

iSCSI-SATA II SUBSYSTEM

Installation Reference Guide

Revision 1.1

P/N: PW002000000233

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Preface

About this manual

This manual is the introduction of **iSCSI-SATA II RAID subsystem**, and to help user to know the operation of the disk array system easily. Information contained in the manual has been reviewed for accuracy, but not for product warranty because of the various environments/OS/settings, Information and specification will be changed without further notice.

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Chapter 1 RAID introduction

1.1 Features


- Front-end 2* 1Gb full iSCSI offload (complete ULP, TCP offload)
- Supports load-balancing & fail-over (802.3ad port trunking, LACP)
- Supports iSCSI jumbo frame
- Supports Microsoft Multipath I/O (MPIO)
- Supports RAID levels 0,1,0+1,3,5,6,10,30,50, 60 and JBOD
- Local N-way mirror: Extension to RAID 1 level, N copies of the disk.
- Global and dedicated hot spare disks
- Write-through or write-back cache policy for different application usage
- Dedicated or shared cache allocation for volume usage
- Supports greater than 2TB per volume set (64-bit LBA support)
- Supports manual or scheduling volume snapshot (up to 32 snapshot)
- Snapshot rollback mechanism
- Online volume migration with no system down-time
- Online volume expansion
- Instant RAID volume availability and background initialization
- Supports S.M.A.R.T, NCQ and OOB Staggered Spin-up capable drives

IS16GL connects to the host system in iSCSI interface. It can be configured to any RAID level. IS16GL provides reliable data protection for servers and the **RAID 6** function ready. The RAID 6 function allows two HDD failures without any impact on the existing data. Data can be recovered from the remaining data and parity drives. (Data can be recovered from the rest disks/drives.)

Snapshot-on-the-box is a fully usable copy of a defined collection of data that contains an image of the data as it appeared at the point in time, which means a point-in-time data replication. It provides consistent and instant copies of data volumes without any system downtime. IS16GL Snapshot-on-the-box can keep up to 32 snapshots for all data volumes. **Rollback** feature is provided for restoring the previously-snapshot data easily while continuously using the volume for further data access. The data access is regular as usual including read/write without any impact to end users. The "on-the-box" terminology implies that it does not require any proprietary agents installed at host side. The snapshot is taken at target side and done by IS16GL. It will not consume any host CPU time thus the server is dedicated to the specific or other application. The snapshot copies can be taken manually or by schedule every hour or every day, depends on the modification.

IS16GL is the most cost-effective disk array subsystem with completely integrated high-performance and data-protection capabilities which meet or

exceed the highest industry standards, and **the best data solution for small/medium business users.**

	<p>Caution Snapshot/rollback features need 512MB RAM or more. Please refer to RAM certification list in Appendix A for more detail.</p>
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1.2 Terminology

The document uses the following terms:

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, data availability, performance to host environment.
PD	The P hysical D isk belongs to the member disk of one specific volume group.
VG	V olume G roup. A collection of removable media. 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 several UDVs. The UDVs from one VG share the same RAID level, but may have different volume capacity.
CV	C ache V olume. IS16GL uses the on board memory as cache. All RAM (except for the part which is occupied by the controller) can be used as cache. User can divide the cache for one UDV or sharing among all UDVs. Each UDV will be associated with one CV for data transaction. Each CV could be assigned different cache memory size.
LUN	L ogical U nit N umber. A logical unit number (LUN) is an unique identifier used on a iSCSI connection which enables it to differentiate among separate devices (each of which is a logical unit).
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.: <ol style="list-style-type: none"> 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	Write-Through cache write policy. A caching technique in which the completion of a write request is not signaled until data is safely stored on non-volatile media. Each data is synchronized in both data cache and the accessed physical disks.
WB	Write-Back cache write policy. A caching technique in which the completion of a write request is signaled as soon as the data is in cache and actual writing to non-volatile media occurs at a later time. It speeds 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 Read-Only .
DS	Dedicated Spare disks. The spare disks are only used by one specific VG. Others could not use these dedicated spare disks for any rebuilding purpose.
GS	Global Spare disks. GS is shared for rebuilding purpose. If some VGs need to use the global spare disks for rebuilding, they could get the spare disks out from the common spare disks pool for such requirement.
DC	Dedicated Cache .
GC	Global Cache .
DG	DeGraded mode. Not all of the array's member disks are functioning, but the array is able to respond to application read and write requests to its virtual disks.
S.M.A.R.T.	Self-Monitoring Analysis and Reporting Technology .

WWN	World Wide Name.
HBA	Host Bus Adapter.
MPIO	Multi-Path Input/Output.
MC/S	Multiple Connections per Session
S.E.S	SCSI Enclosure Services.
NIC	Network Interface Card.
iSCSI	Internet Small Computer Systems Interface.
LACP	Link Aggregation Control Protocol.
MTU	Maximum Transmission Unit.
CHAP	Challenge Handshake Authentication Protocol. An optional security mechanism to control access to an iSCSI storage system over the iSCSI data ports.
iSNS	Internet Storage Name Service.

1.3 RAID levels

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 the following items.

- Check the “**Certification list**” in Appendix A to confirm the hardware setting is fully supported.
- Read the latest release notes before upgrading. Release notes accompany with release firmware.
- A server with a NIC or iSCSI HBA.
- 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. When using static IP, please prepare static IP addresses, subnet mask, and default gateway.
- Gigabit LAN switches. (Recommended) or Gigabit LAN switches with VLAN/LACP/Trunking functions. (Optional)
- CHAP security information, including CHAP usernames and secrets. (Optional)
- Setup the hardware connection before power up servers and IS16GL. Connect console cable, management port cable, and iSCSI data port cables first.

2.2 Unpacking the Subsystem

Before we continue, you need to unpack the subsystem and verify that the contents of the shipping carton are all there and in good condition. Before removing the subsystem from the shipping carton, you should visually inspect the physical condition of the shipping carton. Exterior damage to the shipping carton may indicate that the contents of the carton are damaged. If any damage is found, do not remove the components; contact the dealer where you purchased the subsystem for further instructions.

The package contains the following items:

- iSCSI RAID subsystem unit
- Two power cords
- Three Ethernet LAN cables
- One external null modem cable
- Installation Reference Guide
- Spare screws, etc.

If any of these items are missing or damaged, please contact your dealer or sales representative for assistance.

2.3 Identifying Parts of the subsystem



The illustrations below identify the various features of the subsystem. Get yourself familiar with these terms as it will help you when you read further in the following sections.

2.3.1 Front View



1. HDD status Indicator



Parts	Function
HDD Status LEDs  	Green LED indicates power is on and hard drive status is good for this slot. If hard drive defected in this slot or the hard drive is failure, the LED is orange.
HDD access LEDs	These LED will blink blue when the hard drive is being accessed.

2. HDD trays 1 ~ 16 (From right to left)



3. Smart Function Panel - Function Keys

Parts	Function
Access LED	Blue blinking LED indicates data is being accessed.





4. LCD display panel

5. Smart Function Panel - Function Keys for RAID configuration

The smart LCD panel is where you will configure the RAID subsystem. If you are configuring the subsystem using the LCD panel, please press the controller button to configure your RAID subsystem.

Parts	Function
Up and Down arrow buttons 	Use the Up or Down arrow keys to go through the information on the LCD screen. This is also used to move between each menu when you configure the subsystem.
Select button 	This is used to enter the option you have selected.
Exit button EXIT	Press this button to return to the previous menu.

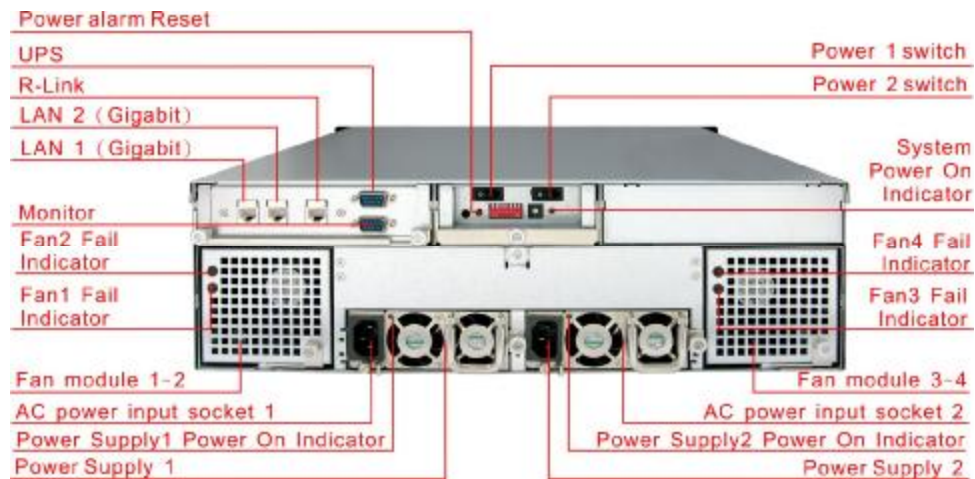
6. Environment status

Parts	Function
Voltage warning LED 	An alarm will sound warning of a voltage abnormality and this LED will turn red.
Over temp LED 	If temperature irregularity in these systems occurs (HDD slot temperature over 45°C), this LED will turn red and an alarm will sound.
Fan fail LED 	When a fan fails, this LED will turn red and an alarm will sound.
Power fail LED 	If a redundant power supply fails, this LED will turn red and an alarm will sound.
Power LED	Green LED indicates power is on.

7. Tray Lever

8. Tray Latch

2.3.2 Rear View



1. Power Supply Alarm Reset button

You can push the power supply reset button to stop the power supply buzzer alarm.

2. Uninterrupted Power Supply (UPS) Port (APC Smart UPS only)

The subsystem may come with an optional UPS port allowing you to connect a APC Smart UPS device. Connect the cable from the UPS device to the UPS port located at the rear of the subsystem. This will automatically allow the subsystem to use the functions and features of the UPS.

3. R-Link Port: Remote Link through RJ-45 ethernet for remote management

The subsystem is equipped with one 10/100 Ethernet RJ45 LAN port. You use web-based browser to management RAID subsystem through Ethernet for remote configuration and monitoring.


4. Monitor Port

The subsystem is equipped with a serial monitor port allowing you to connect a PC or terminal.

5. Fan Fail indicator

If a fan fails, this LED will turn red.

6. Cooling Fan module

Two blower fans are located at the rear of the subsystem. They provide sufficient airflow and heat dispersion inside the chassis. In case a fan fails to function, the “” Fan fail LED will turn red and an alarm will sound.

7. Power Supply Power On Indicator


Green LED indicates power is on.

8. System Power On Indicator

Green LED indicates power is on.

9. Power Supply Unit 1 ~ 2

Two power supplies (power supply 1 and power supply 2) are located at the rear of the subsystem. Turn on the power of these power supplies to power-on the subsystem. The “power” LED at the front panel will turn green.

If a power supply fails to function or a power supply was not turned on, the “” Power fail LED will turn red and an alarm will sound.

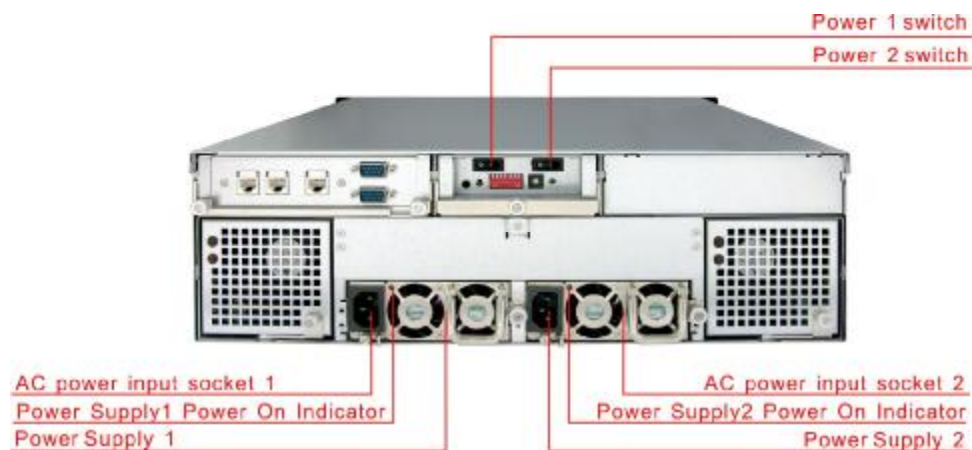
2.4 Connecting iSCSI subsystem to Your Network

To connect the iSCSI unit to the network, insert the cable that came with the unit into the network connection (LAN1) on the back of iSCSI unit. Insert the other end into a Gigabit BASE-T Ethernet connection on your network hub or switch.

2.5 Powering-on the Subsystem

You should press the ON/OFF Power Supply Switch on the Switch. It will turn the iSCSI unit on and the Self-Test will be started automatically.

1. Plug in all the power cords or power connectors located at the rear of the subsystem.



2. You should press the ON/OFF Power supply switch to turn on the power.
3. The "Power" LED on the front panel will turn green.

2.6 Install Hard Drives

This section describes the physical locations of the hard drives supported by the subsystem and gives instructions on installing a hard drive. The subsystem supports hot-swapping allowing you to install or replace a hard drive while the subsystem is running.

1. Pull out an empty disk tray. (You can install in any available slot.)
2. Take off the bracket before installing hard drive.



3. Place the hard drive in the disk tray.
4. Install the mounting screws on each side to secure the drive in the mobile rack.



Note:

Insert screws through the front sides of the mounting holes.

5. Slide the tray into a slot until it clicks into place. The HDD status LED will turn green on front panel.



6. Press the lever in until you hear the latch click into place.
7. If the HDD power LED did not turn green, check the hard drive is in good condition. If the hard drive is not being accessed, the HDD access LED will not illuminate. The LED blinks only when being accessed.

2.7 iSCSI introduction

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

IP SANs are true SANs (Storage Area Networks) which allow few of servers to attach to an infinite number of storage volumes by using iSCSI 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 combining 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 iSCSI, has “two ends” in the connection. These ends are the initiator and the target. In iSCSI we call them iSCSI initiator and iSCSI target. The iSCSI initiator requests or initiates any iSCSI communication. It requests all SCSI operations like read or write. An initiator is usually located on the host/server side (either an iSCSI HBA or iSCSI SW initiator).

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

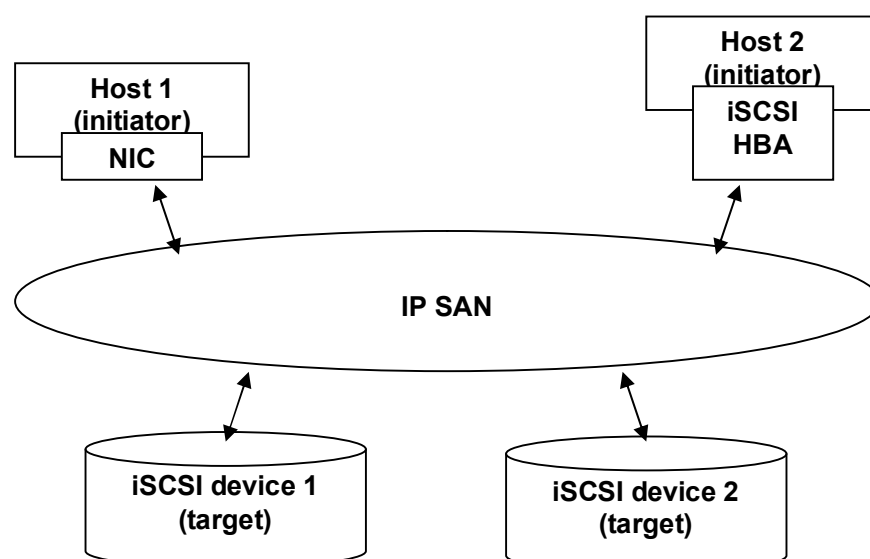


Figure 2.2.1

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

Hardware iSCSI HBA(s) would provide its initiator tool. Please refer to the vendors' HBA user manual. **Microsoft**, **Linux** and **Mac** provide software iSCSI initiator driver. Below are the available links:

1. Link to download the Microsoft iSCSI software initiator:

<http://www.microsoft.com/downloads/details.aspx?FamilyID=12cb3c1a-15d6-4585-b385-befd1319f825&DisplayLang=en>

Please refer to Appendix D for Microsoft iSCSI initiator installation procedure.

2. Linux iSCSI initiator is also available. For different kernels, there are different iSCSI drivers. Please check Appendix A for software iSCSI initiator certification list and "OS_HBA_Initiator List.pdf" for latest update and detail information. If you need the latest Linux iSCSI initiator, please visit Open-iSCSI project for most update information. Linux-iSCSI (sfnet) and Open-iSCSI projects merged in April 11, 2005.

Open-iSCSI website: <http://www.open-iscsi.org/>

Open-iSCSI README: <http://www.open-iscsi.org/docs/README>

Features: <http://www.open-iscsi.org/cgi-bin/wiki.pl/Roadmap>

Support Kernels: http://www.open-iscsi.org/cgi-bin/wiki.pl/Supported_Kernels

Google groups: <http://groups.google.com/group/open-iscsi/threads?gvc=2>
<http://groups.google.com/group/open-iscsi/topics>

Open-iSCSI Wiki: <http://www.open-iscsi.org/cgi-bin/wiki.pl>

3. ATTO iSCSI initiator is available for Mac.

Website: <http://www.attotech.com/xtend.html>

2.8 Management methods

There are three management methods to manage IS16GL, describe in the following:

2.8.1 Web GUI

IS16GL support graphic user interface to manage the system. Be sure to connect LAN cable. The default setting of management port IP is DHCP and the DHCP address displays on LCM; user can check LCM for the IP first, then open the

browser and type the DHCP address: (The DHCP address is dynamic and user may need to check every time after reboot again.) When DHCP service is not available, IS16GL use zero config (Zeroconf) to get an IP address.

E.g., on LCM. IS16GL gets a DHCP address 192.168.10.50 from DHCP server.

192.168.10.50
IS16GL ←

<http://192.168.10.50>

or

<https://192.168.10.50> (**https: connection with encrypted Secure Sockets Layer (SSL). Please be aware of the https function is slower than http.**)

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

Login name: **admin**

Default password: **00000000**

Or login with the read-only account which only allows seeing the configuration and cannot change setting.

Login name: **user**

Default password: 1234

2.8.2 Console serial port

Use NULL modem cable to connect console port.

The console setting is baud rate: **115200**, 8 bits, 1 stop bit, and no parity.

Terminal type: **vt100**

Login name: **admin**

Default password: **00000000**

2.8.3 Remote control – secure shell

SSH (secure shell) is required for IS16GL to remote login. The SSH client software is available at the following web site:

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

Putty WWW: <http://www.chiark.greenend.org.uk/>

Host name: **192.168.10.50 (Please check your DHCP address for this field.)**

Login name: **admin**

Default password: **00000000**



Tips

SB-3164-G1A3 Series only support SSH for remote control. For using SSH, the IP address and the password is required for login.

2.9 Enclosure

2.9.1 LCM

There are four buttons to control **IS16GL** LCM (LCD Control Module), including: ▲ (up), ▼ (down), **EXIT** (Escape), and ✓ (Enter).

After booting up the system, the following screen shows management port IP and model name:

```
192.168.10.50
IS16GL ←
```

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

When there is WARNING or ERROR level of event happening, the LCM shows the event log to give users more detail from front panel too.


The following table is function description.

Alarm Mute	Mute alarm when error occurs.
Reset/Shutdown	Reset or shutdown controller.
Quick Install	Quick 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 sets password to default: 00000000 , and set IP address to default as DHCP setting. Default IP address: 192.168.10.50 (DHCP) Default subnet mask: 255.255.255.0 Default gateway: 192.168.10.254
-------------------------	---

The following is LCM menu hierarchy.

proIPS ▲▼	[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 GB	Volume Size (xxxxxx G)	Adjust Volume Size	
			Apply The Config	[▲Yes No▼]	
	[View IP Setting]	[IP Config] [Static IP]			
		[IP Address] [192.168.010.050]			
		[IP Subnet Mask] [255.255.255.0]			
		[IP Gateway] [192.168.010.254]			
	[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▼]				

	<p>Caution Before power off, it is better to execute “Shutdown” to flush the data from cache to physical disks.</p>
---	--

2.9.2 System buzzer

The system buzzer features are describing in the following:

1. The system buzzer alarms 1 second when system boots up successfully.
2. The system buzzer alarms continuously when there is error level event happened. The alarm will be stopped after mute.
3. The alarm will be muted automatically when the error situation is resolved. E.g., when RAID 5 is degraded and alarm rings immediately, after user changes/adds one physical disk for rebuilding, and when the rebuilding is done, the alarm will be muted automatically.

