	33	GOOD

Figure 3.6.3.1

3.6.4 UPS

Enter **"UPS"** function will set UPS (**U**ninterruptible **P**ower **S**upply).

UPS Type : None

Shutdown Battery Level (%) : 5

Shutdown Delay (s) : 0

Shutdown UPS : OFF

Status :

Battery Level (%) :

CONFIRM

Figure 3.6.4.1

Currently, the system only support and communicate with smart-UPS function of APC (American Power Conversion Corp.) UPS. Please take reference from http://www.apc.com/.

First, interconnect via RS-232 cable between the system and UPS in order that the system can communicate with APC UPS. Then set up the shutdown values when the power is broken. UPS of other vendors can work fine, but they have no such function.

UPS Type	Select UPS Type. Choose Smart-UPS for APC, None for other vendors or no UPS.
Shutdown Battery Level (%)	When below the setting level, the system will issue shutdown. Setting level to **"0"** will be disabled.
Shutdown Delay (s)	If power failure occurred, and not return back in the setting value period, the system will issue shutdown. Setting delay to **"0"** will be disabled.
Shutdown UPS	Select ON, when power is broken, UPS will shutdown by itself after the system shutdown successfully. After power comes back, UPS will start working and notify system to boot up. OFF will not.
Status	The status of UPS. **"Detecting…"** **"Running"** **"Unable to detect UPS"** **"Communication lost"** **"UPS reboot in progress"** **"UPS shutdown in progress"** **"Batteries failed. Please change them NOW!"**
Battery Level (%)	Current percentage of battery level.

3.7 System maintenance

"Maintenance" function allows operation of the system functions including "**Upgrade"** to the latest firmware, **"Info"** to show the system version and **"Shutdown"** to either reboot or shutdown the system.

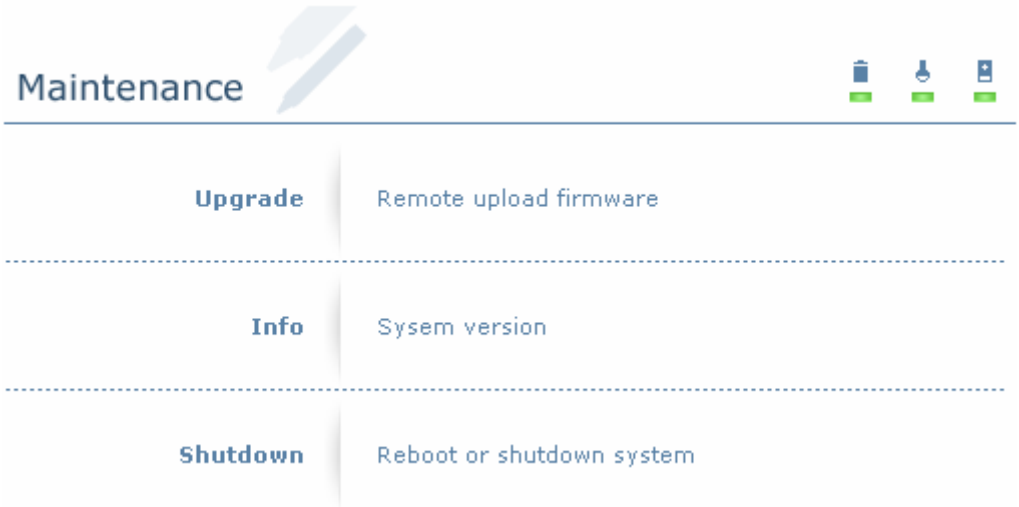


Figure 3.7.1

3.7.1 Upgrade

Enter **"Upgrade"** function to upgrade firmware. Please prepare new firmware file named **"xxxx.bin"** in local hard drive, then press "Browse..." to select the file. Click " » CONFIRM ", it will start to upgrade firmware.

Figure 3.7.1.1

When upgrading, there is a progress bar running. After finished upgrading, the system must reboot manually.

3.7.2 Info

Enter **“Info”** function will display firmware version.

3.7.3 Shutdown

Enter **“Shutdown”** function; it will display **“REBOOT”** and **“SHUTDOWN”** buttons. Before power off, it’s better to press “SHUTDOWN” to flush the data from cache to physical disks.

Figure 3.7.3.1

3.8 Logout

For security reason, **“Logout”** function will allow logout while none is operating the system. Re-login the system by entering username and password.

Chapter 4 Advanced operation

4.1 Rebuild

If one physical disk of the VG which sets to protected RAID level (e.g.: RAID 3 or RAID 5) is FAILED or has been plugged out, the VG becomes degrade mode, then the system will detect spare disk to **rebuild** the degrade VG to a complete one. It will detect dedicated spare as rebuild disk first, then global spare.

In degrade mode, the status of VG will display **"DG"**.

When rebuilding, the status of PD/VG/UDV will display **"R"**; and **"R%"** in UDV will display the ratio in percentage. After complete rebuilding, **"R"** and **"DG"** will disappear. VG will become complete one.

Tips
The list box will disappear if there is no VG or only VG of RAID 0, JBOD. Because these RAID level cannot be set dedicated spare disk.

Caution
The system will not rebuild when the physical disk plug out and insert into the same slot because of protecting the data in new inserted disk. The physical disk must be set to FREE and SPARE disk, then the system will start to rebuild.

Sometimes, rebuild is called recover; these two have the same meaning. The following table is the relationship between RAID levels and rebuild.

RAID 0	Disk striping. No protection. VG will fails if any hard drive fails or plugs out.
RAID 1	Disk mirroring over 2 disks. RAID 1 allows one hard drive fails or plugs out. Need one new hard drive to insert and rebuild to complete.
N-way mirror	Extension to RAID 1 level. It has N copies of the disk. N-way mirror allows N-1 hard drives fail or plug out.

RAID 3	Striping with parity on the dedicated disk. RAID 3 allows one hard drive fails or plugs out.
RAID 5	Striping with interspersed parity over the member disks. RAID 5 allows one hard drive fails or plugs out.
RAID 6	2-dimensional parity protection over the member disks. RAID 6 allows two hard drives fail or plug out. If it needs to rebuild two hard drives at the same time, it will rebuild the first one, then the other, by sequence.
RAID 0+1	Mirroring of the member RAID 0 volumes. RAID 0+1 allows two hard drives fail or plug out, but at the same array.
RAID 10	Striping over the member RAID 1 volumes. RAID 10 allows two hard drives fail or plug out, but at the different array.
RAID 30	Striping over the member RAID 3 volumes. RAID 30 allows two hard drives fail or plug out, but at the different array.
RAID 50	Striping over the member RAID 5 volumes. RAID 50 allows two hard drives fail or plug out, but at the different array.
RAID 60	Striping over the member RAID 6 volumes. RAID 40 allows four hard drives fail or plug out, but each two at the different array.
JBOD	The abbreviation of **"J**ust a **B**unch **O**f **D**isks**"**. No protection. VG will fails if any hard drive fails or plugs out.