Chapter 3 Web GUI guideline

3.1 IS16GL GUI hierarchy

The below table is the hierarchy of IS16GL GUI.

Quick Install	→ Step 1 / Step 2 / Step 3 / Confirm
System Config	
System name	→ System name
IP address	→ DHCP / Static / HTTP port / HTTPS port / SSH port
Language	→ Language
Login config	→ Auto logout / Login lock
Password	→ Old password / Password / Confirm
Date	→ Date / Time / Time zone / Daylight saving / NTP
Mail	→ Mail-from address / Mail-to address / SMTP relay / Authentication / Send test mail / Send events
SNMP	→ SNMP trap address / Community
System log server	→ Server IP / Port / Facility / Event level
Event log	→ Filter / Download / Mute / Clear
iSCSI config	
Entity Property	→ Entity name / iSNS
NIC	→ Link aggregation or Multi-homed / IP settings / Default gateway / Set MTU / MAC address
Node	→ Node name / CHAP Authentication
Session	→ iSCSI sessions and connections
CHAP account	→ Create / Delete CHAP account
Volume config	
Physical disk	→ Free disc / Global spares / Dedicated spares / More information / Auto Spindown
Volume group	→ Create / Delete / More information / Rename / Migrate / Expand
User data Volume	→ Create / Delete / Attach LUN / Snapshot / More information / Rename / Extend / Set read/write mode / Set priority / Resize Snapshot space / Auto Snapshot / QCopy
Cache volume	→ Create / Delete / More information / Resize / Dedicated cache
Logical unit	→ Attach / Detach
Enclosure management	
SES config	→ Enable / Disable
Hardware monitor	→ Status / 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 / Export config
- Info** → System information
- Reset to default** → Reset to factory default
- Config import & export** → Controller configuration import and export function
- Shutdown** → Reboot / Shutdown

Logout

3.2 Login

IS16GL supports graphic user interface (GUI) to operate the system. Be sure to connect the LAN cable. The default IP setting is **DHCP**; open the browser and enter:

http://192.168.10.50 (Please check the DHCP address first on LCM)

Click any function at the first time; it will pop up a dialog for authentication.

Login name: **admin**

Default password: 00000000

After login, you can choose the function blocks on the left side of window to do configuration.

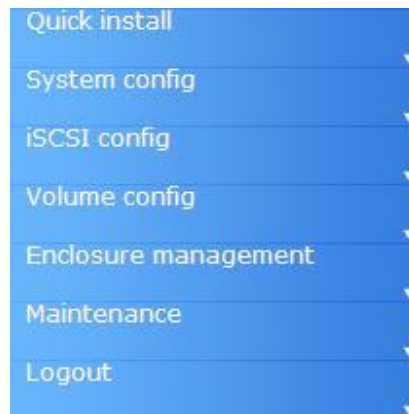








Figure 3.2.1

There are six indicators at the top-right corner for backplane solutions, and cabling solutions have three indicators at the top-right corner.



Figure 3.2.2

1.  **RAID light:** Green means RAID works well. Red represents RAID failure happening.
2.  **Temperature light:** Green is normal. Red represents abnormal temperature.
3.  **Voltage light:** Green is normal. Red represents abnormal voltage status.
4.  **UPS light:** Green is normal. Red represents abnormal UPS status.
5.  **Fan light:** Green is normal. Red represents abnormal fan status.
6.  **Power light:** Green is normal. Red represents abnormal power status.

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 and spare. If snapshot function is needed, please create volumes by manual, and refer to section 4.4 for more detail.

IS16GL Quick Install function has a smarter policy. When the system is full inserted with 16 HDD, and all HDD are in the same size, **IS16GL Quick Install** function lists all possibilities and sizes among different RAID levels, **IS16GL Quick Install** will use all available HDD for the RAID level which user decides. But, when the system is inserted with different sizes of HDD, e.g., 8*200G HDD and 8*80G, **IS16GL** also lists all possibilities and combinations of different RAID Level and different sizes. After user chooses RAID level, user may find there are still some HDD are not used (Free Status). The result is from **IS16GL's** smarter policy on **Quick Install** which gives user:

1. Biggest capacity of RAID level which user chooses and,
2. The fewest disk number for the RAID level/volume size.

E.g., user chooses RAID 5 and the controller has 12*200G HDD + 4*80HDD inserted. Then if using all 16 HDD for a RAID 5, then the volume max size is 1200G (80G*15). But in IS16GL, we do smarter check and find out the most efficient use of HDDs, which results controller only use the 200G HDD (Volume size is 200*11=2200G). Then, the volume size is bigger, and full use of HDD capacity.

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 >>”, which links to another page, user can set up “LUN” here.



Figure 3.3.1

Step 2: Please select a LUN number. Access control of host would show 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. You can start to use the system now.



Figure 3.3.2

(Figure 3.3.2: A RAID 0 user data volume with the UDV name “QUICK13300”, named by the system itself, with the total available volume size 304GB.)

3.4 System configuration

“System config” selection is for the setup of “System name”, “IP address”, “Login config”, “Password”, “Date”, “Mail”, “SNMP” and view “Event log”.

System name	System name for identification
IP address	Internet Protocol(IP) address for remote administration
Language	Language preference for WebUI
Login config	Configuration for auto logout and login lock
Password	Administrator's password
Date	System time for event log
Mail	Alert by e-mail
SNMP	Alert via Simple Network Management Protocol(SNMP)
System log server	Alert to remote system log server
Event log	System event log to record critical events

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: P120-000001.



/ System config / System name

System name : SB-3164-G1A3-A200ED

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 static IP. The default setting is DHCP enabled. User can change the HTTP, HTTPS, and SSH port number when the default port number is not allowed on host/server.



/ System config / IP address

DHCP
 Static

Address :
Mask :
Gateway :
DNS :
MAC : 00:13:78:A0:00:21
HTTP port : 80
HTTPS port : 443
SSH port : 22

Figure 3.4.2.1

3.4.3 Language

Select “**Language**” is for changing GUI language. There are 3 selections, Auto Detect, English, and Simplified Chinese. The default language is the same with your browser (IE or Firefox) default language.



Figure 3.4.3.1

3.4.4 Login config

Select “**Login config**” is to set only one admin and set the auto logout timing. The only one admin can prevent multiple users access the same controller in the same time.

1. Auto logout: Options are (1) Disable (2) 5 mins (3) 30 mins (4) 1 hour. When user is no response for a period of time, the system will logout automatically to allow another user to login.



Figure 3.4.4.1

2. Login block: Disable/Enable. When the login block is enabled, the system allows only one user to login/modify the system settings.

3.4.5 Password

Select “**Password**” is for changing administrator password. The maximum length of admin password is 12 characters.



Figure 3.4.5.1

3.4.6 Date

Select “**Date**” to set up the current date, time, time zone, and NTP server before using.



The screenshot shows a web-based configuration interface for the 'Date' settings. The page title is '/ System config / Date'. The settings are as follows:

Now :	2007/2/8 15:37:46
Date :	2007 / 2 / 8
Time :	15 : 36 : 13
Time zone :	Asia/Taipei
Daylight saving :	<input type="checkbox"/>
NTP :	<input type="checkbox"/>
Server :	

Figure 3.4.6.1

3.4.7 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. User can also select which levels of event logs are needed to be sent out by Mail. Default setting is only ERROR and WARNING event logs enabled.

/ System config / Mail

Mail-from address : mailman@SB-3164-G1A3

Mail-to address 1 :

Send events 1 : INFO WARNING ERROR

Mail-to address 2 :

Send events 2 : INFO WARNING ERROR

Mail-to address 3 :

Send events 3 : INFO WARNING ERROR

SMTP relay :

SMTP server :

Authentication : None

Account :

Password :

Confirm :

Send test mail :

Figure 3.4.7.1

3.4.8 SNMP

Select “**SNMP**” to set up SNMP trap for alert via SNMP. It allows up to 3 SNMP trap addresses. Default community setting is “public”. User can choose the event log type and the default value of SNMP is INFO event log enabled only.

/ System config / SNMP

SNMP trap address 1 :

SNMP trap address 2 :

SNMP trap address 3 :

Community : public

Send events : INFO WARNING ERROR

Figure 3.4.8.1

3.4.9 System log server

Select “**System log server**” to set up the system log server for RAID subsystem event log trapping which is able to support remote logging. Remote logging

means that event log can be forwarded from the RAID subsystem to another running **syslogd** which it can actually log to a disk file.

/ System config / System log server

Server IP/hostname :

Port : 514

Facility : User

Event level : INFO WARNING ERROR

Figure 3.4.9.1

1. Server IP/hostname: enter the IP address or hostname of system log server.
2. Port: enter the UDP port number on which system log server is listening to. The default port number is 514.
3. Facility: select the facility for event log.
4. Event level: Select the event log options
5. Click "Confirm" button.

Server side (Linux – RHEL4)

The following steps are used to log RAID subsystem messages to a disk file. In the followings, all messages are setup with facility "Local1" and event level "WARNING" or higher are logged to `/var/log/raid.log`.

1. Flush firewall
2. Add the following line to `/etc/syslog.conf`
`Local1.warn /var/log/raid.log`
3. Send a HUP signal to `syslogd` process, this lets `syslogd` perform a re-initialization. All open files are closed, the configuration file (default is `/etc/syslog.conf`) will be reread and the `syslog(3)` facility is started again.
4. Activate the system log daemon and restart
5. Check the `syslog` port number, e.g., 10514
6. Change controller's system log server port number as above
7. Then, `syslogd` will direct the selected event log messages to `/var/log/raid.log` when `syslogd` receive the messages from RAID subsystem.

For more detail features, please check the `syslogd` and `syslog.conf` manpage (e.g., `man syslogd`).

Server side (Windows - 2003)

Windows doesn't provide system log server, user needs to find or purchase a client from third party, below URL provide evaluation version, you may use it for test first.

<http://www.winsyslog.com/en/>

1. Install `winsyslog.exe`
2. Open "Interactives Syslog Server"
3. Check the `syslog` port number, e.g., 10514

4. Change controller's system log server port number as above
5. Start logging on "Interactives Syslog Server"

3.4.10 Event log

Select **“Event log”** to view the event messages. Press **“Filter”** button to choose the display. Press **“Download”** button will save the whole event log as text file with file name “log-ModelName-SerialNumber-Date-Time.txt” (E.g., log-IS16GL-A00021-20061011-114718.txt). Press **“Clear”** button will clear event log. Press **“Mute”** button will stop alarm if system alerts.

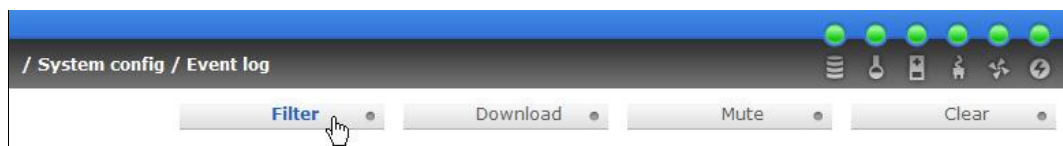


Figure 3.4.10.1

For customizing your own display of event logs, there are total three display methods, on Web UI/Console event log page, popup windows on Web UI, and on LCM. The default setting of these three displays is WARNING and ERROR event logs enabled on Web UI and LCM. The popup is default disabled.



Figure 3.4.10.2

The event log is displayed in reverse order which means the latest event log is on the first page. The event log is actually saved in the first four hard drives, each hard drive has one copy of event log. For one controller, there are four copies of event logs to guarantee users can check event log most of the time when there is/are failed disk(s).

3.5 iSCSI config

“iSCSI config” selection is for the setup of **“Entity Property”**, **“NIC”**, **“Node”**, **“Session”**, and **“CHAP account”**.

/ iSCSI config	
Entity property	iSCSI entity property
NIC	iSCSI portal configuration
Node	iSCSI node configuration
Session	iSCSI session information
CHAP account	Add/Remove account for iSCSI node

Figure 3.5.1

3.5.1 Entity property

Select “**Entity property**” to view the the entity name of the IS16GL, and setup “**iSNS IP**” for iSNS service. **iSNS** is the abbreviation of Internet Storage Name Service. Add an iSNS server IP address to the iSNS servers list which the iSCSI initiator service can send queries.

/ iSCSI config / Entity property	
Entity name :	iqn.1997-05.tw.com.proware:sb-3164-g1a3-000a200ed
iSNS IP :	<input type="text"/>

Figure 3.5.1.1

3.5.2 NIC


Select “**NIC**” to change IP addresses of iSCSI data ports. There are two gigabit LAN ports to transmit data. Each of them must be assigned to 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 not show in the screen.

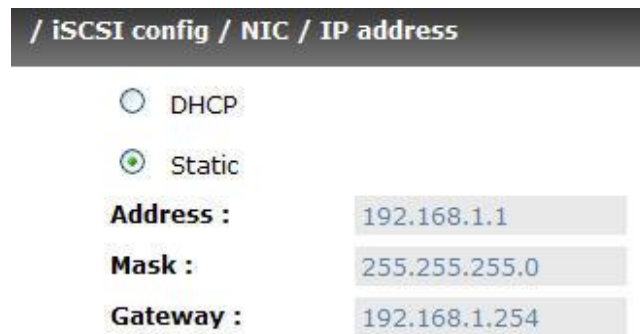
/ iSCSI config / NIC								
No.	Port	Aggregation	DHCP	IP address	Netmask	Gateway	MTU	MAC address
1	LAN1	<input type="radio"/> no	<input type="radio"/> no	192.168.1.1	255.255.255.0	192.168.1.254	<input type="radio"/> 1500	00:13:78:00:03:50
2	LAN2	<input type="radio"/> no	<input type="radio"/> no	192.168.2.1	255.255.255.0	192.168.2.254	<input type="radio"/> 1500	00:13:78:00:03:51

Entity name : iqn.1997-05.tw.com.proware:sb-3164-g1a3-000a200ed

Figure 3.5.2.1

(Figure 3.5.2.1: Each of iSCSI data ports is set to static IP. MTU is 1500.)

User can change IP address by clicking the blue square button “” in the “**DHCP**” column. There are 2 selections, DHCP (Get IP address from DHCP server) or static IP.



/ iSCSI config / NIC / IP address

DHCP


Static


Address : 192.168.1.1

Mask : 255.255.255.0

Gateway : 192.168.1.254

Figure 3.5.2.2

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. 1** 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.




/ iSCSI config / NIC / MTU

LAN1 MTU : 1500 

Figure 3.5.2.3

The range of MTU size is between **1500** and **9000**. Default MTU size is 1500. If it is changed, the setting of MTU size on switching hub and LAN card should be set to the same size. Otherwise, the LAN cannot work properly.

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




/ iSCSI config / NIC / Aggregation


Aggregation : Multi-homed

Trunking

LACP

Figure 3.5.2.4

1. **Multi-homed:** The two LAN ports are connected to two different networks. Multi-homed is default.
2. **Trunking:** Trunking links 2 LAN ports together to be a single link. Trunking could multiply the bandwidth. They will be aggregated to one IP. If clicking the blue square button “” at “No. 1” row, the IP setting will be set to default value after setting trunking, and vice versa. For detailed setup steps, please refer to Appendix E: Trunking/LACP setup instructions.
3. **LACP:** Link Aggregation Control Protocol (LACP) could balance the bandwidth. IP setting concept is the same as trunking. For detailed setup steps, please refer to Appendix E: Trunking/LACP setup instructions.



Caution
Each of gigabit LAN ports must have IP address in different subnet for backplane solutions, P120C-8 and P120C-16.

3.5.3 Node

Select “**Node**” to view the target name for iscsi initiator. Press “**Auth**” to enable CHAP authentication. **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 a key to be used for encrypting the username and password. CHAP enables the username and password to transmitting in an encrypted form for protection.




Figure 3.5.3.1

To use CHAP authentication, please follow the procedures.



Figure 3.5.3.2

1. Click “ ” in Auth column.
2. Select “**CHAP**”.
3. Go to \iSCSI config\CHAP account to create account and password.



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

Select “**None**” to disable the authentication method.

3.5.4 Session

Enter “**Session**” function, it will display iSCSI session and connection information, including the following items:

1. Host (Initiator Name)
2. Security Protocol
3. TCP Port Number
4. Error Recovery Level
5. Error Recovery Count
6. Detail of Authentication status and Source IP: port number.



No.	Host	TPGT	Error recovery level	Error recovery count
0	iqn.1991-05.com.microsoft:demo	0x0001	0	0

Figure 3.5.4.1

3.5.5 CHAP account

Enter “**CHAP account**” function to create a CHAP account for authentication.

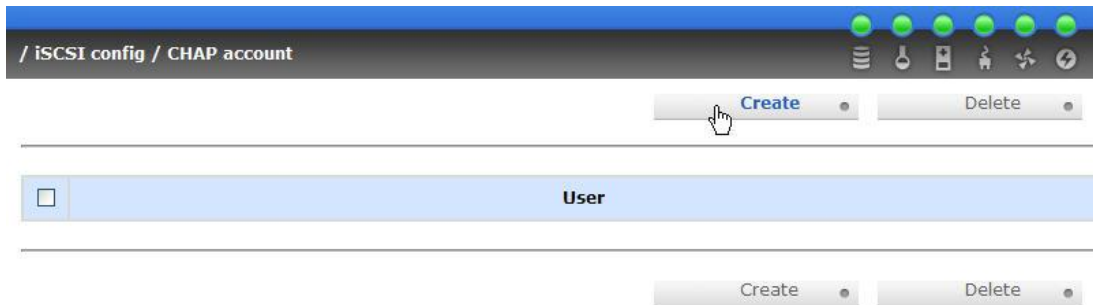


Figure 3.5.5.1

The screenshot shows the "Create" form for a CHAP account. The breadcrumb is "/ iSCSI config / CHAP account / Create". There are three input fields: "User" with a "(max: 223)" constraint, "Secret" with "(min: 12, max: 31)" constraints, and "Confirm" with "(min: 12, max: 31)" constraints.

Figure 3.5.5.2

3.6 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.

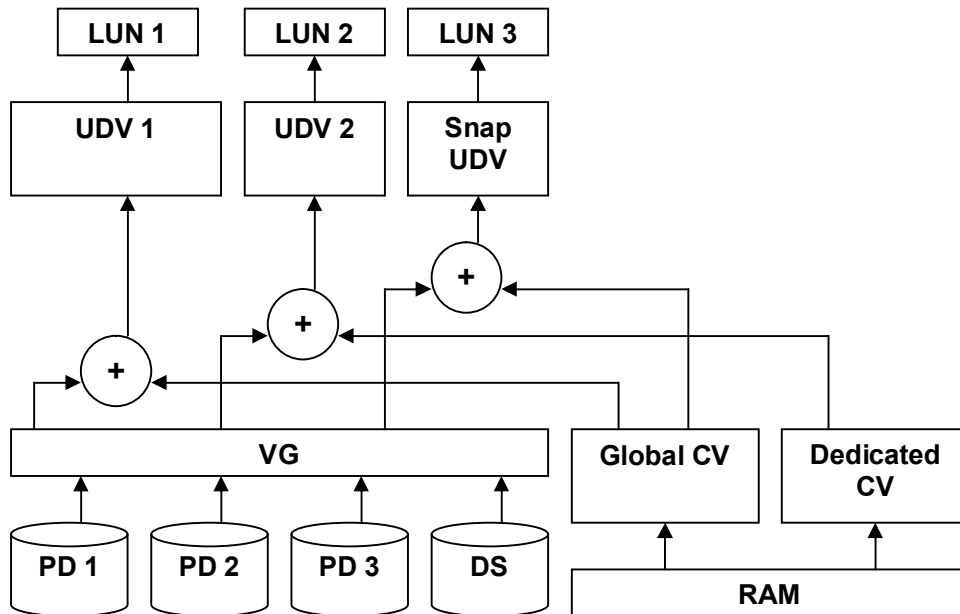
/ Volume config	
Physical disk	Hard disks to store data
Volume group	Sets of physical disks with RAID functions
User data volume	Slices of volume groups
Cache volume	Dedicated or global cache space for user data volume
Logical unit	Target volumes for hosts access

Figure 3.6.1

3.6.1 Volume relationship diagram

The below 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 can be divided into several UDVs. The UDVs from one VG share the same RAID level, but may have different volume capacity.

Each UDV will be associated with one specific CV (Cache Volume) to execute the data transaction. Each CV could have different cache memory size from user's modification/setting. LUN is the logical volume/unit, which the users could access through SCSI commands.



3.6.2 Physical disk

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

1. Multiple select. Select one or more 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 do multiple selects, too.
4. The operations of the other web pages (e.g.: volume config of VG, UDV, CV, LUN pages) are similar to previous steps.

Slot	WWN	Size (GB)	VG name	Status	1	2	Speed
1	200a001378a20032	76	VG-R0	Good	RD		Unknown
2	2016001378a00021	38	VG-R0	Good	RD		1.5Gb
3	2018001378a00021	38	VG-R6	Good	RD		1.5Gb
4	200a001378a20032	111	VG-R6	Good	RD		1.5Gb
5	2017001378a00021	38	VG-R6	Good	RD		1.5Gb
6	200d001378a20032	76	VG-R6	Good	RD		Unknown
7	2015001378a00021	38	VG-R6	Good	DS		1.5Gb
8	200b001378a20032	111		Good	FR		1.5Gb

Auto spindown : Disabled

Figure 3.6.2.1

(Figure 3.6.2.1: Physical disks of slot 1, 2 are created for a VG named “VG-R0”. Physical disks of slot 3, 4, 5, 6 are created for a VG named “VG-R6”. Slot 7 is set as dedicated spare disk of VG named “VG-R6”. 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	World Wide Name.
Size (GB)	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	<p>“RD” → RAID Disk. This hard drive has been set to RAID.</p> <p>“FR” → FRee disk. This hard drive is free for use.</p> <p>“DS” → Dedicated Spare. This hard drive has been set to the dedicated spare of the VG.</p> <p>“GS” → Global Spare. This hard drive has been set to a global spare of all VGs.</p> <p>“RS” → ReServe. The hard drive contains the VG information but cannot be used. It may be caused by an uncompleted VG set, or hot-plug of 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.</p>
Status 2	<p>“R” → Rebuild. The hard drive is doing rebuilding.</p> <p>“M” → Migration. The hard drive is doing migration.</p>
Speed	<p>3.0G→ From SATA ATAPI standard, if the disk can support ATAPI IDENTIFY PACKET DEVICE command, and the speed can achieve Serial ATA Gen-2 signaling speed (3.0Gbps).</p> <p>1.5G→ From SATA ATAPI standard, if the disk can support ATAPI IDENTIFY PACKET DEVICE command, and the speed can achieve Serial ATA Gen-1 signaling speed (1.5Gbps).</p> <p>Unknown→ The disk doesn't support above command, so the speed is defined as unknown.</p>

- **PD operations description:**

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

In this page, IS16GL also provides HDD auto spin down function to save power. The default value is disabled. User can set up in physical disk page, too.



Figure 3.6.2.2



Figure 3.6.2.3

3.6.3 Volume group

Enter “Volume group” to view the status of each volume group.

- **VG column description:**

<input type="checkbox"/>	No.	Name	Total (GB)	Free (GB)	#PD	#UDV	Status	1	2	3	RAID
<input type="checkbox"/>	1	VG-RO	76	46	2	1	Online				RAID 0
<input type="checkbox"/>	2	VG-R6	76	16	4	1	Online				RAID 6

Figure 3.6.3.1

(Figure 3.6.3.1: There is a RAID 0 with 2 physical disks, named “VG-R0”, total size is 76GB, free size is 46GB, related to 1 UDV. Another is a RAID 6 with 4 physical disks, named “VG-R6”.)

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(GB)	Total capacity of this volume group.
Free(GB)	Free capacity of this volume group.
#PD	The number of physical disks of the volume group.
#UDV	The number of user data volumes related to the volume group.
Status	The status of volume group. "Online" → volume group is online. "Fail" → volume group is fail.
Status 1	"DG" → DeGraded mode. This volume group is not completed. The reason could be lack of one disk or failure of disk.
Status 2	"R" → Rebuild . This volume group is doing rebuilding.
Status 3	"M" → Migration . This volume group is doing migration.
RAID	The RAID level of the volume group. 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 a volume group

3.6.4 User data volume

Enter “User data volume” function to view the status of each user data volume.



Figure 3.6.4.1

(Figure 3.6.4.1: Create a UDV named “UDV-01”, related to “VG-R0”, size is 30GB, status is online, write back, high priority, related to 1 LUN, with cache volume 116MB, 10GB snapshot space. The other UDV is named “UDV-02”, initializing to 23%)

- 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(GB)	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	<p>“WT” → Write Through.</p> <p>“WB” → Write Back.</p> <p>The blue square button in below to the status1 is “Set read/write mode” function.</p>
Status 2	<p>“HI” → High priority.</p> <p>“MD” → MiD priority.</p> <p>“LO” → LOw priority.</p> <p>The blue square button in below to the status2 is “Set Priority” function.</p>
Status 3	<p>“I” → user data volume is doing initializing.</p> <p>“R” → user data volume is doing rebuilding.</p>
Status 4	<p>“M” → user data volume is doing migration.</p>
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(GB)	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 the frequency of taking snapshots. The number means “Free snapshot space” / “Total snapshot space”. If the snapshot UDV has been created, this column will be the creation time.
QCopy	Remote replication function.
VG name	The VG name of the user data volume.
CV (MB)	The cache volume of the user data volume.

- **UDV operations description:**

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

3.6.5 Cache volume

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

The global cache volume is a default cache volume, which is created after power on automatically, and cannot be deleted. The size of global cache is based on the RAM size. It is total memory size minus the system usage.

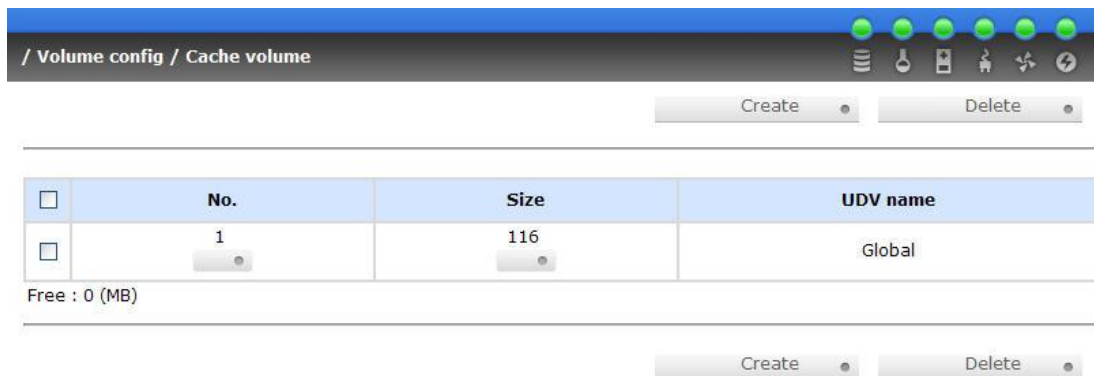


Figure 3.6.5.1

- **CV column description:**

No.	Number of the 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 the 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 a cache volume function.

3.6.6 Logical unit number

Enter “**Logical unit**” function to view the status of attached logical unit number of each UDV. User can attach LUN by clicking the “ **Attach** ”. Please refer to Figure 3.6.6.1. “**Host**” must input an initiator node name for access control, or fill-in wildcard “*”, which means every host can access the volume. Choose LUN and permission, then click “ **Confirm** ”. Please refer to Figure 3.6.6.2. User can assign up to 256 LUNs per system (controller). For the host connection, the host number limitation is 32 per system (controller) in the same time, and 8 for single user data volume (UDV) which means 8 hosts can access the same UDV in the same time.



Figure 3.6.6.1

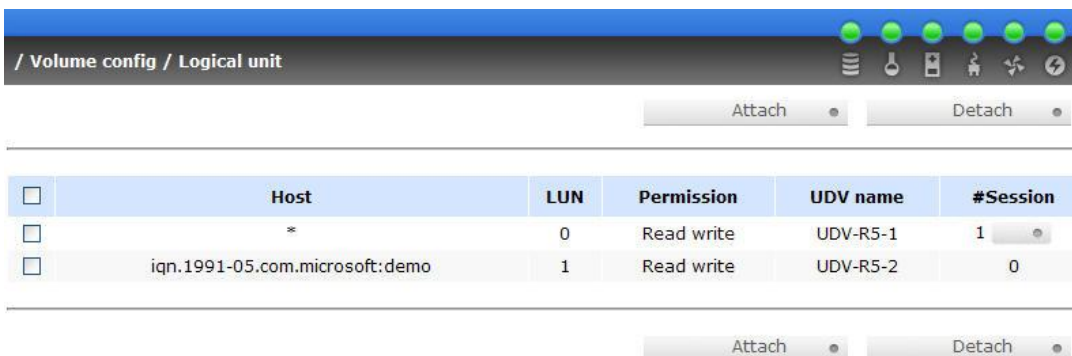


Figure 3.6.6.2

(Figure 3.6.6.2: UDV-01 is attached to LUN 0 with every host can access. UDV-02 is attached to LUN 1 with only initiator node 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 when there is no matching rule.

3.6.7 Examples

The followings are examples for creating volumes. Example 1 is to create two U DVs sharing the same CV (global cache volume) and set a global spare disk. Example 2 is to create two U DVs. One shares global cache volume, the other uses dedicated cache volume. Set a dedicated spare disk.

- **Example 1**

Example 1 is to create two U DVs in one VG, each U DV uses global cache volume. Global cache volume is created after system boots up automatically. So, no action is needed to set 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:

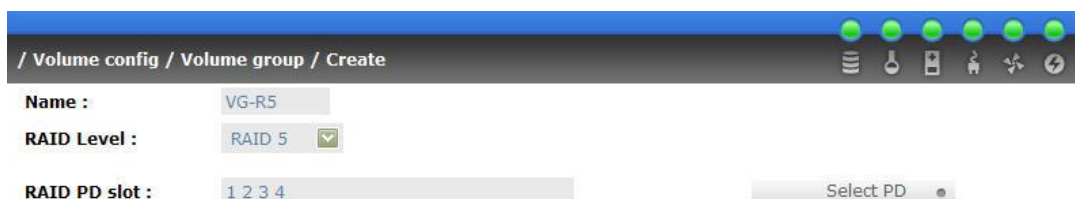


Figure 3.6.7.1

1. Select “/ **Volume config / Volume group**”.
2. Click “ **Create** ”.
3. Input a VG Name, choose a RAID level from the picklist, press “ **Select PD** ” to choose the RAID PD slot(s), then press “ **Next >>** ”.
4. Check the outcome. Press “ **Confirm** ” if all setups are correct.
5. Done. A VG has been created.

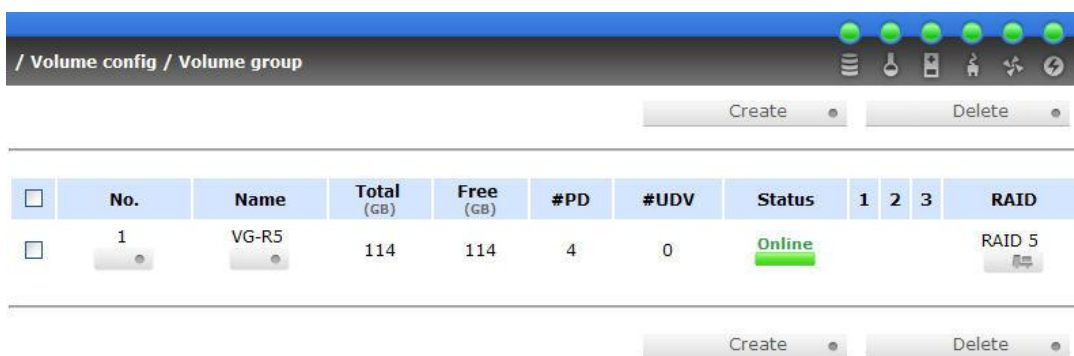


Figure 3.6.7.2

(Figure 3.6.7.2: Creating a RAID 5 with 4 physical disks, named “VG-R5”. The total size is 114GB. Because of no related UDV there, free size still remains 114GB.)

Step 2: Create UDV (User Data Volume).

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

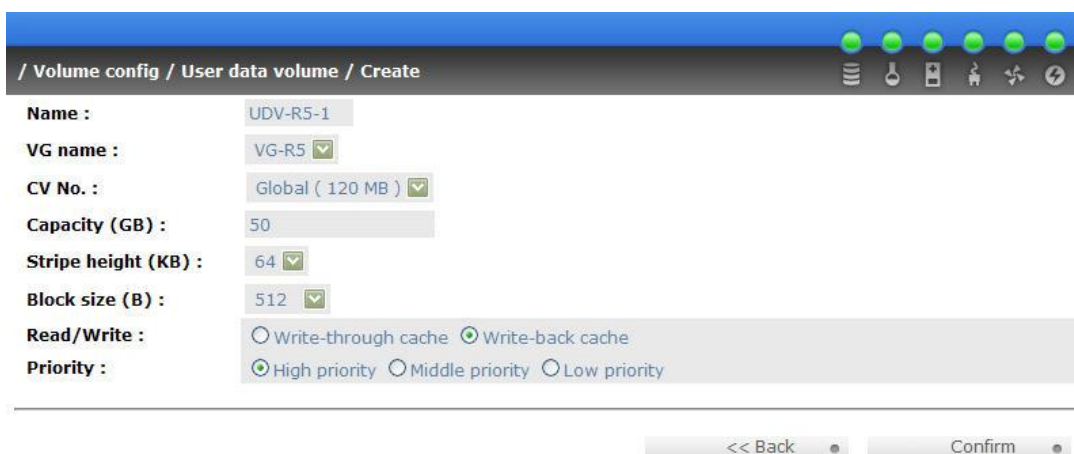


Figure 3.6.7.3

1. Select “/ **Volume config / User data volume**”.

2. Click “ ”.
3. Input a UDV name, choose a VG Name and input a size to the UDV; decide the stripe high, block size, read/write mode and set priority, finally click “ ”.
4. Done. A UDV has been created.
5. Do one more time to create another UDV.

<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	Snapshot (GB)	VG name	CV (MB)
<input type="checkbox"/>	1	UDV-R5-1	50	Online	<input type="button" value="WB"/>	<input type="button" value="HI"/>			RAID 5	0	0.00/0.00	VG-R5	120
<input type="checkbox"/>	2	UDV-R5-2	64	Online	<input type="button" value="WB"/>	<input type="button" value="HI"/>	<input type="button" value="I"/>	4%	RAID 5	0	0.00/0.00	VG-R5	120

Figure 3.6.7.4

(Figure 3.6.7.4: Create UDV named “UDV-R5-1” and “UDV-R5-2”, related to “VG-R5”, the size of “UDV-R5-1” is 50GB, the size of “UDV-R5-2” is 64GB. The status of these UDV are online, write back, high priority with cache volume 120MB. “UDV-R5-2” is initializing about 4%. 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 “ ”.
2. In “/ **Volume config** / **Logical unit**”, press “ ”.

The procedures are as follows:

/ Volume config / Logical unit / Attach

UDV :

Host :

LUN :

Permission : Read-only Read-write


Figure 3.6.7.5

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.

<input type="checkbox"/>	Host	LUN	Permission	UDV name	#Session
<input type="checkbox"/>	*	0	Read write	UDV-R5-1	1
<input type="checkbox"/>	iqn.1991-05.com.microsoft:demo	1	Read write	UDV-R5-2	0

Figure 3.6.7.6

(Figure 3.6.7.6: UDV-R5-1 is attached to LUN 0 with any hosts can access. UDV-R5-2 is attached to LUN 1 with only initiator node 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 3.6.6 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.

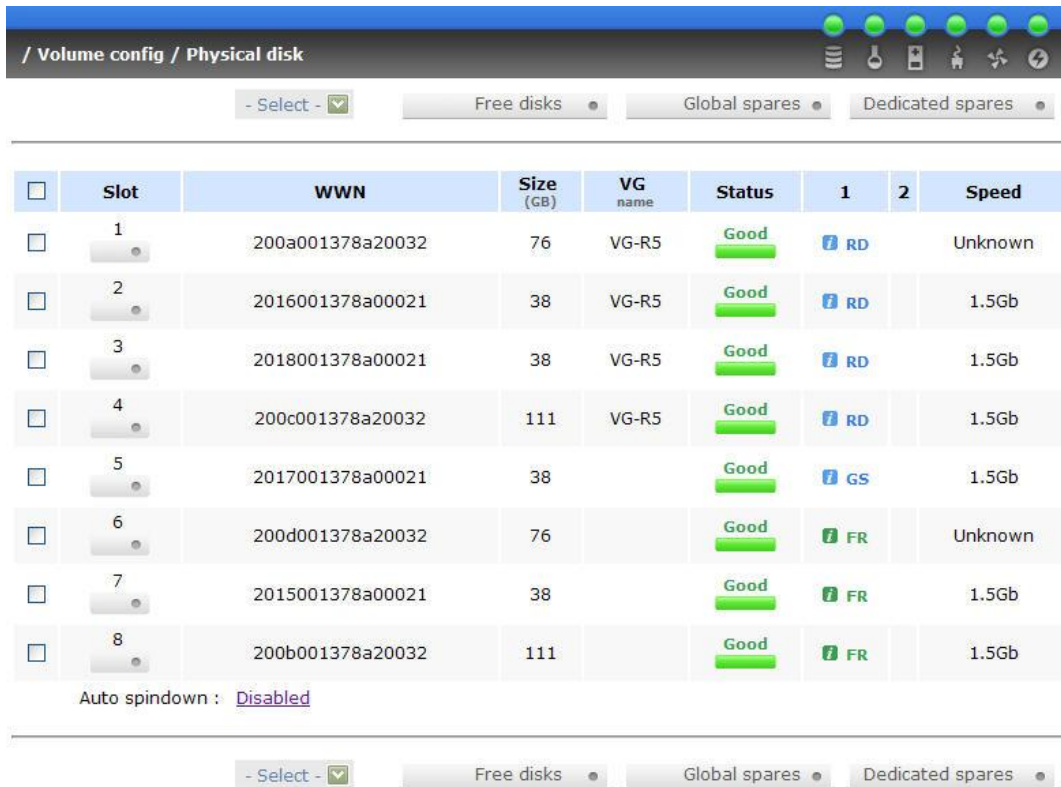


Figure 3.6.7.7

(Figure 3.6.7.7: Slot 5 is set as global spare disk.)

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


Delete UDV's, VG, please follow the steps.

Step 6: Detach LUN from UDV.

In “/ Volume config / Logical unit”,




Figure 3.6.7.8

1. Select LUNs by clicking the checkbox of the row, then click “”. 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 “”. There will pop up a confirm page.
4. Choose “OK”.
5. Done. Then, the UDVs are deleted.




Tips

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

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 “”. There will pop up a confirmation 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 deleted in this VG. Otherwise, it will have an error when deleting this VG.

Step 9: Free global spare disk.

To free 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 disks ” to free disk.

Step 10: Done, all volumes have been deleted.

- **Example 2**

Example 2 is to create two UDV's 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 is associated with one specific CV (cache volume) to execute the data transaction. Each CV could have different cache memory size. If there is no special request in UDV's, it uses global cache volume. Or user can create a dedicated cache for individual UDV manually. Using dedicated cache volume, the performance would not be affected by the other UDV's data access.