4.2 VG migration and expansion

To migrate the RAID level, please follow the procedures. If migrate to the same RAID level of the original VG, it is called expansion.

1. Select **"/ Volume config / Volume group"**.
2. Decide which VG to be migrated, click the blue square button "" in the RAID column next the RAID level.
3. Change the RAID level by clicking the down arrow mark "RAID 5". There will be a pup-up shows if the HDD is not enough to support the new setting RAID level, click "SELECT PD" to increase hard drives, then click "CONFIRM" to go back to setup page.

4. Double check the setting of RAID level and RAID PD slot. If no problem, click " NEXT ".
5. Finally a confirm page is shown with detail RAID info. If no problem, click " CONFIRM " to start migration.
6. Migration starts and it can be seen from the "status 3" of a VG with a running square and an **"M"**. In **"/ Volume config / User data volume"**, it will display a **"M"** in **"Status 4"** and complete percentage of migration in **"R%"**.

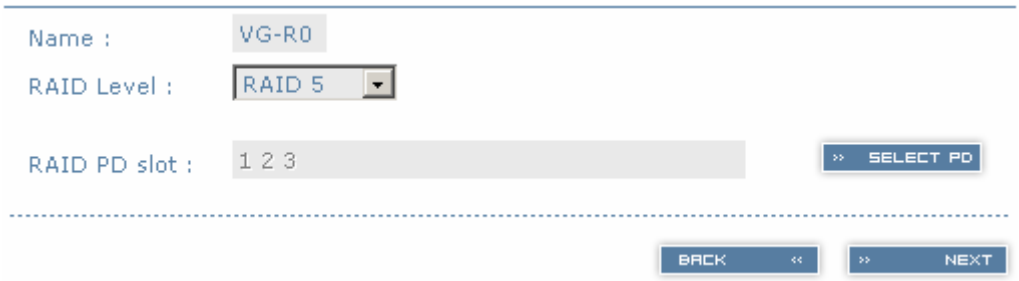


Figure 4.2.1

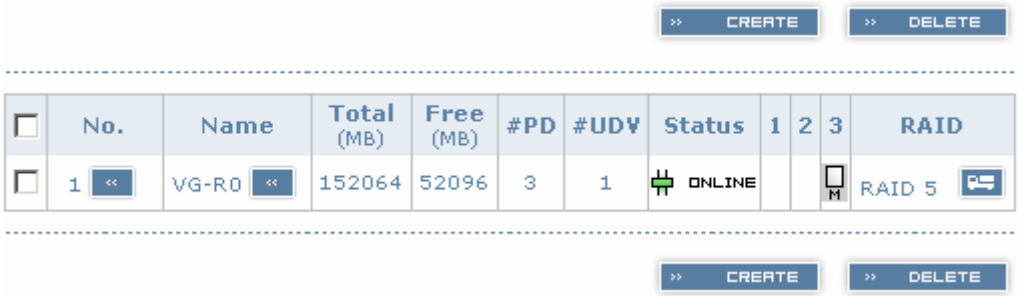


Figure 4.2.2

(Figure 4.2.2: A RAID 0 with 2 physical disks migrates to RAID 5 with 3 physical disks.)

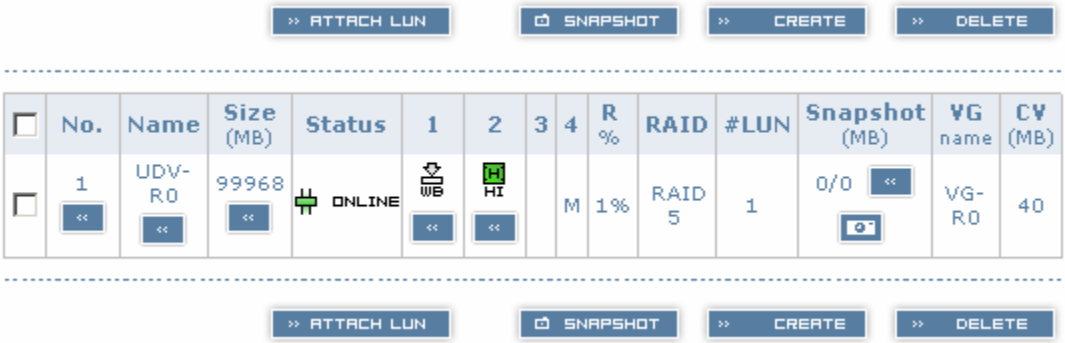


Figure 4.2.3

(Figure 4.2.3: A RAID 0 migrates to RAID 5, complete percentage is 1%.)

Tips

Executing migration/expansion, the total size of VG must be larger or equal to the original VG. It does not allow expanding the same RAID level with the same hard disks of original VG.

Caution
VG Migration cannot be executed during rebuild or UDV extension.

4.3 UDV Extension

To extend UDV size, please follow the procedures.

1. Select **"/ Volume config / User data volume"**.
2. Decide which UDV to be extended, click the blue square button " « " in the Size column next the number.
3. Change the size. The size must larger than the original, then click " » CONFIRM " to start extension.
4. Extension starts. If UDV needs initialized, it will display an **"I"** in **"Status 3"** and complete percentage of initialization in **"R%"**.

Figure 4.3.1

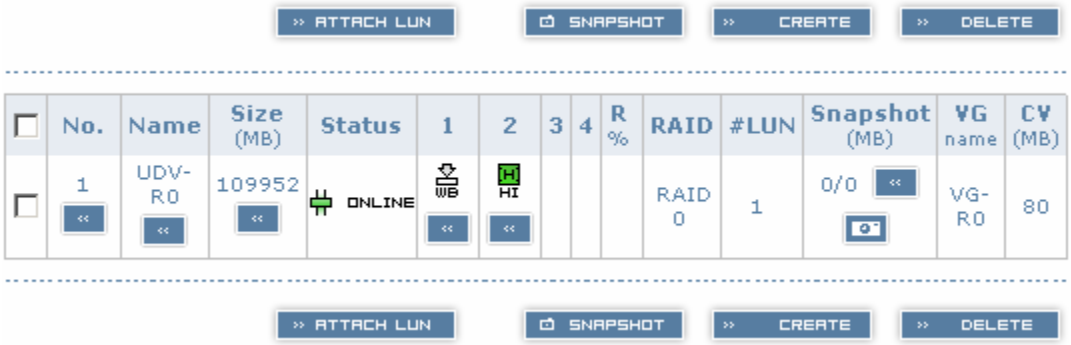


Figure 4.3.2

(Figure 4.3.2: Extend UDV-R0 from 99968MB to 109952MB (It's multiple of base stripe height, so the number may be less than the setting size.)