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


Step 1: Create dedicated cache volume.



Figure 3.6.7.9

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 “ ” to return to cache volume page.
3. Click “ ” to enter the setup page.

4. Fill in the size and click “ ”.
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 user data volume with dedicated cache volume, please follow the below procedures.

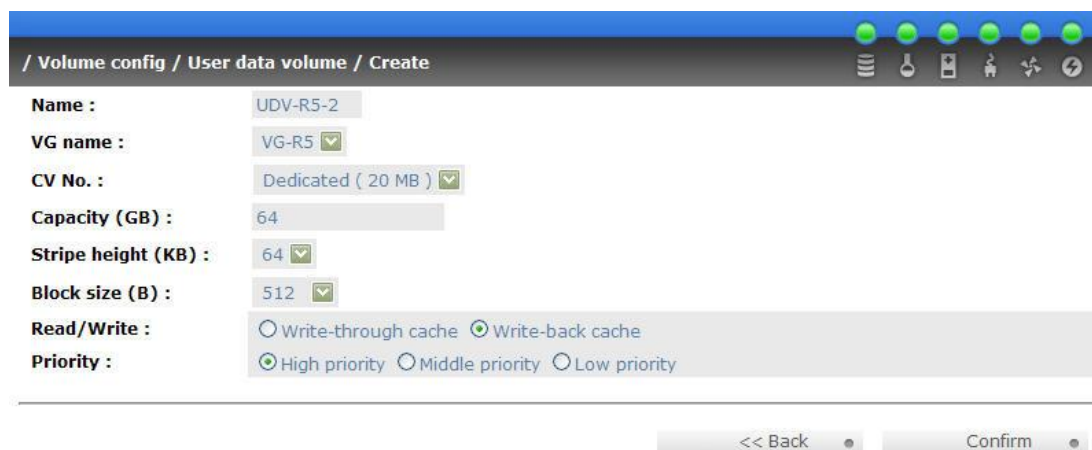


Figure 3.6.7.10

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

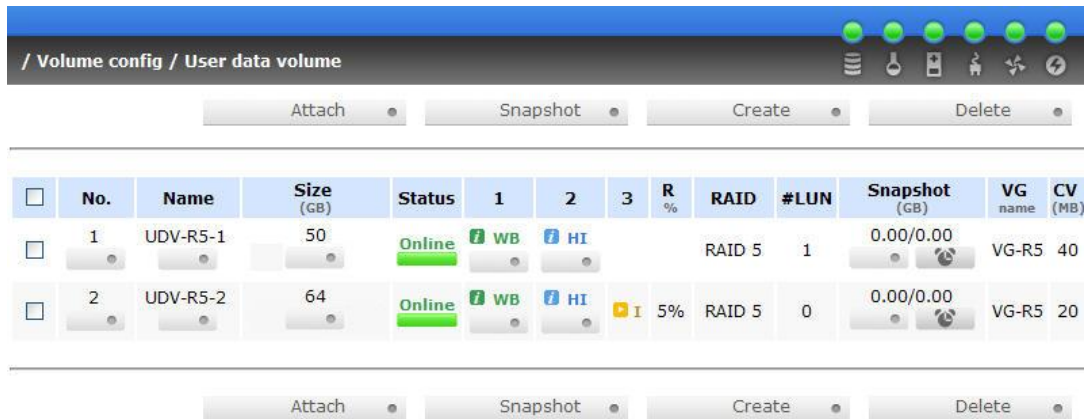


Figure 3.6.7.11

(Figure 3.6.7.11: UDV named “UDV-R5-1” uses global cache volume 40MB, and “UDV-R5-2” uses dedicated cache volume 20MB. “UDV-R5-2” is initializing about 5%.)



Figure 3.6.7.12

(Figure 3.6.7.12: 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.

<input type="checkbox"/>	Slot	WWN	Size (GB)	VG name	Status	1	2	Speed
<input type="checkbox"/>	1	200a001378a20032	76	VG-R5	Good	RD		Unknown
<input type="checkbox"/>	2	2016001378a00021	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	3	2018001378a00021	38	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	4	200c001378a20032	111	VG-R5	Good	RD		1.5Gb
<input type="checkbox"/>	5	2017001378a00021	38	VG-R5	Good	DS		1.5Gb
<input type="checkbox"/>	6	200d001378a20032	76		Good	FR		Unknown
<input type="checkbox"/>	7	2015001378a00021	38		Good	FR		1.5Gb
<input type="checkbox"/>	8	200b001378a20032	111		Good	FR		1.5Gb

Auto spindown : [Disabled](#)

Figure 3.6.7.13

(Figure 3.6.7.13: Slot 5 has been set as dedicated spare disk of VG named “VG-R5”.)

Step 6: Done. The PDs can be used as iSCSI disks.

Delete UDV, 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 free dedicated spare disks, please follow the procedures:

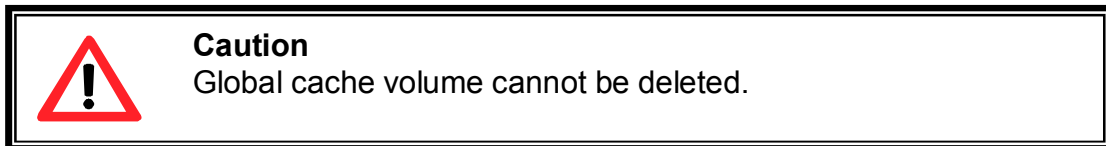
1. Select “/ **Volume config / Physical disk**”.

2. Select the dedicated spare disk by clicking the checkbox of the row, then click “  “ 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 “  “. There will pop up a confirmation page.
4. Choose “OK”.
5. Done. The CV has been deleted.



Step 12: Done, all volumes have been deleted.

3.7 Enclosure management

“**Enclosure management**” function allows managing enclosure information including “**SES config**”, “**Hardware monitor**”, “**S.M.A.R.T.**” and “**UPS**” functions. For the enclosure management, there are many sensors for different purposes, such as temperature sensors, voltage sensors, hard disks, fan sensors, power sensors, and LED status. And due to the hardware characteristics are different among these sensors, for different sensors, they have different polling intervals. Below is the detail polling time intervals:

1. Temperature sensors: 1 minute.
2. Voltage sensors: 1 minute.
3. Hard disk sensors: 10 minutes.
4. Fan sensors: 10 seconds, when there are continuous 3 times of error, controller sends ERROR event log.
5. Power sensors: 10 seconds, when there are continuous 3 times of error, controller sends ERROR event log.
6. LED status: 10 seconds.

/ Enclosure management	
SES config	Access control for SES management
Hardware monitor	System monitored voltage, temperature and battery backup module
S.M.A.R.T.	Self-monitoring analysis and reporting technology for physical disks
UPS	Uninterruptible power supply

Figure 3.7.1

3.7.1 SES configuration

SES represents **SCSI Enclosure Services**, one of the enclosure management standards. Enter “**SES config**” function can enable or disable the management of SES.

/ Enclosure management / SES config				
<input type="button" value="Enable"/> <input type="button" value="Disable"/>				
<input type="checkbox"/>	Host	LUN	Permission	UDV name
<input type="checkbox"/>	*	0	Read write	(SES)
<input type="button" value="Enable"/> <input type="button" value="Disable"/>				

Figure 3.7.1.1

(Figure 3.7.1.1: Enable SES in LUN 0, and can be accessed from every host.)

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

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

3.7.2 Hardware monitor

Enter “**Hardware monitor**” function to view the information of current voltage and temperature.

/ Enclosure management / Hardware monitor	
Item	Information
+1.5V:	+1.52 V (min = +1.44 V, max = +1.63 V)
+3.3V:	+3.28 V (min = +3.10 V, max = +3.55 V)
+5V:	+5.02 V (min = +4.80 V, max = +5.35 V)
+12V:	+12.08 V (min = +11.40 V, max = +12.80 V)
+2.5V:	+2.54 V (min = +2.45 V, max = +2.75 V)
PSU +5V(Backplane):	+5.10 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):	+3.31 V (min = +3.10 V, max = +3.55 V)
Daughter Board:	+43.0 (C) (hyst = +0.0 (C), high = +70.0 (C))
PCI-X BRG:	+33.5 (C) (hyst = +0.0 (C), high = +60.0 (C))
Core Processor:	+46.0 (C) (hyst = +0.0 (C), high = +75.0 (C))
Location 1(Backplane):	+29.0 (C) (hyst = +0.0 (C), high = +45.0 (C))
Location 2(Backplane):	+29.0 (C) (hyst = +0.0 (C), high = +45.0 (C))
Location 3(Backplane):	+29.5 (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 3.7.2.1

If “**Auto shutdown**” has been checked, the system will shutdown automatically when voltage or temperature is out of the normal range. For better data protection, please check “**Auto Shutdown**”.

For better protection and to avoid single short period of high temperature triggering Auto shutdown, IS16GL use multiple condition judgments for Auto shutdown, below is the detail of when the Auto shutdown will be triggered.

1. There are 3 sensors placed on controllers for temperature checking, on core processor, on PCI-X bridge, and on daughter board. IS16GL will check each sensor every 30 seconds. When one of these sensors is over the high temperature value for continuous 3 minutes, the Auto shutdown will be triggered immediately.
2. The core processor temperature limit is 85°. The PCI-X bridge temperature limit is 80°. The daughter board temperature limit is 80°.
3. If the high temperature situation doesn't last for 3 minutes, IS16GL will not do auto shutdown.

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

S.M.A.R.T. (Self-Monitoring Analysis and Reporting Technology) is a diagnostic tool for hard drives to give advanced warning of drive failures. **S.M.A.R.T.** provides users chances to take actions before possible drive failure.

S.M.A.R.T. measures many attributes of the hard drive all the time and decide the hard drives which are close to out of tolerance. The advanced notice of possible hard drive failure can allow users to back up hard drive or replace the hard drive. This is much better than hard drive crash when it is writing data or rebuilding a failed hard 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 values of hard drive vendors are different, please refer to vendors’ specification for details.

Slot	Read error rate	Spin up time	Reallocated sector count	Seek error rate	Spin up retries	Calibration retries	Temperature (C)	Status
1		203(63)	253(63)	253(0)	253(157)	253(223)	41	Good
2	100(16)	107(24)	100(5)	100(67)	100(60)		31	Good
3	100(16)	104(24)	100(5)	100(67)	100(60)		32	Good
4	70(6)	96(0)	100(36)	75(30)	100(97)		31	Good
5	100(16)	102(24)	100(5)	100(67)	100(60)		32	Good
6		203(63)	253(63)	253(0)	253(157)	253(223)	28	Good
7	94(16)	99(24)	100(5)	100(67)	100(60)		31	Good
8	200(51)	171(21)	200(140)	200(51)	100(51)	100(51)	30	Good

Figure 3.7.3.1

3.7.4 UPS

Enter “**UPS**” function will set UPS (Uninterruptible Power Supply).

UPS Type : None

Shutdown Battery Level (%) : 5

Shutdown Delay (s) : 0

Shutdown UPS : OFF

Status :

Battery Level (%) :

Confirm

Figure 3.7.4.1

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

First, connect the system and APC UPS via RS-232 for communication. Then set up the shutdown values when the power is gone. UPS of other vendors can work fine, but they have no such function of communication.

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 shutdown. Setting level to “0” will disable UPS function.
Shutdown Delay (s)	If power failure occurred, and the system can not return back to the setting value period, the system will shutdown. Setting delay to “0” will disable the function.
Shutdown UPS	Select ON, when power is gone, 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.

3.8 System maintenance

“**Maintenance**” function allows operation of the system functions including “**Upgrade**” to the latest firmware, “**Info**” to show the system version, “**Reset to default**” to reset all controller configuration values to origin settings, “**Config**”

import & export” to export and import all controller configuration except for VG/UDV setting and LUN setting, and **“Shutdown”** to either reboot or shutdown the system.

Upgrade	Remote upload firmware
Info	System information
Reset to default	Reset to factory default
Config import & export	Import/export configurations
Shutdown	Reboot or shutdown system

Figure 3.8.1

3.8.1 Upgrade

Enter **“Upgrade”** function to upgrade firmware. Please prepare new firmware file named **“xxx.bin”** in local hard drive, then press **“Browse...”** to select the file. Click **“Confirm”**, it will pop up a message **“Upgrade system now? If you want to downgrade to the previous FW later, please export your system config first”**, click **“Cancel”** to export system config first, then click **“OK”** to start to upgrade firmware.

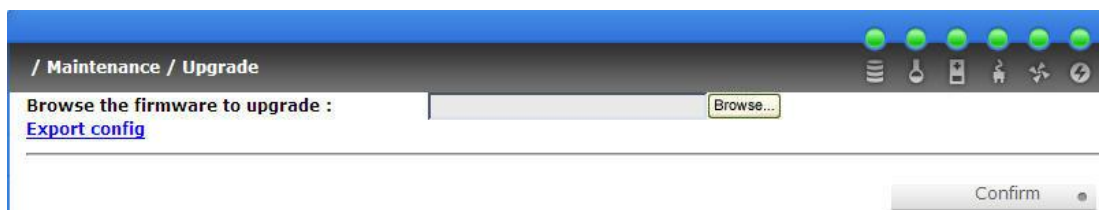


Figure 3.8.1.1

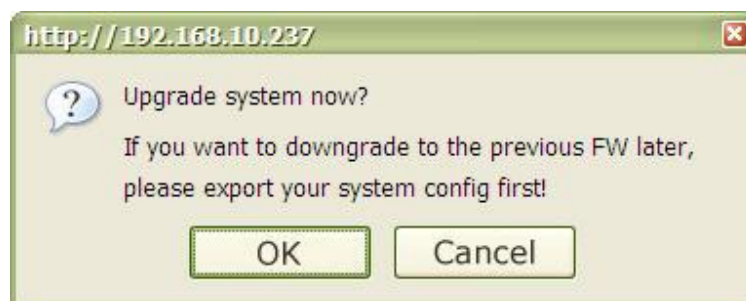


Figure 3.8.1.2

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

Notice: When upgrading FW, IS16GL can only accept the newer version and guarantee the compatibility issue which means, if customer changes FW to older version, the VG/UDV/LUN config may be lost.

3.8.2 Info

Enter “**Info**” function will display system type, FW number, CPU type, RAM size, and serial number.

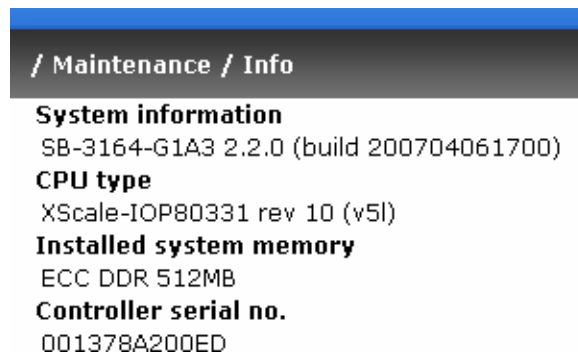


Figure 3.8.2.1

3.8.3 Reset to default

Enter “**Reset to default**” function, it allows user to reset the controller to the factory default setting.

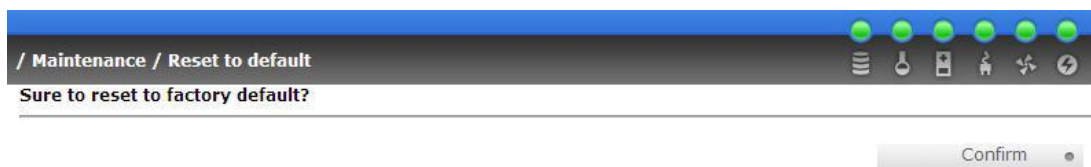


Figure 3.8.3.1

3.8.4 Config import & export

Enter “**Config import & export**” function, it allows user to save system configurable values – export function and to apply all configuration – import function. For the volume config setting, the values are available in export function and not available in import function which can avoid conflict/delete between two subsystems. That says if one controller already has valuable data on the disks and user may forget it and use import function. If the volume setting

was also imported, the user's current data will be cleared. Below is table of available configuration in import & export function.

System name	Controller system name
IP address	Web UI IP address with (1) DHCP enabled, (2) IP, (3) Subnet mask, (4) Gateway, (5) DNS
iSCSI	iSCSI data port address with (1) Aggregation, (2) iSNS, (3) CHAP, (4) LAN 1 IP, Aggregation, IP, Subnet mask, Gateway, MTU
Login config	Admin account login config with (1) Auto logout setting, (2) Admin login lock
Password	Admin password value with (1) Current password, (2) Old password
Date	Time Zone setting
Mail	Event log mail setting with (1) Mail_from address, (2) SMTP server, (3) Authentication, (4) Mail account ID, (5) Mail password, (6) Mail_To_1 address, (7) Mail_To_2 address, (8) Mail_To_3 address, (9) Event log filter setting
SNMP	SNMP setting with (1) SNMP trap address 1, (2) SNMP trap address 2, (3) SNMP trap address 3, (4) Community setting, (5) Event log filter function
Event log	Event log filter setting with (1) Web UI and console UI setting, (2) LCM setting, (3) Web UI pop up event setting
SES config	SES management setting
vol_temp	Auto shutdown setting
UPS	UPS setting with (1) UPS type, (2) Shutdown Battery Level, (3) Shutdown Delay, (4) Shutdown UPS
Physical disk	Not available in import function. Current controller hard disk status with (1) size, (2) block size, (3) VG, (4) hard status

Physical disk spindown	Not available in import function. Hard disk auto spindown setting
Volume group	Not available in import function. VG setting with (1) VG name, (2) size, (3) number of physical disks, (4) number of UDVs, (5) RAID level
Cache volume	Not available in import function. Cache volume setting with (1) size, (2) percentage
User data volume	Not available in import function. UDV setting with (1) UDV name, (2) size, (3) VG name, (4) cache volume, (5) Stripe height, (6) block size, (7) write through or write back, (8) priority
Logical unit	Not available in import function. LUN setting with (1) host name, (2) target name, (3) UDV name, (4) LUN number, (5) permission



Figure 3.8.4.1



Figure 3.8.4.2

3.8.5 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. The step is better for the data protection.



Figure 3.8.5.1

3.9 Logout

For security reason, “**Logout**” function will allow logout while no user is operating the system. Re-login the system, please enter username and password again.

Chapter 4 Advanced operation

4.1 Rebuild

If one physical disk of the VG which is set as protected RAID level (e.g.: RAID 3 , RAID 5, or RAID 6) is FAILED or has been unplugged/removed, then, the VG status is changed to degraded mode, the system will search/detect spare disk to **rebuild** the degraded VG to a complete one. It will detect dedicated spare disk as rebuild disk first, then global spare disk.

IS16GL support Auto-Rebuild function. When the RAID level allows disk failures which the VG is protected, such as RAID 3, RAID 5, RAID 6, and etc, IS16GL starts Auto-Rebuild as below scenario:

Take RAID 6 for example:

1. When there is no global spare disk or dedicated spare disk on the system, IS16GL will be in degraded mode and wait until (A) there is one disk assigned as spare disk, or (B) the failed disk is removed and replaced with new clean disk, then the Auto-Rebuild starts. The new disk will be a spare disk to the original VG automatically.

- a. If the new added disk is not clean (with other VG information), it would be marked as RS (reserved) and the system will not start "auto-rebuild".


- b. If this disk is not belonging to any existing VG, it would be FR (Free) disk and the system will start Auto-Rebuild function.

- c. if user only removes the failed disk and plugs the same failed disk in the same slot again, the auto-rebuild will start by this case. But rebuilding in the same failed disk may impact customer data later from the unstable disk status. **IS16GL** suggests all customers not to rebuild in the same failed disk for better data protection.

2. When there is enough global spare disk(s) or dedicated spare disk(s) for the degraded array, IS16GL starts Auto-Rebuild immediately. And in RAID 6, if there is another disk failure happening during the time of rebuilding, IS16GL will starts the above Auto-Rebuild scenario as well. And the Auto-Rebuild feature only works at "RUNTIME". It will not work the downtime. Thus, it will not conflict with the "Roaming" function.

In degraded mode, the status of VG is "**DG**".