Tips
The size of UDV extension must be larger than original.

Caution
UDV Extension cannot be executed during rebuild or migration.

4.4 Snapshot/Rollback (optional)

Snapshot function will freeze the data at the moment while taking snapshot. When executing snapshot, it will become a new **snap UDV**, which can be attached a LUN then use it as a disk. **Rollback** function can return the whole data back to the time taking snapshot in order to avoid virus intrusion or files deletion by accident. Snapshot uses the same disk space of associated VG, we suggest to leave **20%** of VG size or more for snapshot space. Please refer to Figure 4.4.1 for snapshot concept.

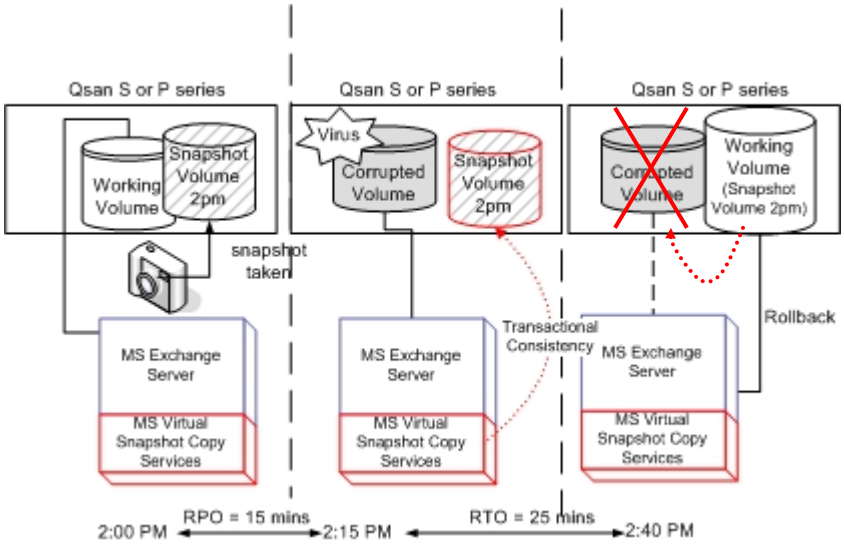


Figure 4.4.1

Caution
Snapshot/rollback features need **512MB** RAM or more. Please refer RAM certification list in Appendix A.

4.4.1 Create snapshot volume

To take a snapshot of the data, please follow the procedures.

1. Select **"/ Volume config / User data volume"**.
2. Choose a UDV to execute the snapshot by clicking the blue square button " « " in the **"Snapshot (MB)"** column, it will direct to a setup page.
3. Set up the size for executing snapshot. The size is suggested to be **20%** of UDV size or more, then click " » CONFIRM ". It will go back to the UDV page and the size will be shown in snapshot column. It may not be the same as the number entered because some space is reserved for snapshot internal usage. There will be 2 numbers in **"Snapshot (MB)"** column. These numbers mean **"Free snapshot space"** and **"Total snapshot space"**.
4. Choose a UDV by clicking the checkbox of the row and then click " SNAPSHOT ".
5. A snap UDV is created with the date and time taken snapshot of the chosen UDV.
6. Attach LUN to UDV, please refer to section 3.5.6 for more detail.
7. Done. It can be used as a disk.

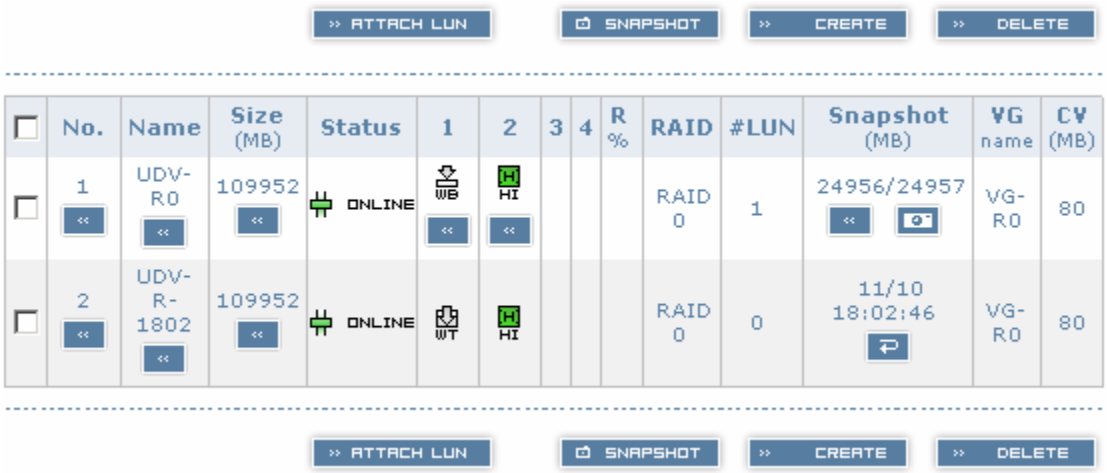


Figure 4.4.1.1

(Figure 4.4.1.1: No.1 is a RAID 0 UDV. Set snapshot space to 24957MB. And now its space is free to snapshot. No.2 is a snap UDV taken on 11/10 18:02:46.)

Snapshot has some constraints as described in the following:

1. Minimum RAM size of enabling snapshot function is **512MB**.
2. For performance concern, saving data of taking snapshots are incremental. For example: three snapshots has been taken and created as name “snap1”(first), “snap2” and “snap3”(last). When deleting “snap2”, both of “snap1” and “snap2” will be deleted because “snap1” are related to “snap2”.
3. For resource concern, the max number of snapshots is **32**.
4. If snapshot space is full, snap UDV will fail.
5. Snap UDV cannot be migrated, when executing migration of related VG, snap UDV will fail.
6. Snap UDV cannot be extended.

4.4.2 Auto snapshot

The snapshot copies can be taken manually or by schedule such as hourly and daily. Please follow the procedures.

1. Select **“/ Volume config / User data volume”**.
2. Create a snapshot space. Please refer to section 4.4.1 for more detail.
3. Click “ ” in **“Snapshot (MB)”** column to set auto snapshot.
4. The auto snapshot can be set at the period of weekly, daily, or hourly. Select the number means how many snapshot copies which will be kept. **“Hours to take snapshots”** function only enable when selecting **“Number of hourly snapshots”**. Last, click “ CONFIRM “.
5. Done. It will take snapshots automatically.

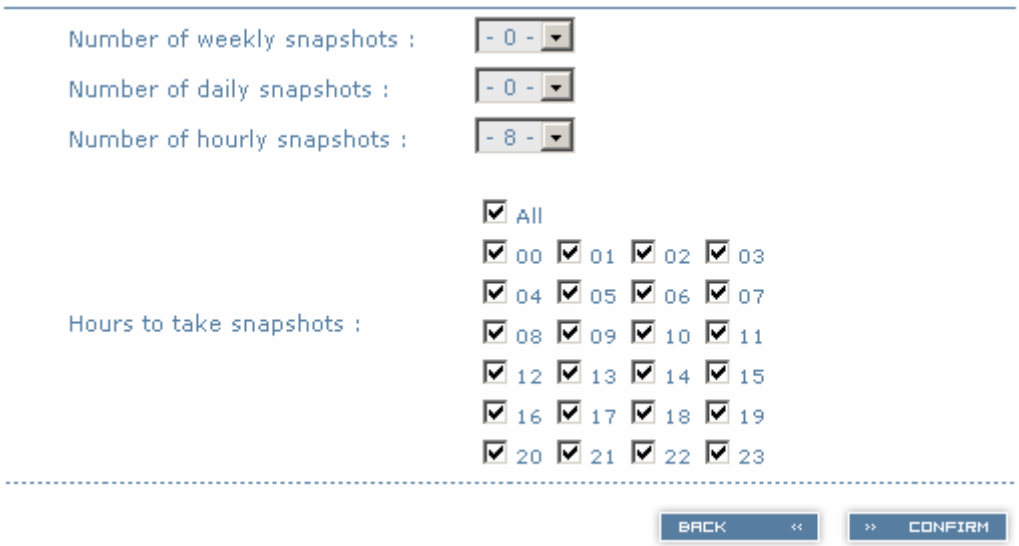


Figure 4.4.2.1

(Figure 4.4.2.1: It will take snapshots every hours, and keep the last 8 snapshot copies.)

Tips
Daily snapshot will be taken at every 00:00. Weekly snapshot will be taken on every Monday 00:00.

4.4.3 Rollback

The data in snapshot UDV can rollback to original UDV. Please follow the procedures.

1. Select **"/ Volume config / User data volume"**.
2. Take one or more snapshots. Please refer to section 4.4.1 for more detail.
3. Click "" in **"Snapshot (MB)"** column to rollback the data, which is at the time of taking snapshot.

Rollback function has some constraints as described in the following:

1. Minimum RAM size of enabling rollback function is **512MB**.
2. When executing rollback, the original UDV cannot be accessed for a while. At this time, transfer connections from original UDV to snap UDV, and then start rollback.
3. During rollback data from snap UDV to original UDV, the original UDV can be accessed and the data in it shown just like finished rollback. At the same time, the other related snap UDV(s) will not be accessed.
4. After rollback process finished, the other related snap UDV(s) will be deleted, and snapshot space will be set to **0**.

Caution
Before executing rollback, it is better to dismount file system for flushing data from cache to disks in OS.

4.5 Disk roaming

Physical disks can be re-sequenced in the same system or move whole physical disks from system-1 to system-2. This is called disk roaming. Disk roaming has some constraints as described in the following:

1. Check the firmware of two systems first. It's better that both have same firmware version or newer.
2. Whole physical disks of related VG should be moved from system-1 to system-2. The configuration of both VG and UDV will be kept but LUN configuration will be cleared to avoid conflict with system-2.

4.6 Support Microsoft MPIO (optional)

MPIO (Multi-Path Input/Output) uses redundant physical path to create logical "paths" between the server and the storage device. In the event that one or more of these components fails, causing the path to fail, multi-pathing logic uses an alternate path for I/O so that applications can still access their data.

Microsoft iSCSI initiator supports multi-path function. Please follow the procedures to use MPIO feature.

1. A host with dual LAN ports connects cables to EnhanceRAID R4 XP2000 series controller.
2. Create a VG/UDV, attach this UDV to the host.
3. When installing **"Microsoft iSCSI initiator"**, please install MPIO driver at the same time.
4. Logon to target separately on each port. When logon to target, check "Enable multi-path". Please refer to Appendix D, step 6.
5. MPIO mode can be selected on Targets → Details → Devices → Advanced.
6. Rescan disk.
7. There will be one disk running MPIO.

Appendix

A. Certification list

- **RAM**

  RAM Spec: 184pins, DDR333(PC2700), Reg.(register) or UB(unbuffer), ECC or Non-ECC.

Vendor	Model
Unigen	UG732D6688KN-DH, 256MB DDR333 (UB)
Unigen	UG732D7588KZ-DH, 256MB DDR333 (Reg, ECC)
Unigen	UG764D7588KZ-DH, 512MB DDR333 (Reg, ECC)
Unigen	UG7128D7588LZ-DH, 1GB DDR333 (Reg, ECC)
Unigen	UG732D6688KS-DH, 256MB DDR333 (UB)
Unigen	UG764D6688LS-DH, 512MB DDR333 (UB)
Trenscend	256MB DDR333 (Reg ECC)
Trenscend	512MB DDR333 (Reg ECC)
Trenscend	1GB DDR333 (Reg ECC)

- ***i*SCSI HBA card**

Vendor	Model
Adaptec	7211C (Gigabit, 1 port, TCP/IP offload, iSCSI offload)
QLogic	QLA40xxC (Gigabit, 1 port, TCP/IP offload, iSCSI offload)

- **NIC**

Vendor	Model
Intel	PWLA8490MT (Gigabit, 1 port, TCP/IP offload)
Intel	PWLA8492MT (Gigabit, 2 port, TCP/IP offload)
Intel	PWLA8494MT (Gigabit, 4 port, TCP/IP offload)

- **SATA hard drive**

Vendor	Model
Hitachi	Deskstar 7K250, HDS722580VLSA80, 80GB, 7200RPM, SATA, 8M
Hitachi	Deskstar 7K80, HDS728080PLA380, 80GB, 7200RPM, SATA-II, 8M
Hitachi	Deskstar 7K500, HDS725050KLA360, 500G, 7200RPM, SATA-II, 16M
Maxtor	DiamondMax Plus 9, 6Y080M0, 80G, 7200RPM, SATA, 8M
Samsung	SpinPoint P80, HDSASP0812C, 80GB，7200RPM, SATA, 8M

Seagate	Barracuda 7200.7, ST380013AS, 80G, 7200RPM, SATA, 8M
Seagate	Barracuda 7200.7, ST380817AS, 80G, 7200RPM, SATA, 8M, NCQ
Seagate	Barracuda 7200.7, ST380013AS, 80G, 7200RPM, SATA, 8M
Seagate	Barracuda 7200.8, ST3400832AS, 400G, 7200RPM, SATA, 8M, NCQ
Western Digital	Caviar SE, WD800JD, 80GB, 7200RPM, SATA, 8M
Western Digital	Caviar SE, WD1600JD, 160GB, 7200RPM, SATA, 8M
Western Digital	Raptor, WD360GD, 36.7GB, 10000RPM, SATA, 8M
Western Digital	Caviar RE2, WD4000YR, 400GB, 7200RPM, SATA, 16M, NCQ

B. Event notifications

- **PD/S.M.A.R.T. events**

Level	Type	Description
Info	Disk inserted	Info: Disk <slot> is inserted.
Info	Disk removed	Info: Disk <slot> is removed.
Warning	S.M.A.R.T. threshold exceed condition	Warning: S.M.A.R.T. threshold exceed condition occurred.