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

	<p>Tips The list box doesn't exist if there is no VG or only VG of RAID 0, JBOD. Because user cannot set dedicated spare disk for these RAID levels.</p>
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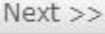

Sometimes, rebuild is called recover; these two have the same meaning. The following table is the relationship between RAID levels and rebuild.

RAID 0	Disk striping. No protection of data. VG fails if any hard drive fails or unplugs.
RAID 1	Disk mirroring over 2 disks. RAID 1 allows one hard drive fails or unplugging. Need one new hard drive to insert to the system and rebuild to be completed.
N-way mirror	Extension to RAID 1 level. It has N copies of the disk. N-way mirror allows N-1 hard drives fails or unplugging.
RAID 3	Striping with parity on the dedicated disk. RAID 3 allows one hard drive fail or unplugging.
RAID 5	Striping with interspersed parity over the member disks. RAID 5 allows one hard drive fail or unplugging.
RAID 6	2-dimensional parity protection over the member disks. RAID 6 allows two hard drives fails or unplugging. 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 fails or unplugging, but at the same array.
RAID 10	Striping over the member RAID 1 volumes. RAID 10 allows two hard drives fails or unplugging, but at different arrays.
RAID 30	Striping over the member RAID 3 volumes. RAID 30 allows two hard drives fails or unplugging, but at different arrays.

RAID 50	Striping over the member RAID 5 volumes. RAID 50 allows two hard drives fails or unplugging, but at different arrays.
RAID 60	Striping over the member RAID 6 volumes. RAID 40 allows four hard drives fails or unplugging, but each two at different arrays.
JBOD	The abbreviation of “ J ust a B unch O f D isks”. No protection of data. VG fails if any hard drive fails or unplugs.

4.2 VG migration and expansion

To migrate the RAID level, please follow the below procedures. If the VG migrates to the same RAID level of the original VG, it is 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 which shows if the HDD is not enough to support the new RAID level, click “” to increase hard drives, then click “” to go back to setup page. When doing migration to lower RAID level, such as the original RAID level is RAID 6 and user wants to migrate to RAID 0, the controller will evaluate this operation is safe or not, and display “**Sure to migrate to a lower protection array?**” to give user warning.
4. Double check the setting of RAID level and RAID PD slot. If no problem, click “”.
5. Finally a confirmation page shows detail RAID info. If no problem, click “” to start migration. Controller also pops up a message of “**Warning: power lost during migration may cause damage of data!**” to give user warning. When the power is abnormally off during migration, the data is in high risk.
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 displays an “**M**” in “**Status 4**” and complete percentage of migration in “**R%**”.

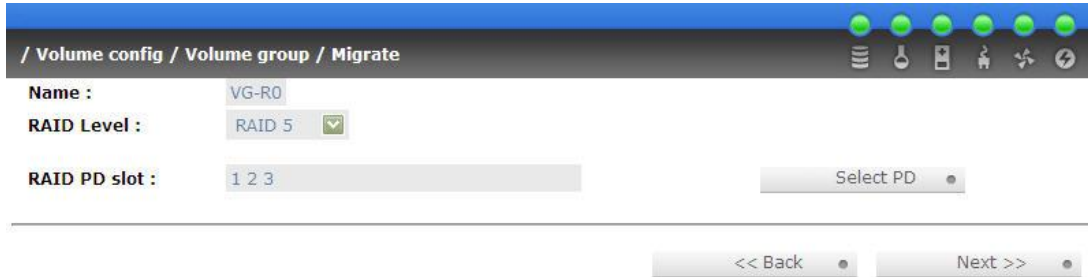


Figure 4.2.1

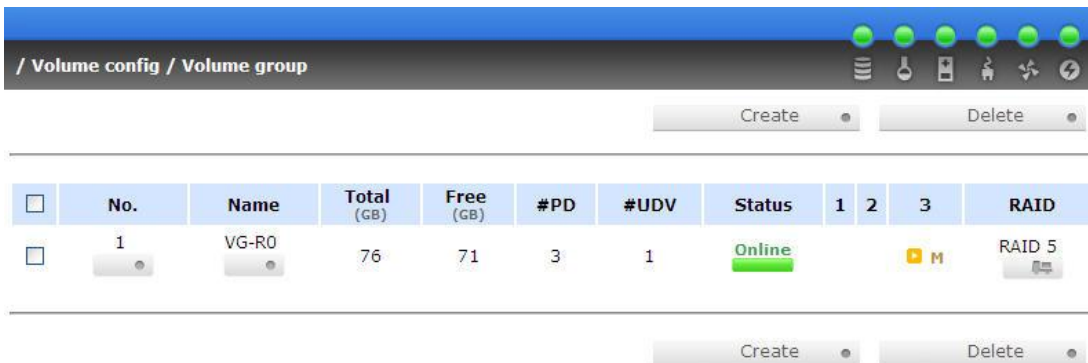


Figure 4.2.2

(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 12%.)



Tips

To do 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.

During setting migration, if user doesn't setup correctly, controller will pop up warning messages. Below is the detail of messages.

"Invalid VG ID": Source VG is invalid.

"Degrade VG not allowed": Source VG is degraded.

"Initializing/rebuilding operation's going": Source VG is initializing or rebuilding.

"Migration operation's going": Source VG is already in migration.

"Invalid VG raidcell parameter": Invalid configuration. E.g., New VG's capacity < Old VG's capacity, New VG's stripe size < Old VG's stripe size. Or New VG's configuration == Old VG's configuration.

"Invalid PD capacity": New VG's minimum PD capacity < Old VG's minimum PD capacity.



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 be larger than the original, then click " " to start extension.
4. Extension starts. If UDV needs initialization, it will display an **"I"** in **"Status 3"** and complete percentage of initialization in **"R%"**.



Figure 4.3.1

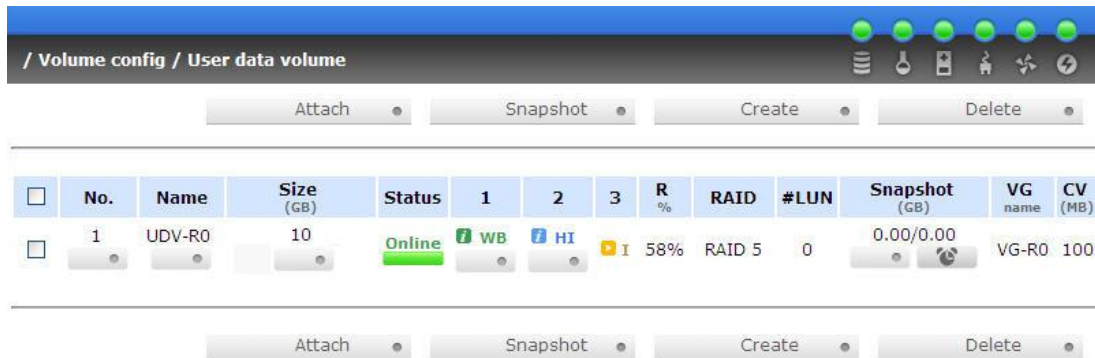




Figure 4.3.2

(Figure 4.3.2: Extend UDV-R0 from 5GB to 10GB.)



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

IS16GL Snapshot-on-the-box captures the instant state of data in the target volume in a logical sense. The underlying logic is Copy-on-Write -- moving out the to-be-written data to certain location whenever a write action occurs since the time of data capture. The certain location, named as **snap UDV**, is essentially a new UDV, which can be attached to a LUN thus provisioned to a host as a disk just like other ordinary UDVs in the system. **Rollback** function restores the data back to the state of any point in time previously captured for whatever

unfortunate reason it might be (e.g. virus attack, data corruption, human errors and so on). Snap UDV is allocated within the same VG in which the snapshot is taken, we suggest to reserve **20%** of VG size or more for snapshot space. Please refer to Figure 4.4.1 for snapshot concept.

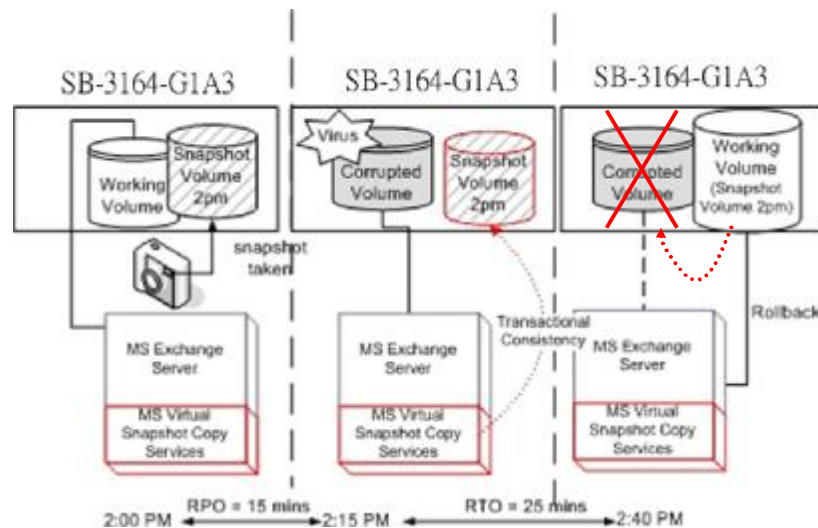



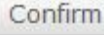
Figure 4.4.1



Caution
 Snapshot /rollback features need **512MB** RAM at least. Please also refer to 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 do snapshot by clicking the blue square button “” in the “**Snapshot (GB)**” column, it will direct to a setup page. The maximum snapshot space is 2TB which user can setup the space no bigger than 2048GB.
3. Set up the size for snapshot. The size is suggested to be **20%** of UDV size at least, then click “”. It will go back to the UDV page and the size will show in snapshot column. It may not be the same as the number entered because some is reserved for snapshot internal usage. There will be 2 numbers in “**Snapshot (GB)**” 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 snapshot UDV is created with the date and time taken snapshot of the chosen UDV. The snapshot UDV size is the same as the chosen UDV no matter the actual snapshot UDV data occupies.
6. Attach LUN to UDV, please refer to section 3.6.6 Logical unit number for more detail.
7. Done. It can be used as a disk.

<input type="checkbox"/>	No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	Snapshot (GB)	VG name	CV (MB)
<input type="checkbox"/>	1	UDV-R0	10	Online	WB	HI			RAID 0	1	10.00/10.00	VG-R0	100
<input type="checkbox"/>	2	UDV-R-1713	10	Online	RO	HI			RAID 0	0	02/14 17:13:35	VG-R0	100

Figure 4.4.1.1


(Figure 4.4.1.1: No.1 is a RAID 0 UDV. Set snapshot space to 10GB. And now its space is free to snapshot. No.2 is a snap UDV taken on 02/14 17:13:35.)

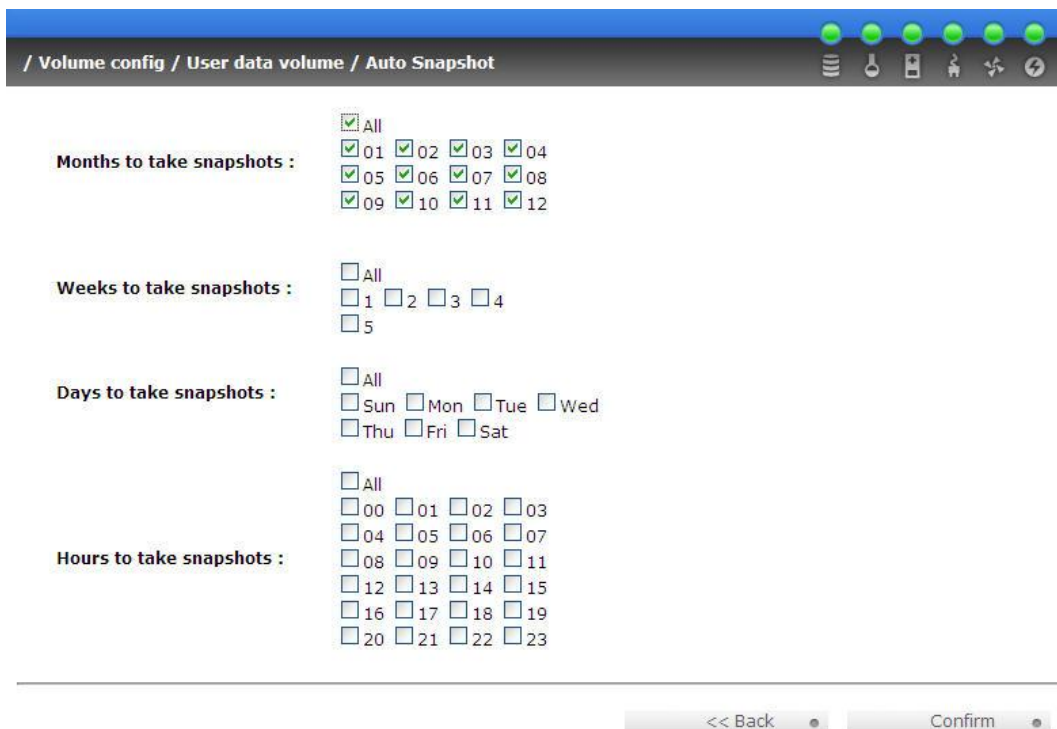
Snapshot has some constraints as the following:

1. Minimum RAM size of enabling snapshot function is **512MB**.
2. For performance concern and future rollback, the system saves snapshot with names in sequences. For example: three snapshots has been taken and named “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, controller will send a warning message about space full and the new taken snapshot will replace the oldest snapshot by rotation sequence.
5. Snap UDV cannot be migrated, when doing 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 or 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 (GB)**” column to set auto snapshot .
4. The auto snapshot can be set at the period of monthly, weekly, daily, or hourly.
5. Done. It will take snapshots automatically.



/ Volume config / User data volume / Auto Snapshot

All
Months to take snapshots :
 01 02 03 04
 05 06 07 08
 09 10 11 12

All
Weeks to take snapshots :
 1 2 3 4
 5


All
Days to take snapshots :
 Sun Mon Tue Wed
 Thu Fri Sat

All
Hours to take snapshots :
 00 01 02 03
 04 05 06 07
 08 09 10 11
 12 13 14 15
 16 17 18 19
 20 21 22 23

<< Back Confirm

Figure 4.4.2.1


(Figure 4.4.2.1: It will take snapshots every month, and keep the last 32 snapshot copies.)



Tips
Daily snapshot will be taken at every 00:00. Weekly snapshot will be taken on every Sunday 00:00. Monthly snapshot will be taken on every first day of month 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 (GB)**” column to rollback the data, which user can recover data to the time that snapshot is taken.

Rollback function has some constraints as described in the following:

1. Minimum RAM size of enabling rollback function is **512MB**.
2. When doing rollback, the original UDV cannot be accessed for a while. At the same time, the system connects original UDV and snap UDV, and then starts rollback.
3. During rollback data from snap UDV to original UDV, the original UDV can be accessed and the data in it just like it finished rollback. At the same time, the other related snap UDV(s) can 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 first. SB-3164-G1A3 also send pop-up message when user checks rollback function.

Roll back snapshot UDV now?

Please dismount the disk in the host side first.





4.5 QCopy remote replication

IS16GL QCopy service is to build a IS16GL proprietary replication mechanism for created UDVs. It will copy the logical user volume data exactly to the remote place. The QCopy is built-in service without any host-based application for the data replication and it has easy configuration setup from management UIs. The first QCopy version on IS16GL FW V2.2.0 supports copy from one snapshot UDVs of the source device to the remote target device.

QCopy V2.2.0 supports 2 copying tasks in the system which user can setup QCopy to 2 snapshot UDV for replication in the same time. The target device

capacity needs to be greater or equal to the source capacity. (The target UDV capacity is equal or larger than the source UDV capacity.)

To do a QCopy task, please follow the below steps:

1. Take snapshot on the source UDV, for detail setup steps of snapshot, please refer to section 4.4.1. When setup UDV block size, please set 512B for the block size. The QCopy now supports 512B block size only.
2. Click QCopy icon “” on the selected snapshot UDV
3. Input the remote iSCSI target IP, Click “”, and wait for a while, when webui receives the target UDV information and corresponding LUN
4. Select remote target LUN of the target UDV which is for QCopy, Click “”, then there will be a pop-up window to ask user to dismount the target UDV from host/server first. This dismount step is to avoid any data inconsistency from others. After the target UDV is dismounted from host/server, then click “Yes” for confirmation.
5. When the QCopy is processing data, on the \\Volume config\User data volume status column, there will be an indicator “ P” for QCopy and completed percentage.
6. The source system will issue one “INFO” event describes the replication setting. E.g., INFO:Wed, 28 Mar 2007 17:23:55 CST Qcopy start, Target `iqn.2004-08.tw.com.proware:iS16GL-000a00021:default-target`, IP 192.168.10.187 ,Type Duplicate.
7. If the replication has been completed successfully, the source system will issue one “INFO” event describes the replication started at what time and completed at what time.
8. The source system will try to reconnect the target system when there is any network error or unstable transferring. And if the replication has been stopped for some interrupts, the source system will issue one “WARNING” event describes the possibility of the interrupts to stop the replication. The possibility to stop the replication may be “network link failure”, “the target system not reachable”, “connection fail”, and etc.
9. When the causes to the interrupts have been removed, the users can manually activate the QCopy replication again to restart the replication work. The source system will issue one “INFO” event describes the replication has been resumed.

When the QCopy is completed, user can delete the LUN of the target UDV for avoiding wrong operation or deleting data. When recovery is needed, the operation steps are the same as replication steps, user only needs to setup the QCopy service from target system reversely.



Figure 4.5.1

(Figure 4.5.1: setup QCopy on selected snapshot UDV)

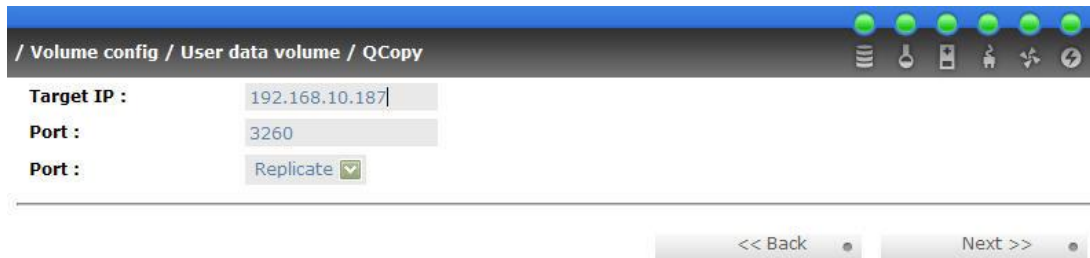


Figure 4.5.2

(Figure 4.5.2: input the target system data port IP address)

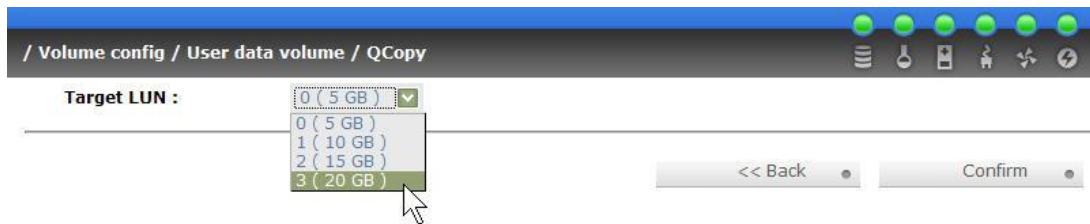


Figure 4.5.3

(Figure 4.5.3: select the target UDV LUN, the target UDV capacity must be equal or larger than the source UDV capacity.)



Figure 4.5.4

(Figure 4.5.4: click OK after the target UDV is dismounted from host/server.)



Figure 4.5.5

(Figure 4.5.5: QCopy is copying, and the completed percentage it 24%)

Tips

When setup block size for UDV, please setup **512B** for QCopy. In the current design, QCopy supports **512B block size** only for both source and target side.



Caution

Before executing QCopy, it is better to dismount target file system for avoiding any inconsistent data IO. SB-3164-G1A3 controller also send pop-up message when user checks QCopy function.

Sure to QCopy?