- **Physical HW events**

Level	Type	Description
Warning	ECC error	Warning: Single-bit ECC error is detected.
Error	ECC error	Error: Multi-bit ECC error is detected.
Info	ECC DIMM Installed	Info: ECC Memory is installed.
Info	Non-ECC installed	Info: Non-ECC Memory is installed.
Error	Host chip failure	Error: Host channel chip failed.
Error	Drive chip failure	Error: Drive channel chip failed.
Warning	Ethernet port failure	Warning: GUI Ethernet port failed.

- **HDD IO events**

Level	Type	Description
Warning	Disk error	Error: Disk <slot> read block error.
Warning	Disk error	Error: Disk <slot> writes block error.
Warning	HDD failure	Error: Disk <slot> is failed.
Warning	Channel error	Error: Disk <slot> IO incomplete.

- **SES events**

Level	Type	Description
Info	SES load conf. OK	Info: SES configuration has been loaded.

Warning	SES Load Conf. Failure	Error: Failed to load SES configuration. The SES device is disabled.
Info	SES is disabled	Info: The SES device is disabled.
Info	SES is enabled	Info: The SES device is enabled

- **Environmental events**

Level	Type	Description
Info	Admin Login OK	Info: Admin login successfully.
Warning	Admin Login Fail	Warning: Admin fails to login.
Info	Admin Logout OK	Info: Admin logout successfully.
Warning	Admin Logout Fail	Warning: Admin fails to logout.
Error	Thermal critical	Error: System Overheated!!! The system will do the auto shutdown immediately.
Warning	Thermal warning	Warning: System temperature is a little bit higher.
Error	Voltage critical	Error: System voltages failed!!! The system will do the auto shutdown immediately
Warning	Voltage warning	Warning: System voltage is a little bit higher/lower.
Info	PSU restore	Info: Power <number> is restored to work.
Error	PSU Fail	Error: Power <number> is out of work.
Info	Fan restore	Info: Fan <number> is restore to work.
Error	Fan Fail	Error: Fan <number> is out of work.
Error	Fan non-exist	Error: System cooling fan is not installed.
Error	AC Loss	Error: AC loss for the system is detected.
Error	UPS power low	Error: UPS Power Low!!! The system will do the auto shutdown immediately.
Info	Mgmt Lan Port Active	Info: Management LAN Port is active.
Warning	Mgmt Lan Port Failed	Warning: Fail to manage the system via the LAN Port.
Info	RTC Device OK	Info: RTC device is active.
Warning	RTC Access Failed	Warning: Fail to access RTC device
Info	Reset Password	Info: Reset Admin Password to default.
Info	Reset IP	Info: Reset network settings set to default.

- **System config events**

Level	Type	Description
Info	Sys Config. Defaults Restored	Info: Default system configurations restored.
Info	Sys NVRAM OK	Info: The system NVRAM is active.
Error	Sys NVRAM IO Failed	Error: Can’t access the system NVRAM.
Warning	Sys NVRAM is full	Warning: The system NVRAM is full.

- **System maintenance events**

Level	Type	Description

Info	Firmware Upgraded	Info: System firmware has been upgraded
Error	Firmware Upgraded Failed	Error: System firmware upgrade failed.
Info	System reboot	Info: System has been rebooted
Info	System shutdown	Info: System has been shutdown.
Info	System Init OK	Info: System has been initialized OK.
Error	System Init Failed	Error: System cannot be initialized in the last boot up.

- **LVM events**

Level	Type	Description
Info	VG Created OK	Info: VG <name> has been created.
Warning	VG Created Fail	Warning: Fail to create VG <name>.
Info	VG Deleted	Info: VG <name> has been deleted.
Info	UDV Created OK	Info: UDV <name> has been created.
Warning	UDV Created Fail	Warning: Fail to create UDV <name>.
Info	UDV Deleted	Info: UDV <name> has been deleted.
Info	UDV Attached OK	Info: UDV <name> has been LUN-attached.
Warning	UDV Attached Fail	Warning: Fail to attach LUN to UDV <name>.
Info	UDV Detached OK	Info: UDV <name> has been detached.
Warning	UDV Detached Fail	Warning: Fail to detach LUN from Bus <number> SCSI_ID <number> LUN <number>.
Info	UDV_OP Rebuild Started	Info: UDV <name> starts rebuilding.
Info	UDV_OP Rebuild Finished	Info: UDV <name> completes rebuilding.
Warning	UDV_OP Rebuild Fail	Warning: Fail to complete UDV <name> rebuilding.
Info	UDV_OP Migrate Started	Info: UDV <name> starts migration.
Info	UDV_OP Migrate Finished	Info: UDV <name> completes migration.
Warning	UDV_OP Migrate Failed	Warning: Fail to complete UDV <name> migration.
Warning	VG Degraded	Warning: VG <name> is under degraded mode.
Warning	UDV Degraded	Warning: UDV <name> is under degraded mode.
Info	UDV Init OK	Info: UDV <name> completes the initialization.
Warning	UDV_OP Stop Initialization	Warning: Fail to complete UDV <name> initialization.
Warning	UDV IO Fault	Error: IO failure for stripe number <number> in UDV <name>.
Warning	VG Failed	Error: Fail to access VG <name>.
Warning	UDV Failed	Error: Fail to access UDV <name>.
Warning	Global CV Adjustment Failed	Error: Fail to adjust the size of the global cache.
Info	Global Cache	Info: The global cache is OK.
Error	Global CV Creation Failed	Error: Fail to create the global cache.
Info	UDV Rename	Info: UDV <name> has been renamed as

		<name>.
Info	VG Rename	Info: VG <name> has been renamed as <name>.
Info	Set VG Dedicated Spare Disks	Info: Assign Disk <slot> to be VG <name> dedicated spare disk.
Info	Set Global Disks	Info: Assign Disk <slot> to the Global Spare Disks.
Info	UDV Read-Only	Info: UDV <name> is a read-only volume.
Info	WRBK Cache Policy	Info: Use the write-back cache policy for UDV <name>.
Info	WRTHRU Cache Policy	Info: Use the write-through cache policy for UDV <name>.
Info	High priority UDV	Info: UDV <name> is set to high priority.
Info	Mid Priority UDV	Info: UDV <name> is set to mid priority.
Info	Low Priority UDV	Info: UDV <name> is set to low priority.

- **Snapshot events**

Level	Type	Description
Warning	Allocate Snapshot Mem Failed	Warning: Fail to allocate snapshot memory for UDV <name>.
Warning	Allocate Snapshot Space Failed	Warning: Fail to allocate snapshot space for UDV <name>.
Warning	Reach Snapshot Threshold	Warning: The threshold of the snapshot of UDV <name> has been reached.
Info	Snapshot Delete	Info: The snapshot of UDV <name> has been deleted.
Info	Snapshot replaced	Info: The oldest snapshot version of UDV <name> has been replaced by the new one.
Info	Take a Snapshot	Info: Take a snapshot to UDV <name>.
Info	Set Size for Snapshot	Info: Set the snapshot size of UDV <name> to <number> MB/GB.
Info	Snapshot rollback start	Info: The snapshot of UDV <name> rollback start.
Info	Snapshot rollback finish	Info: The snapshot of UDV <name> rollback finish.

C. Known issues

1. Microsoft MPIO is not supported on Windows XP or Windows 2000 Professional.

   Workaround solution: Using Windows Server 2003 or Windows 2000 server to run MPIO.

2. It can succeed to ping the management port of the controller, but fail to access Web GUI.

   Workaround solution: Connect the Ethernet cable into management port before turning on power.

D. Microsoft *i*SCSI Initiator

Here is the step by step to setup Microsoft *i*SCSI Initiator.