Replicate [snapshot UDV name] (source UDV capacity) to [target system data port IP address:3260] LUN: [number] (target UDV capacity)



Tips

If QCopy access control is needed on the target system when user doesn't want any other system connecting to this target UDV, user can setup source system's node name to target UDV LUN. Please go to source system \iscsi config\Entity property\, find the entity name (node name) and add **:refinitiator.001** after entity name for target UDV LUN. **The QCopy Node Name is displayed in \Volume config\ User data volume page.** E.g., the source system entity name (node name) is `iqn.2004-08.tw.com.proware:sb-3164-g1a3-000a0001f`. Then this source system's QCopy node name is as follows:

iqn.2004-08.tw.com.proware:sb-3164-g1a3-000a0001f:refinitiator.001

You may wonder why QCopy node name is different from the node name you see from host/server iscsi initiator. (e.g., `iqn.2004-08.tw.com.proware:sb-3164-g1a3-000a0001f:default-target`.) When doing QCopy, the source system is acting like a host/server copying its data to target system. The source system is not a "disk device" in QCopy, so, the node name is different for distinguishing QCopy to "disk device".

4.6 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 together. The configuration of both VG and UDV will be kept but LUN configuration will be cleared to avoid conflict with system-2.

4.7 Support Microsoft MPIO and MC/S

MPIO (Multi-Path Input/Output) and MC/S (Multiple Connections per Session) both use multiple physical paths to create logical "paths" between the server and the storage device. In the case which one or more of these components fails, causing the path to fail, multi-path 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 **IS16GL**.
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.

For detailed setup steps, please refer to Appendix F: MPIO and MC/S setup instructions. MC/S setup steps are very similar to MPIO, please also refer to Appendix: F.

Appendix

A. Certification list

- **RAM**

RAM Spec: 184pins, DDR333(PC2700), Reg.(register) or UB(Unbuffered), ECC or Non-ECC, from 64MB to 1GB, 32-bit or 64-bit data bus width, x8 or x16 devices, 9 to 11 bits column address.


Vendor	Model
Unigen	UG732D6688KN-DH, 256MB DDR333 (UNBUFFERED) with Hynix
Unigen	UG732D6688KS-DH, 256MB DDR333 (UNBUFFERED, LOW PROFILE) with Hynix
Unigen	UG732D7588KZ-DH, 256MB DDR333 (REG, ECC) with Elpida
Unigen	UG764D6688LS-DH, 512MB DDR333 (UNBUFFERED, LOW PROFILE) with Hynix
Unigen	UG764D7588KZ-DH, 512MB DDR333 (REG, ECC) with Elpida
Unigen	UG7128D7588LZ-DH, 1GB DDR333 (REG, ECC) with Hynix
Unigen	UG7128D7488LN-GJF, 1GB DDR400 (ECC) with Hynix
Unigen	UG7128D7588LZ-GJF, 1GB DDR400 (ECC, REG) with Elpida
Unigen	UG7128D7588LZ-GJF, 1GB DDR400 (ECC, REG) with Hynix
Unigen	UG718D6688LN-GJF, 1GB DDR400 (Non-ECC) with Hynix
Unigen	UG718D688LN-GJF, 1GB DDR400 (Non-ECC) with Elpida
ATP	AG28L72T8SHC4S, 1GB DDR400 (ECC) with Samsung
ATP	AG28L64T8SHC4S, 1GB DDR400 (Non-ECC) with Samsung
ATP	AG64L72T8SQC4S, 512MB DDR400 (ECC) with Samsung

- **iSCSI Initiator (Software)**

OS	Software/Release Number
Microsoft Windows	Microsoft iSCSI Software Initiator Version 2.03 System Requirements: 1. Windows XP Professional with SP2 2. Windows 2000 Server with SP4 3. Windows Server 2003 with SP1 4. Windows Server 2003 R2
Linux	The iSCSI Initiators are different for different Linux Kernels. 1. For Redhat Linux 9 (Kernel 2.4), install linux-iscsi-3.6.3.tar 2. For Red Hat Enterprise Linux 3 (Kernel 2.4), install linux-iscsi-3.6.3.tar 3. For Red Hat Enterprise Linux 4 (Kernel 2.6), use the build-in iSCSI initiator in kernel 2.6.9-34.Elsmp
Mac	ATTO XTEND 2.0x SAN / Mac iSCSI Initiator

	System Requirements: Mac® OS X v10.3.5 or later
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For ATTO initiator, it is not free. Please contact your local distributor for ATTO initiator.




Tips

Please check “OS_HBA_Initiator List.pdf” for the latest update and detail information of iSCSI initiator.

- **iSCSI HBA card**

Vendor	Model
Adaptec	7211C (Gigabit, 1 port, TCP/IP offload, iSCSI offload)
QLogic	QLA4010C (Gigabit, 1 port, TCP/IP offload, iSCSI offload)
Qlogic	QLA4052C (Gigabit, 2 port, TCP/IP offload, iSCSI offload)

For detailed setup steps of Qlogic QLA4010C, please refer to Appendix G: QLogic QLA4010C setup instructions.



Tips

Please check “OS_HBA_Initiator List.pdf” for the latest update and detail information of iSCSI HBA Bios version and driver version..

- **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)

- **GbE Switch**

Vendor	Model
Dell	PowerConnect 5324
Dell	PowerConnect 2724
HP	ProCurve 1800-24G

- **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
Hitachi	Deskstar 7K80, HDS728040PLA320, 40G, 7200RPM, SATA-II, 2M
Maxtor	DiamondMax Plus 9, 6Y080M0, 80G, 7200RPM, SATA, 8M
Maxtor	DiamondMax 11, 6H500F0, 500G, 7200RPM, SATA 3.0Gb/s, 16M
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 7200.8, ST3400832AS, 400G, 7200RPM, SATA, 8M, NCQ
Seagate	Barracuda 7200.9, ST3500641AS, 500G, 7200RPM, SATA-II, 16M
Seagate	NL35, ST3400633NS, 400G, 7200RPM, SATA 3Gb/s, 16M
Seagate	NL35, ST3500641NS, 500G, 7200RPM, SATA 3Gb/s, 16M
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: Disk <slot> S.M.A.R.T. threshold exceed condition occurred for attribute of <ol style="list-style-type: none"> 1. read error rate 2. spin up time 3. reallocated sector count 4. seek error rate 5. spin up retries 6. calibration retries
Warning	S.M.A.R.T. information	Warning: Disk <slot>: Failure to get S.M.A.R.T information

- **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 from <IP or serial console> via <Web UI or Console UI>.
Info	Admin Logout OK	Info: Admin logout from <IP or serial console> via <Web UI or Console UI>.
Info	iSCSI data port login	Info: iSCSI login from <IQN> (<IP:Port Number>) succeeds.
Warning	iSCSI data port login reject	Warning: iSCSI login from <IQN> (<IP:Port Number>) was rejected, reason of 1. initiator error 2. authentication failure 3. authorization failure 4. target not found 5. unsupported version 6. too many connections 7. missing parameter 8. session does not exist 9. target error 10. out of resources 11. unknown
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.
Info	UPS Detection OK	Info: UPS detection succeed
Warning	UPS Detection Fail	Warning: UPS detection failed
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.
Error	PD configuration	Error: PD <slot> lba <#> length <#> config

	read/write error	<read write> failed.
Error	PD read/write error	Error: PD <#> lba <#> length <#> <read write> error.
Error	UDV recoverable read/write error	Error: UDV <name> stripe <#> PD <#> lba <#> length <#> <read write> recoverable
Error	UDV unrecoverable read/write error	Error: UDV <#> stripe <#> PD <#> lba <#> length <#> <read write> unrecoverable
Info	UDV stripe rewrite start/fail/succeed	Info: UDV <name> stripe <#> rewrite column bitmap <BITMAP> <started failed finished>.

- **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> 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.

- **QCopy events**

Level	Type	Description
Info	QCopy Starts	Info: QCopy start, Target <node name>, IP x.x.x.x ,Type Duplicate
Info	QCopy Restarts	Info: QCopy restart, Target <node name>, IP x.x.x.x,Type Duplicate
Warning	QCopy Connection Down	Warning: QCopy connection fail
Warning	QCopy Connection Retry	Warning: QCopy task was aborted
Warning	QCopy Task Setting	Warning: QCopy task was aborted. reason :UDV LBA block size ONLY support 512 bytes

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.

D. Microsoft iSCSI Initiator

Here is the step by step to setup Microsoft iSCSI Initiator. Please visit Microsoft website for latest iSCSI initiator. The following setup may not use the latest Microsoft iSCSI initiator.

1. Run Microsoft iSCSI Initiator version 2.03. Please see Figure D.1.
2. Click **“Discovery”**.

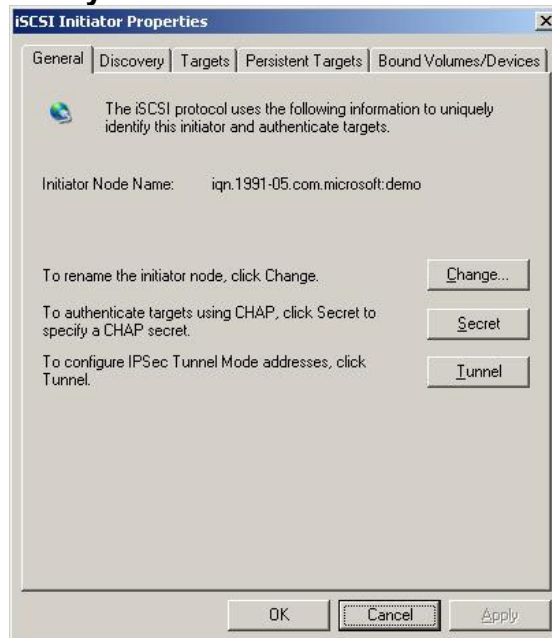


Figure D.1

3. Click **“Add”**. Input IP address or DNS name of iSCSI storage device. Please see Figure D.2.

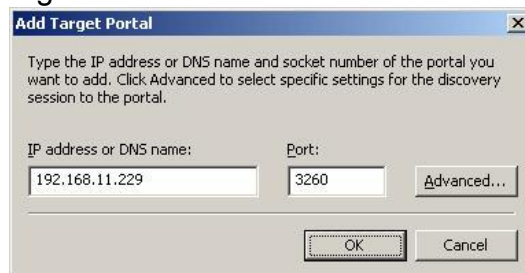


Figure D.2

- Click **“OK”**. Please see Figure D.3.

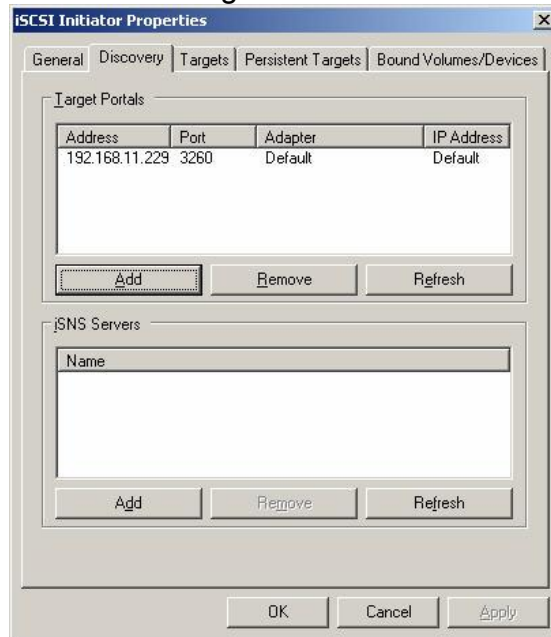


Figure D.3

- Click **“Targets”**. Please see Figure D.4.

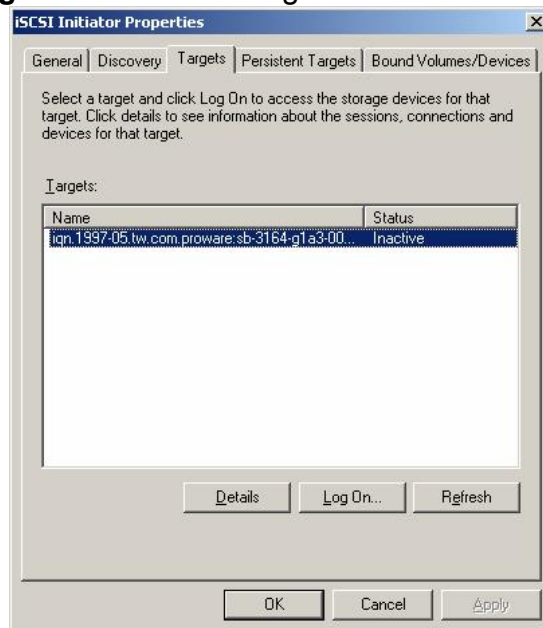


Figure D.4

- 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.

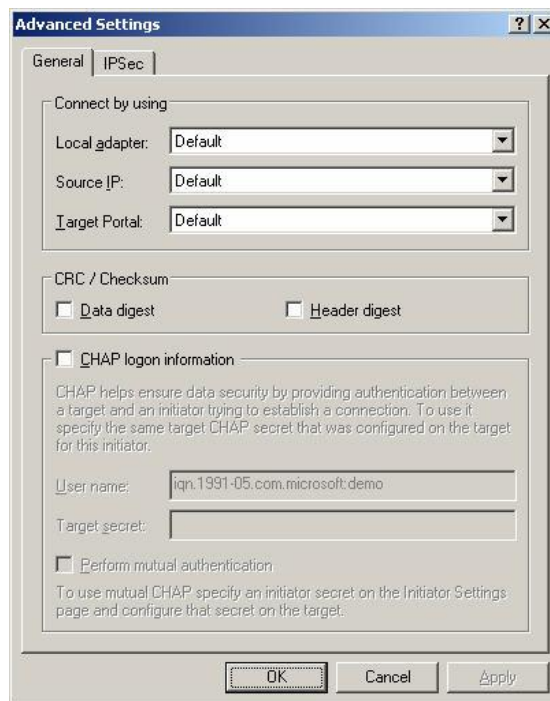


Figure D.6

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

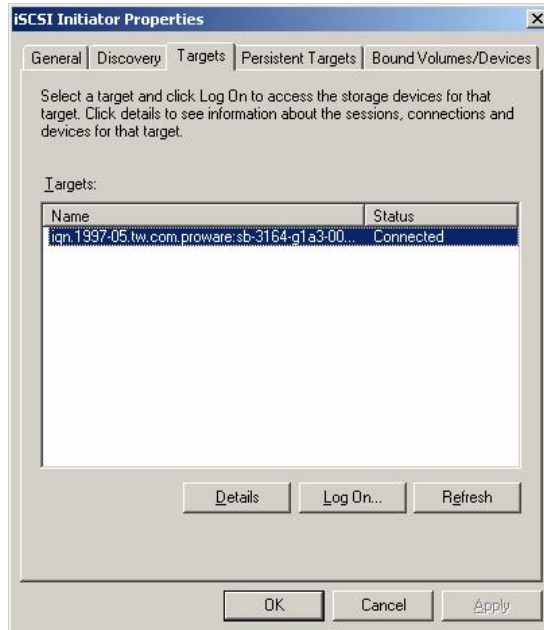


Figure D.7

The following procedure is to log off iSCSI device.

A. Click “**Details**”. Please see Figure D.8.

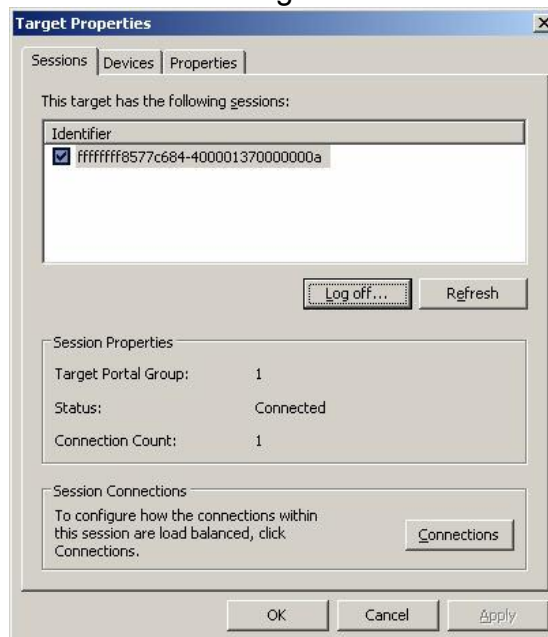


Figure D.8

- B. Check the Identifier, which will be deleted.
- C. Click “**Log off**”.
- D. Done, the iSCSI device log off successfully.

E. Trunking/LACP setup instructions

Here is the step by step to setup Trunking and LACP. There are 2 kinds of scenarios for Trunking/LACP. Please see Figure E.1.

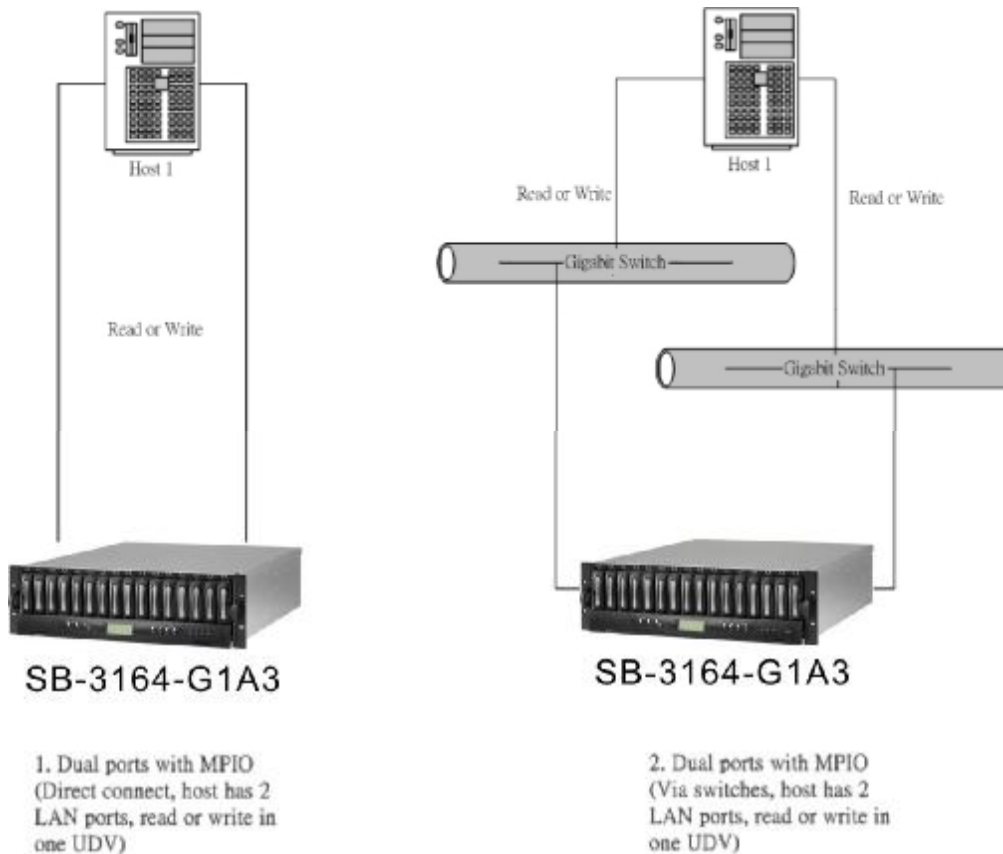


Figure E.1 Network diagram of Trunking/LACP.

The setup instructions are in the following figures.

- Create a VG with RAID 5, using 3 HDDs.



Figure E.2

- Create a UDV by using the RAID 5 VG.