1. Run Microsoft iSCSI Initiator version 2.0. Please see Figure D.1.
2. Click **"Discovery"**.

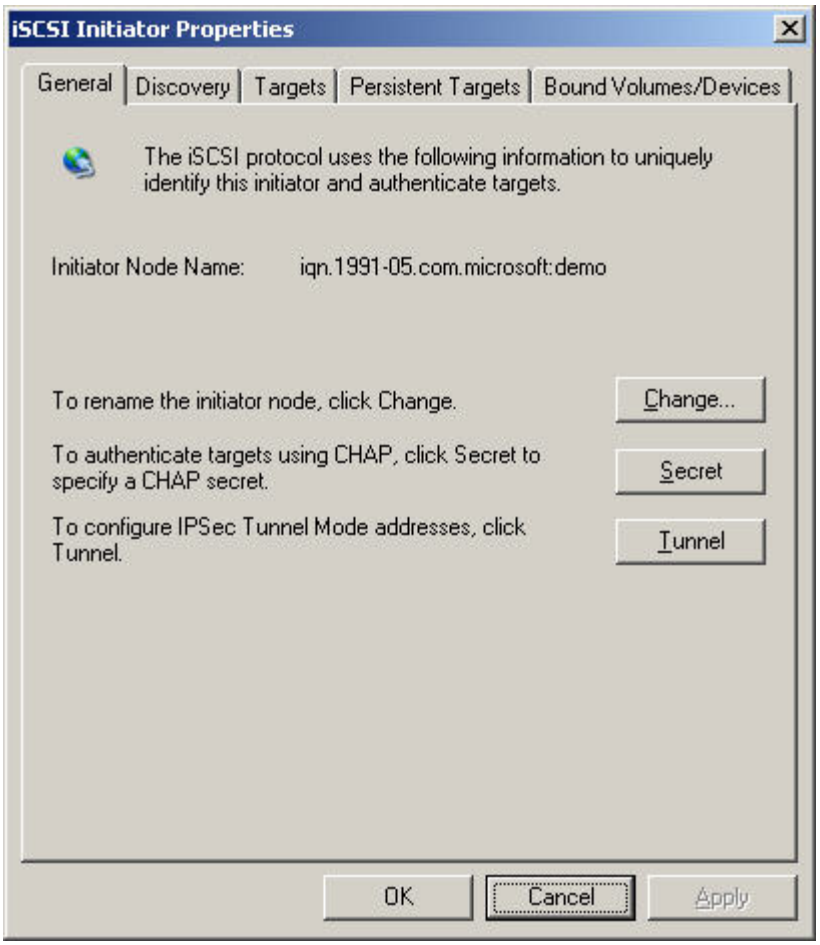


Figure D.1

3. Click **"Add"**. Input IP address or DNS name of *i*SCSI storage device. Please see Figure D.2.

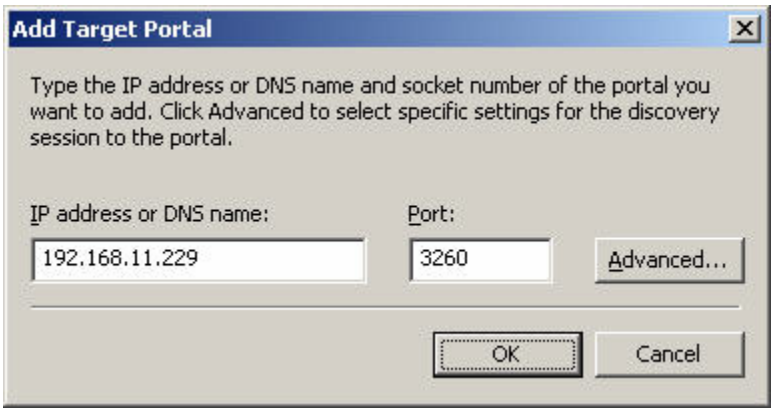


Figure D.2

4. Click **"OK"**. Please see Figure D.3.

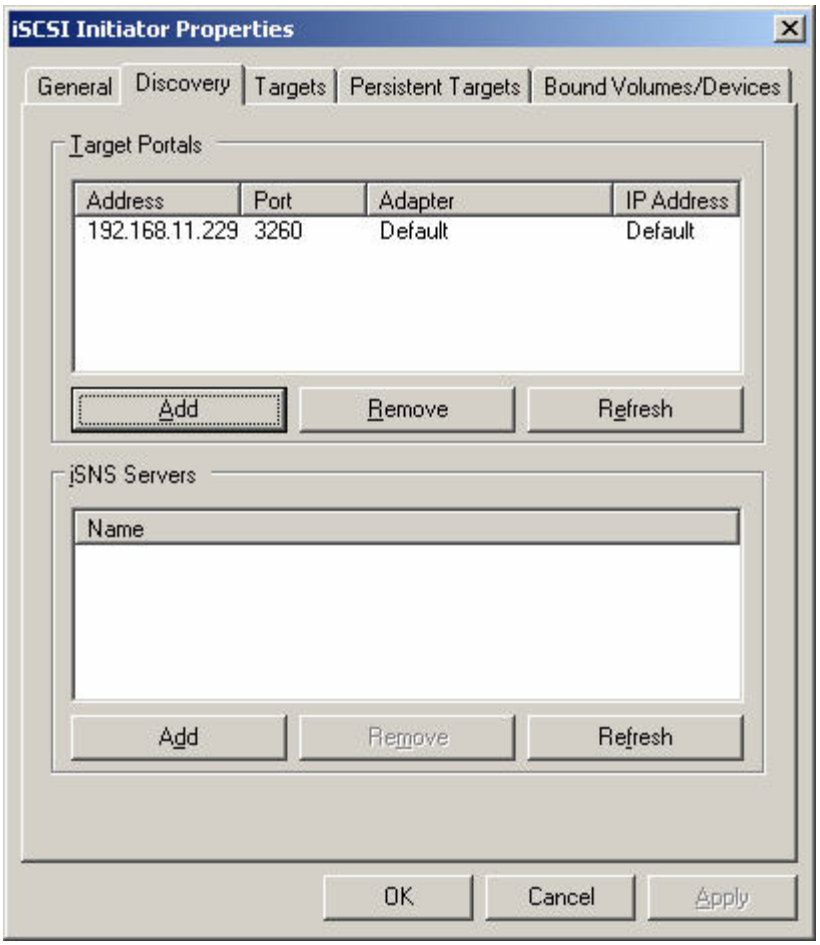


Figure D.3

5. Click **"Targets"**. Please see Figure D.4.

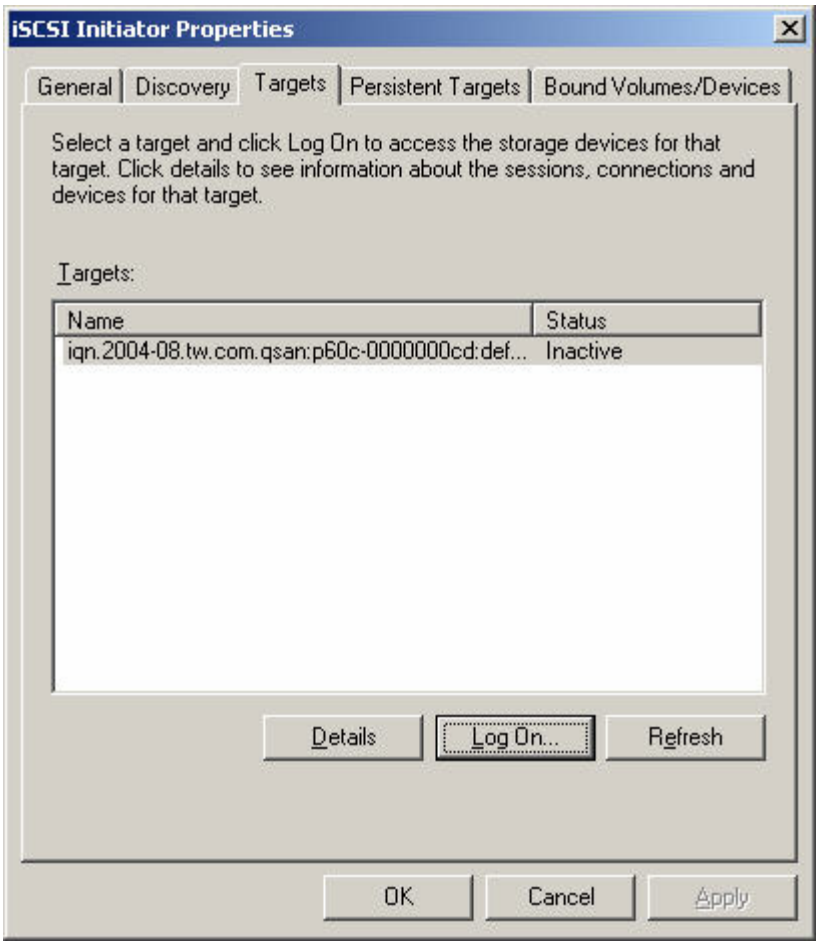


Figure D.4

6. Click **"Log On"**. Please see Figure D.5. Check **"Enable multi-path"** if running MPIO.