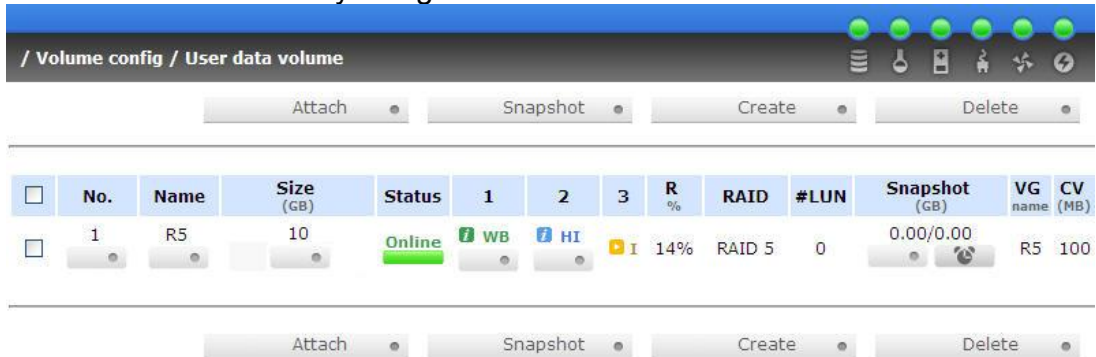


Figure E.3

- Run Microsoft iSCSI initiator 2.03 and check the **Initiator Node Name**.

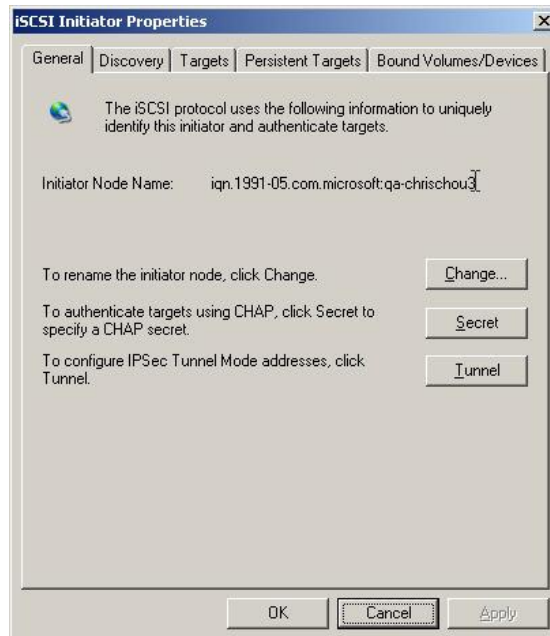


Figure E.4

- Attaching LUN to R5 UDV. Input the **Initiator Node Name** in the **Host** field.

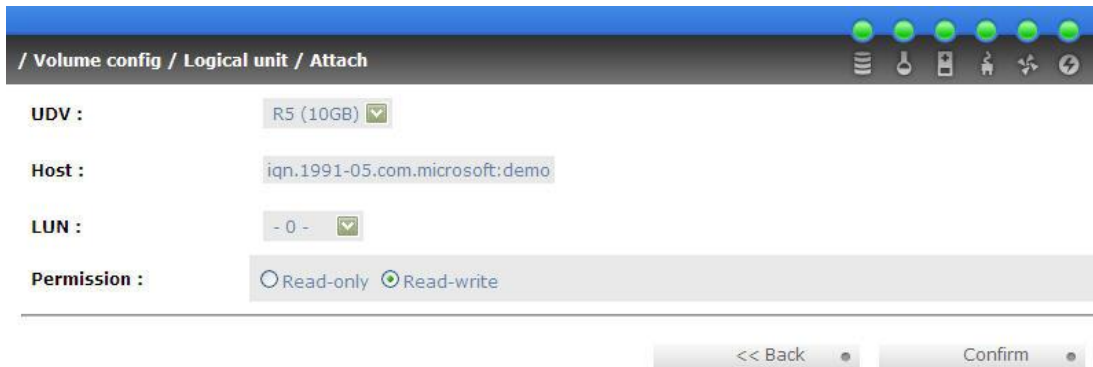


Figure E.5

- Done, please check the settings.

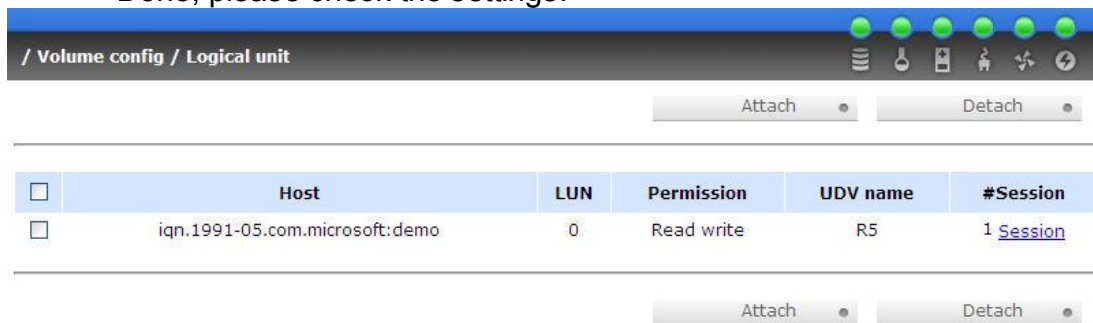


Figure E.6

- Check iSCSI settings. The IP address of iSCSI data port 1 is 192.168.11.229. Using port 1 as Trunking or LACP. Click the blue square in “Aggregation” field to set Trunking or LACP.

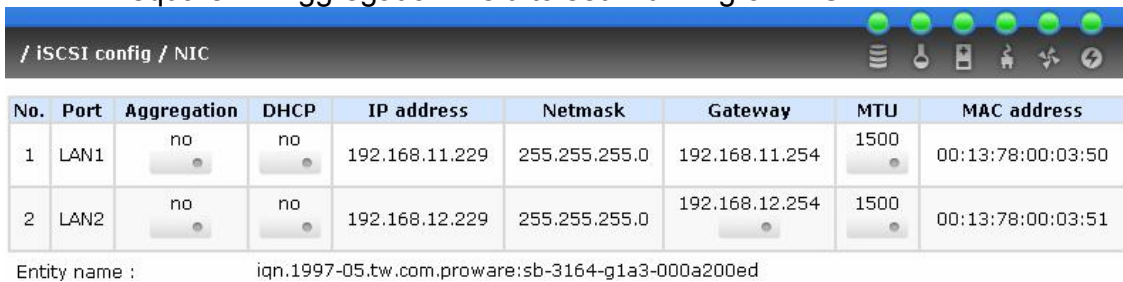


Figure E.7

- Select “Trunking”. If LACP is needed, please see Figure E.12.

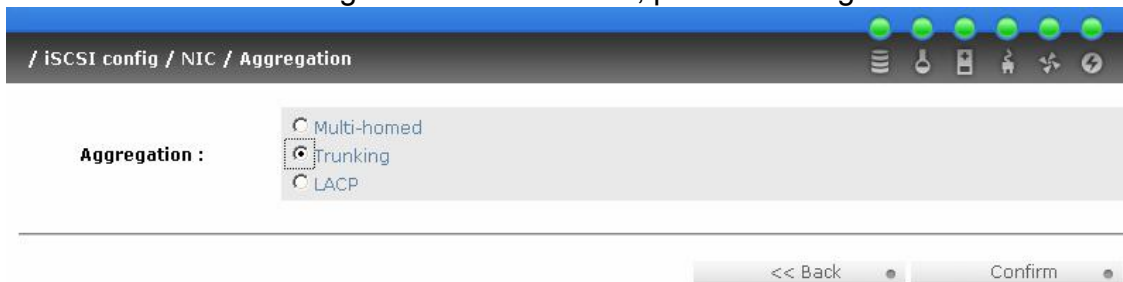


Figure E.8

- Now, the setting is in Trunking mode.

No.	Port	Aggregation	DHCP	IP address	Netmask	Gateway	MTU	MAC address
1	LAN(12)	Trunking	no	192.168.11.229	255.255.255.0	192.168.11.254	1500	00:13:78:00:03:50

Entity name : iqn.1997-05.tw.com.proware:sb-3164-g1a3-000a200ed

Figure E.9

- Enable switch Trunking function of port 21 and 23. Below is an example of Dell PowerConnect 5324. Go to Figure E.14 for next step.

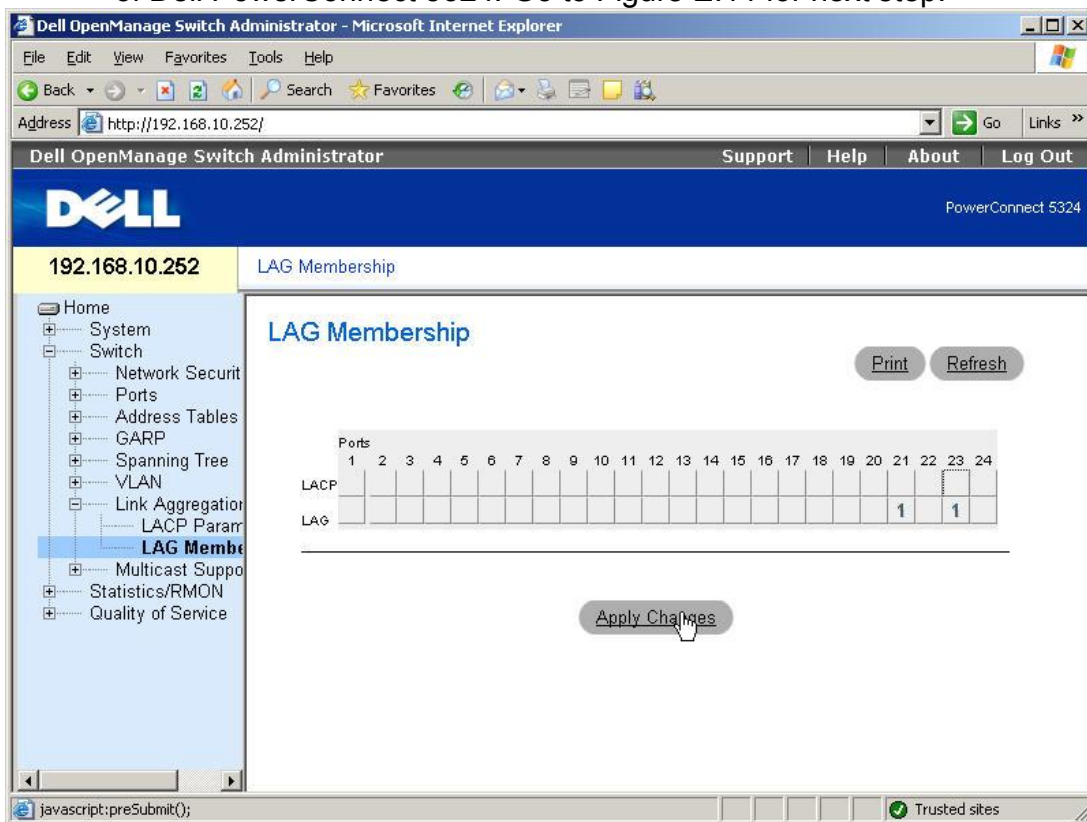


Figure E.10

- Select "LACP". If Trunking is needed, please see Figure E.8.

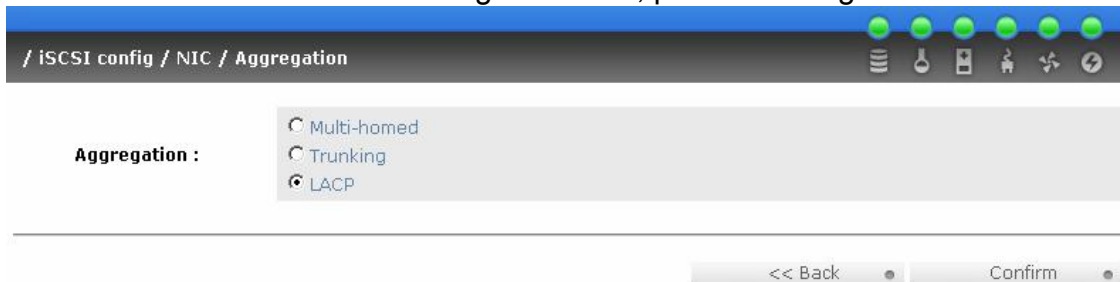


Figure E.11

- Now, the setting is LACP mode.

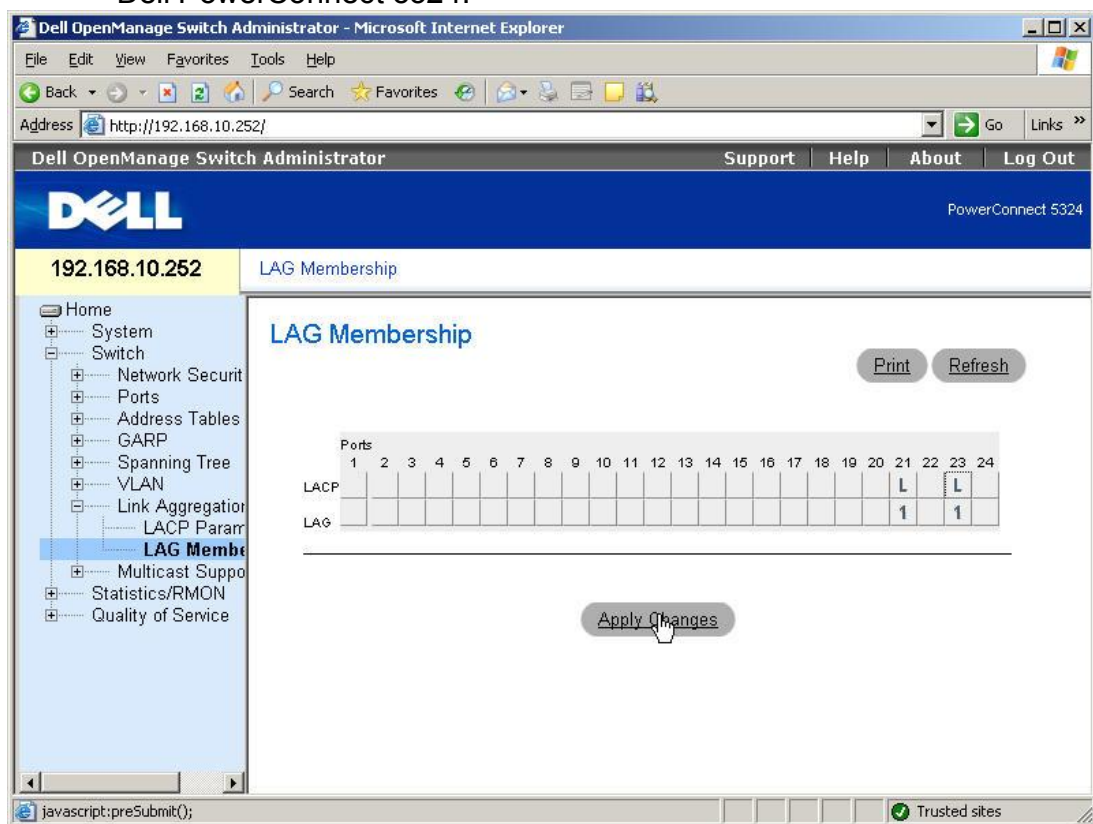


No.	Port	Aggregation	DHCP	IP address	Netmask	Gateway	MTU	MAC address
1	LAN(12)	LACP	no	192.168.11.229	255.255.255.0	192.168.11.254	1500	00:13:78:00:03:50

Entity name : iqn.1997-05.tw.com.proware:sb-3164-g1a3-000a200ed

Figure E.12

- Enable switch LACP function of port 21 and 23. Below is an example of Dell PowerConnect 5324.



The screenshot shows the Dell OpenManage Switch Administrator interface in a Microsoft Internet Explorer browser window. The address bar shows <http://192.168.10.252/>. The page title is "Dell OpenManage Switch Administrator" and the device is identified as "PowerConnect 5324".

The main content area is titled "LAG Membership" and displays a table for configuring LACP and LAG settings for 24 ports. The table has columns for ports 1 through 24 and rows for LACP and LAG. The LACP row shows 'L' in columns 21 and 23. The LAG row shows '1' in columns 21 and 23. There are "Print" and "Refresh" buttons above the table, and an "Apply Changes" button below it.

Ports	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
LACP																					L		L	
LAG																					1		1	

Figure E.13

- Add Target Portals in Microsoft iSCSI initiator 2.03.

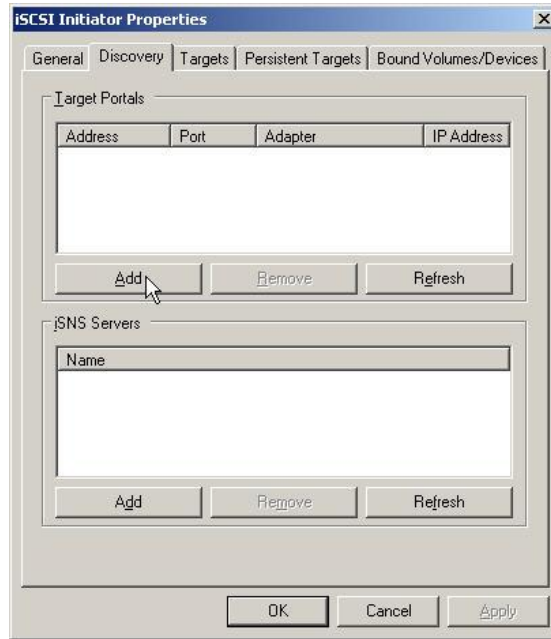


Figure E.14

- Input the IP address of iSCSI data port 1 (192.168.11.229 as mentioned in previous page).

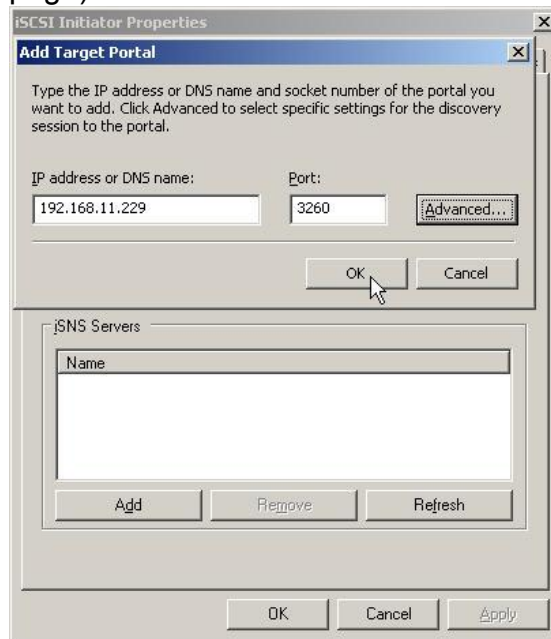


Figure E.15

- Click "Targets" to log on.

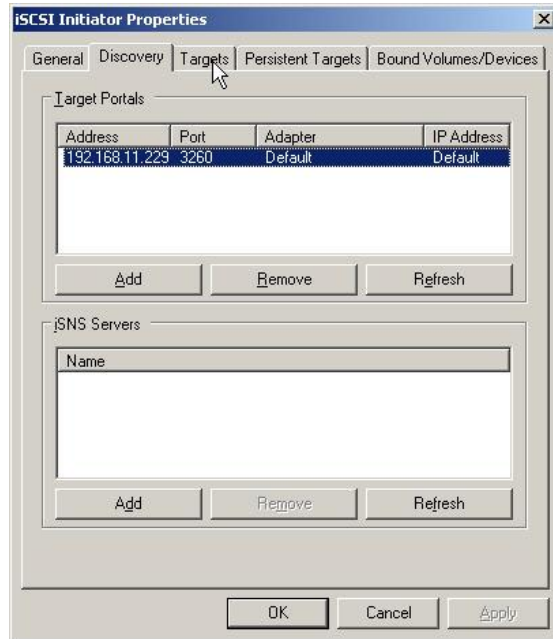


Figure E.16

- Log on.