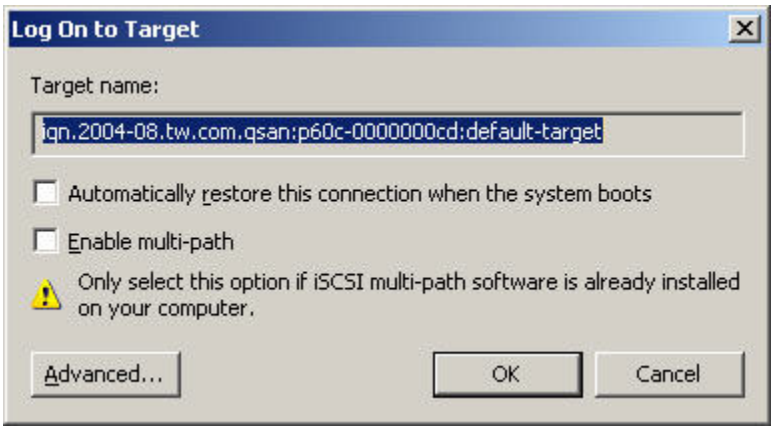


Figure D.5

7. Click **"Advance"** if CHAP information is needed. Please see Figure D.6.

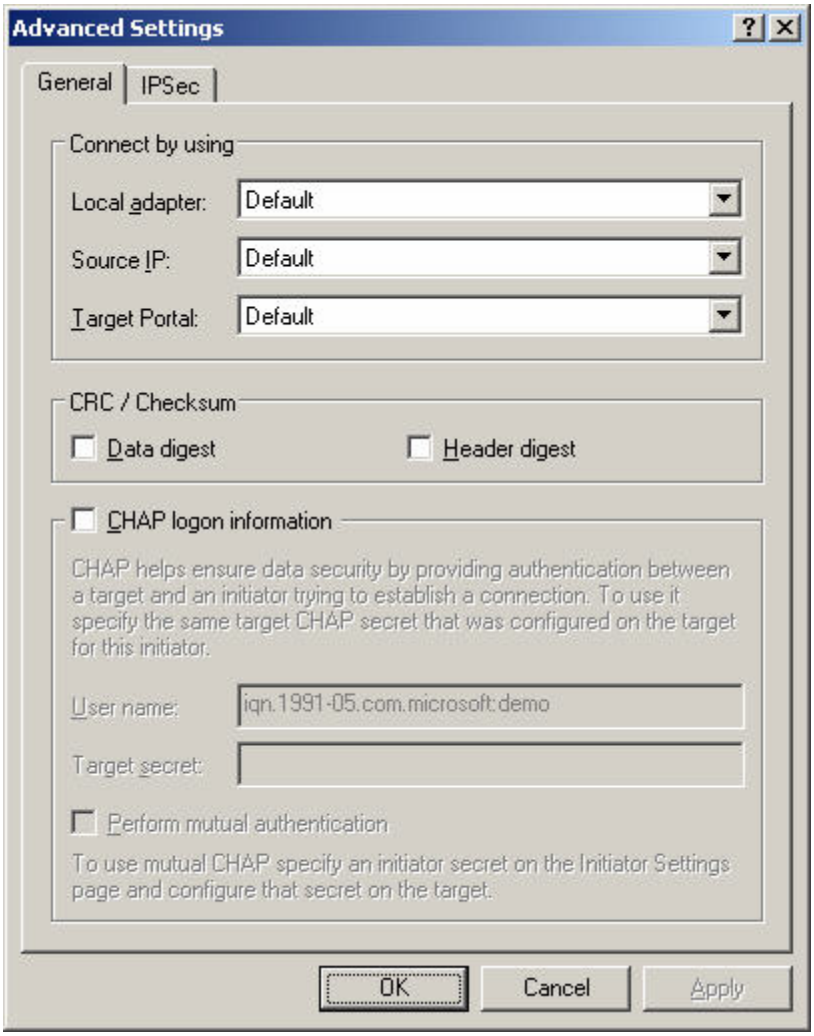


Figure D.6

8. Click **"OK"**. The status would be "Connected". Please see Figure D.7.
9. Done, it can connect to an *i*SCSI disk.

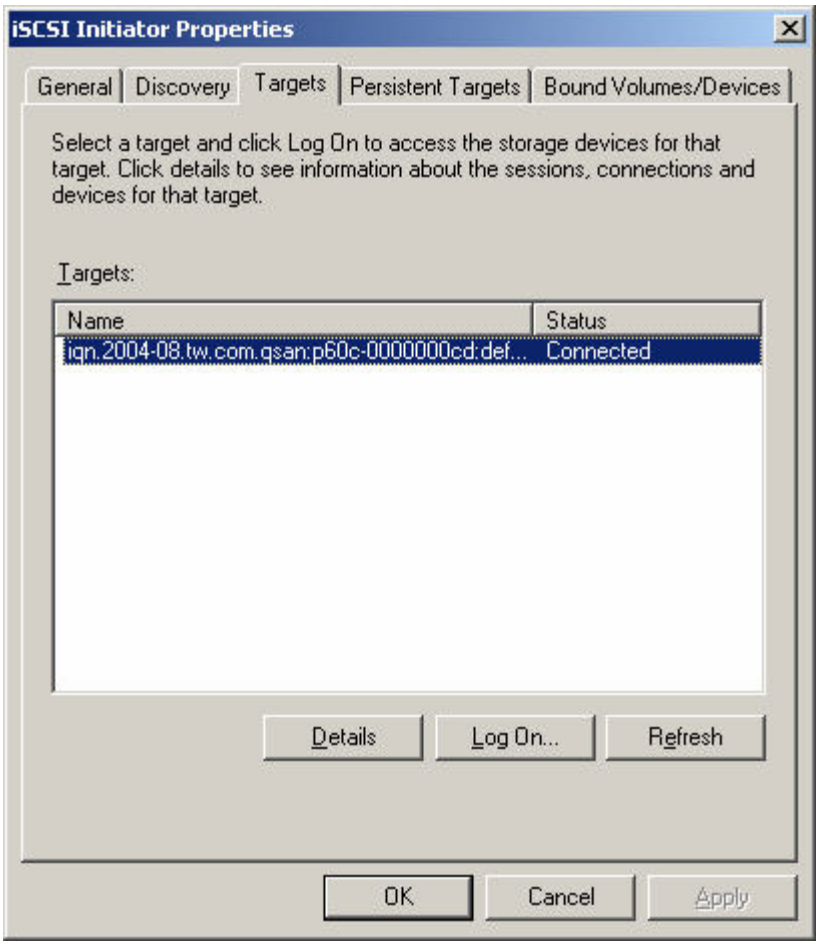


Figure D.7

The following procedure is to log off *i*SCSI device.

1. Click **"Details"**. Please see Figure D.8.

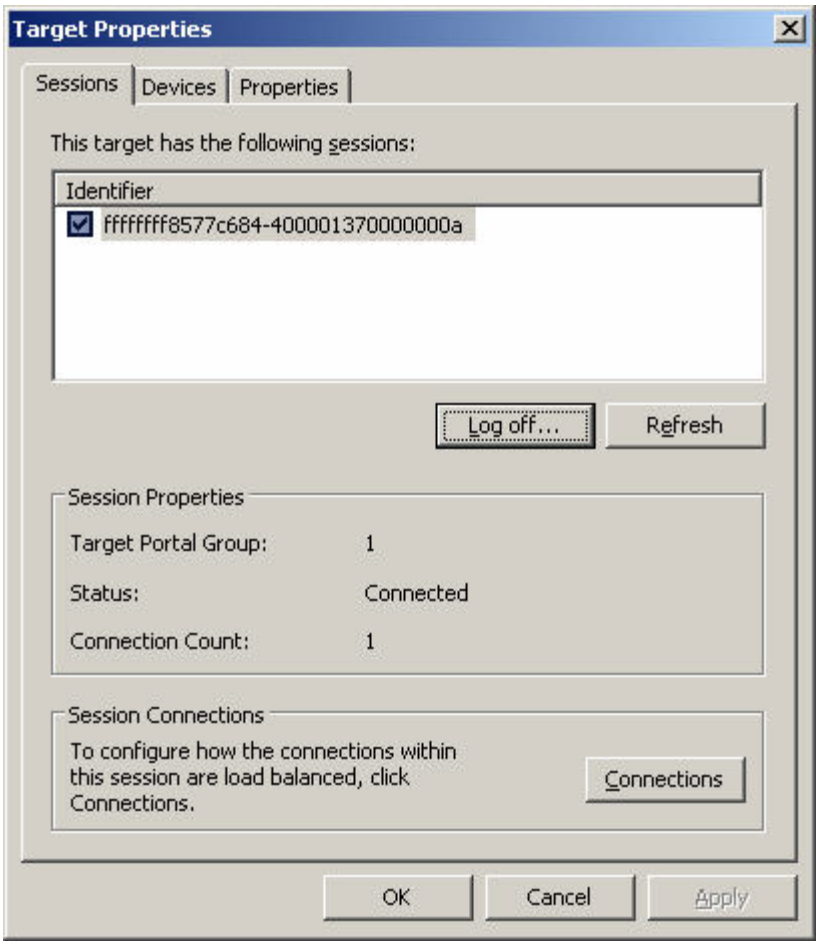


Figure D.8

2. Check the Identifier, which would be deleted.
3. Click **"Log off"**.
4. Done, the iSCSI device log off successfully.