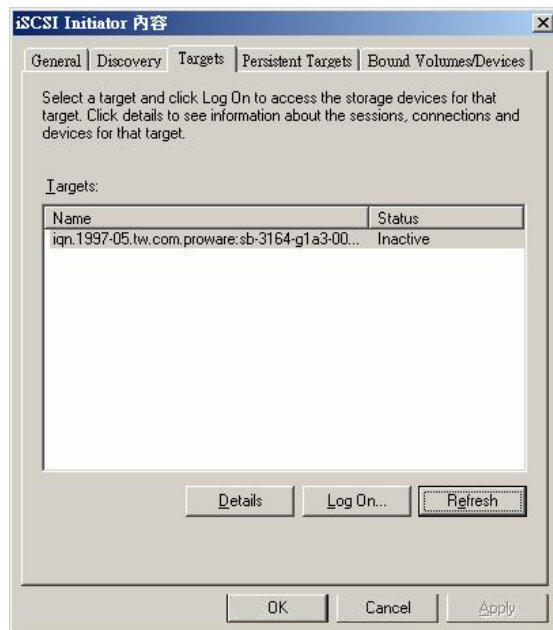


Figure E.17

- Click "Advanced".

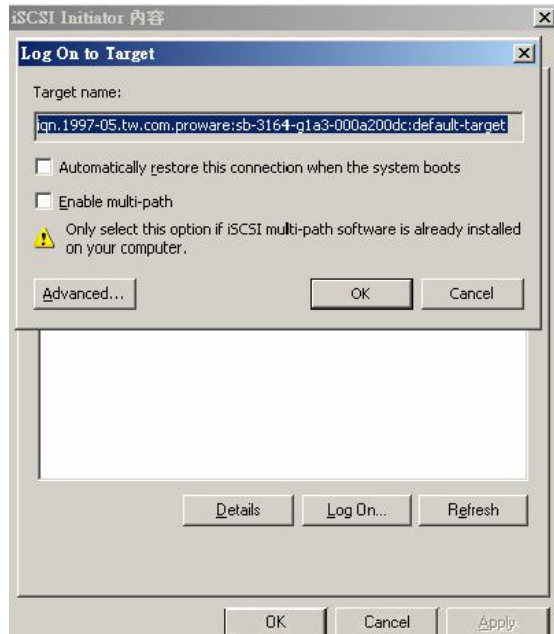


Figure E.18

- Select Target Portal to iSCSI data port 1 (192.168.11.229). Then click “OK”.

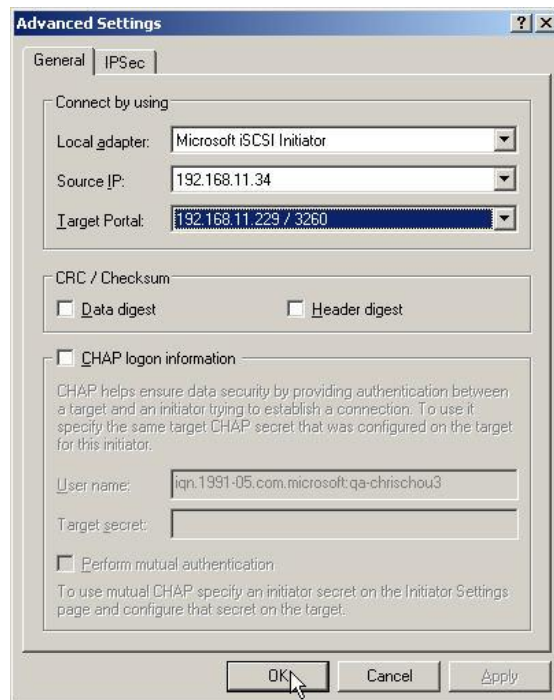


Figure E.19

- The setting is completed.

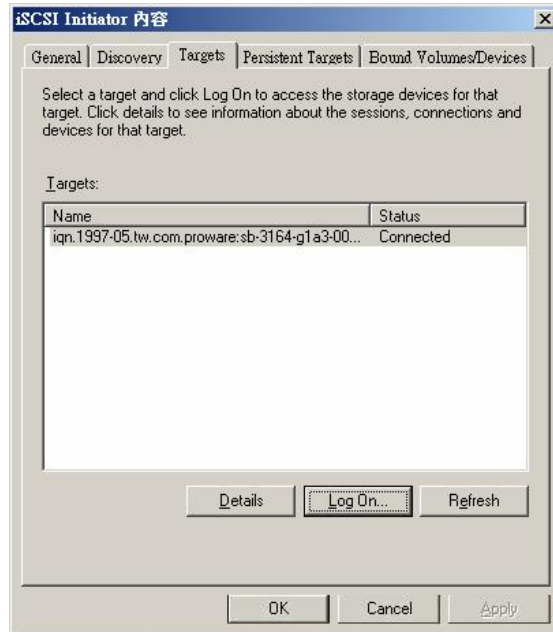


Figure E.20

- Run "Computer Management" in Windows. Make sure the disks are available. Then the disks can be tested for performance by IOMETER.

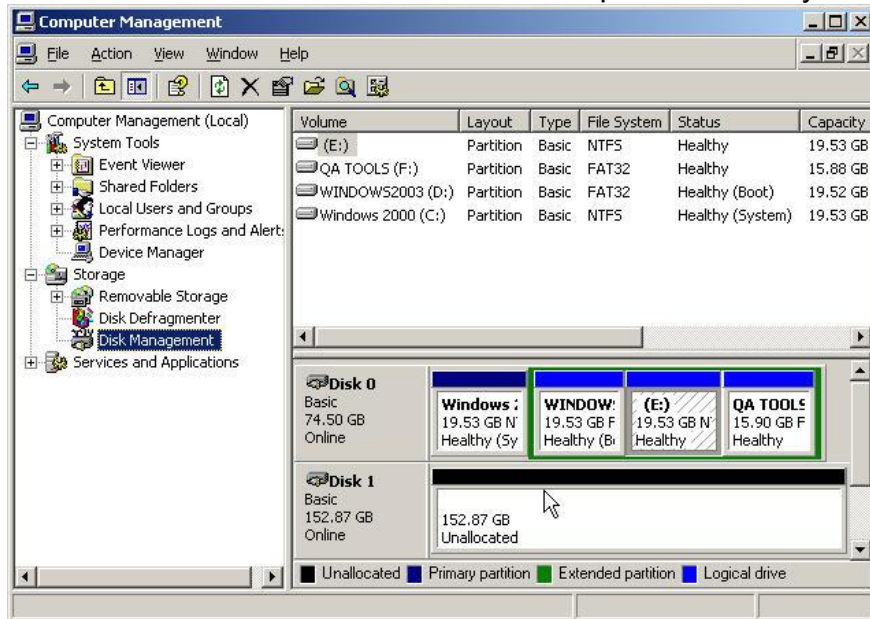


Figure E.21

F. MPIO and MC/S setup instructions

Here is the step by step to setup MPIO. There are 2 kinds of scenarios for MPIO. Please see Figure F.1. **IS16GL** suggests using scenario 2 for better performance.

- Network diagram of MPIO.

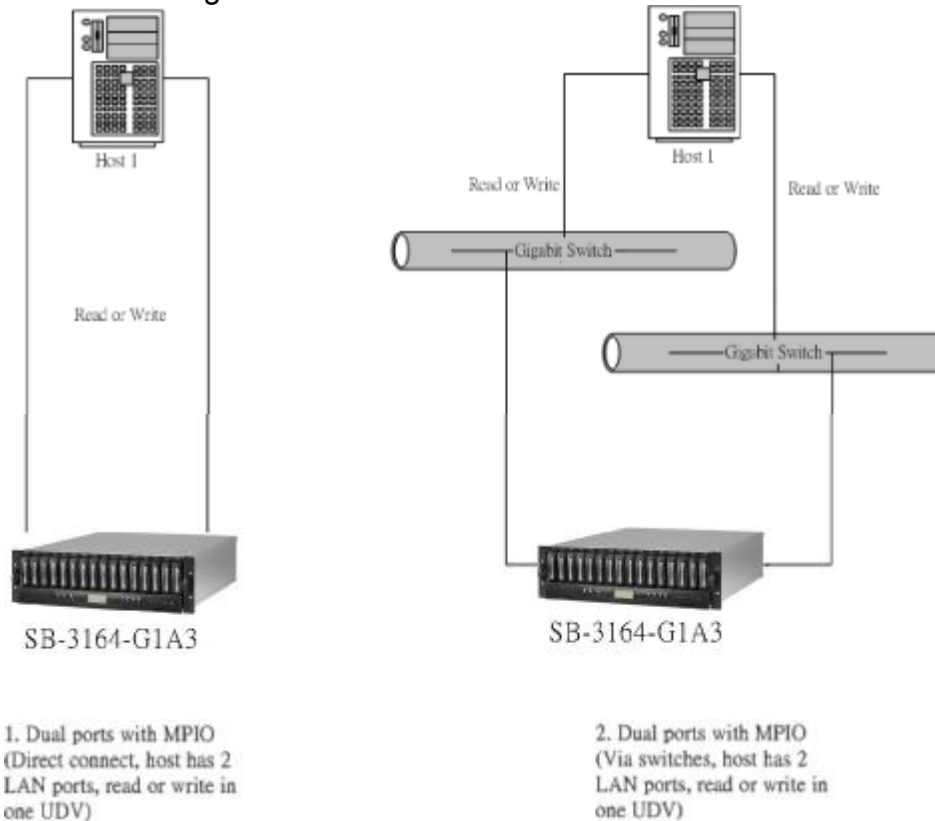


Figure F.1

The setup instructions are in the following figures.

- Create a VG with RAID 5, using 3 HDDs.

/ Volume config / Volume group

Create Delete

<input type="checkbox"/>	No.	Name	Total (GB)	Free (GB)	#PD	#UDV	Status	1	2	3	RAID
<input type="checkbox"/>	1	R5	76	76	3	0	Online				RAID 5

Create Delete

Figure F.2

- Create a UDV by using RAID 5 VG.

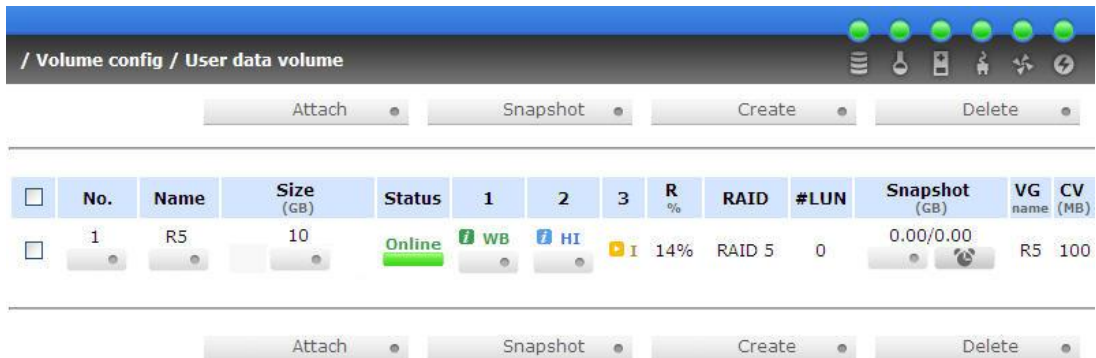


Figure F.3

- Run Microsoft iSCSI initiator 2.03 and check the **Initiator Node Name**.

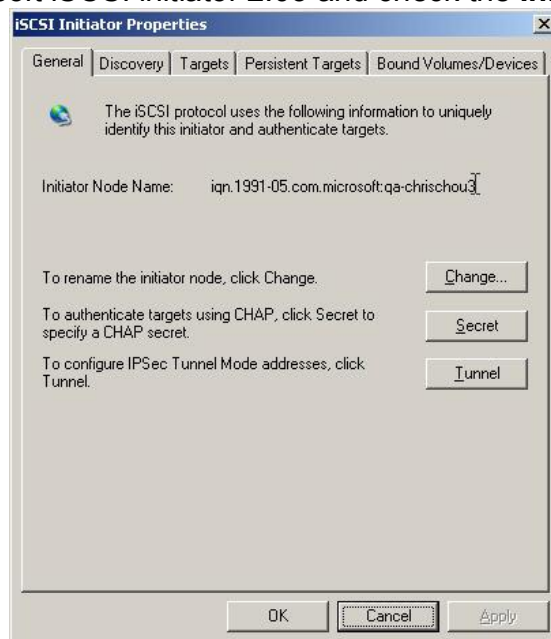


Figure F.4

- Attaching LUN to R5 UDV. Input the **Initiator Node Name** in **Host** field.

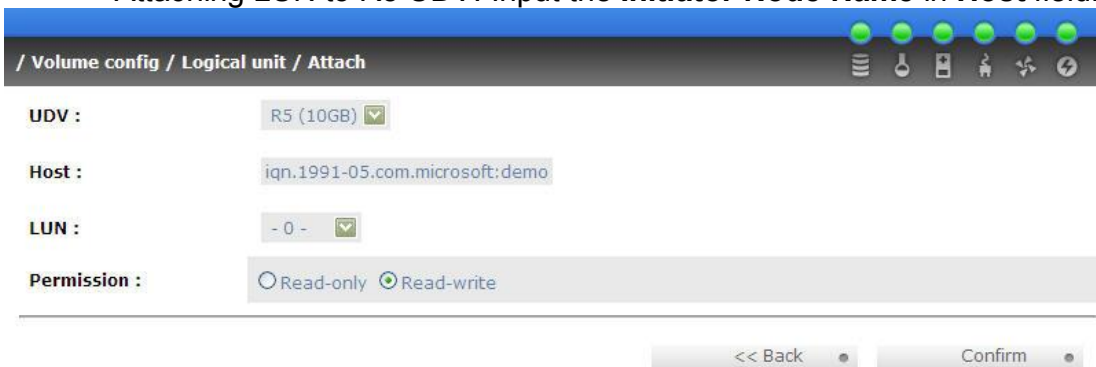


Figure F.5

- The volume config setting is done.



Figure F.6

- Check iSCSI settings. The IP address of iSCSI data port 1 is 192.168.11.229, port 2 is 192.168.12.229 for example.

No.	Port	Aggregation	DHCP	IP address	Netmask	Gateway	MTU	MAC address
1	LAN1	no	no	192.168.11.229	255.255.255.0	192.168.11.254	1500	00:13:78:00:03:50
2	LAN2	no	no	192.168.12.229	255.255.255.0		1500	00:13:78:00:03:51

Entity name : iqn.1997-05.tw.com.proware:sb-3164-g1a3-000a200ed

Figure F.7

- Add Target Portals on Microsoft iSCSI initiator 2.03.

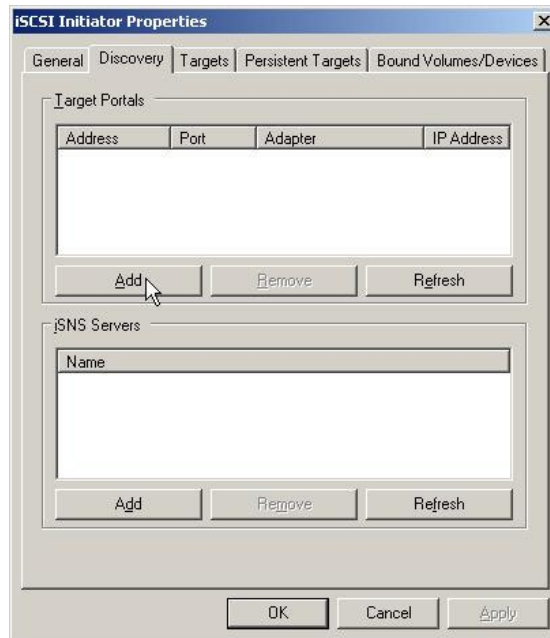


Figure F.8

- Input the IP address of iSCSI data port 1 (192.168.11.229 as mentioned in previous page).

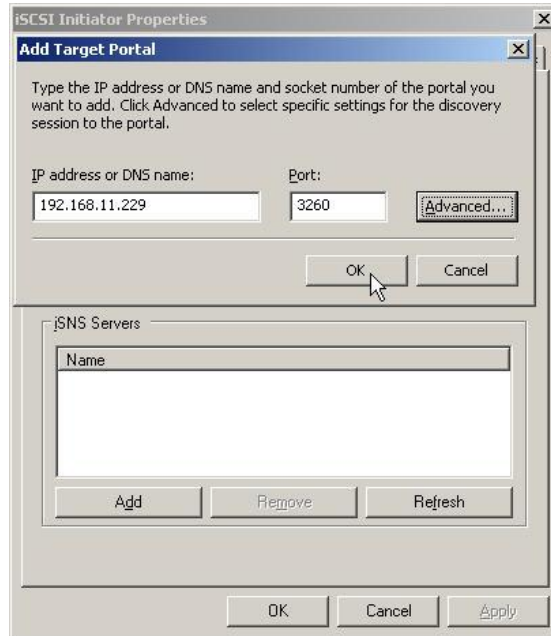


Figure F.9

- Add second Target Portals on Microsoft iSCSI initiator 2.03.

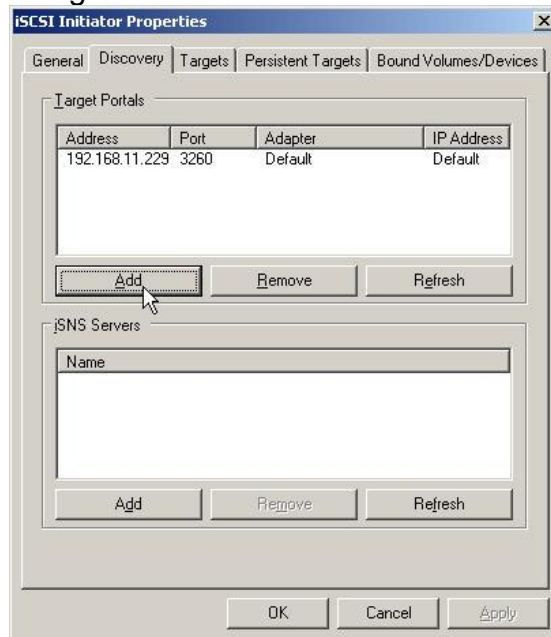


Figure F.10

- Input the IP address of iSCSI data port 2 (192.168.12.229 as mentioned in previous page).

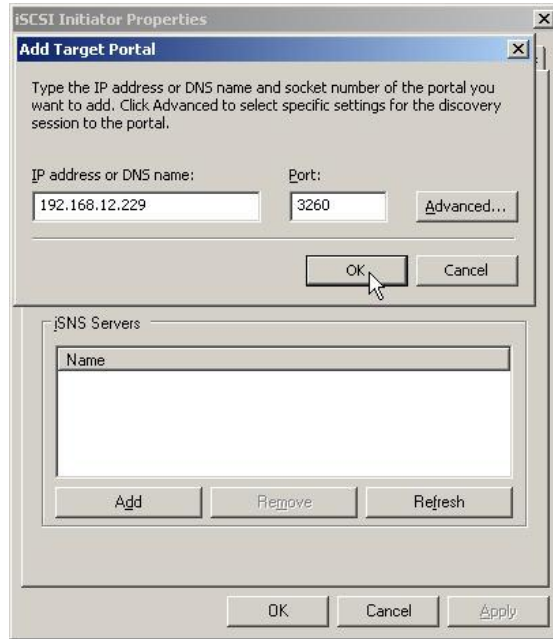


Figure F.11

- The initiator setting is done.

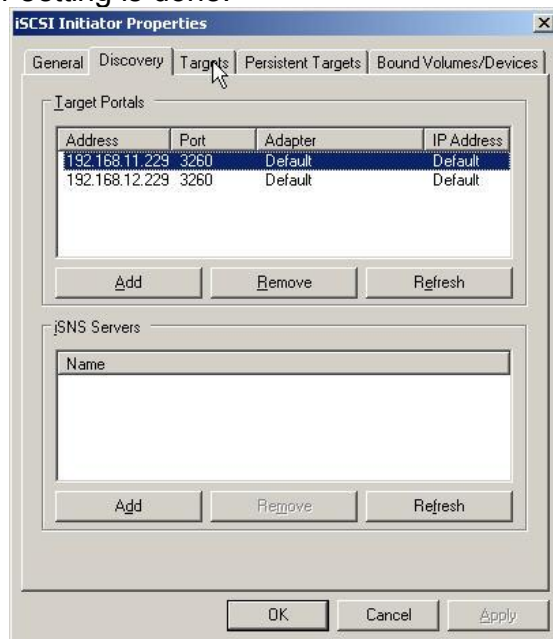


Figure F.12

- Log on.

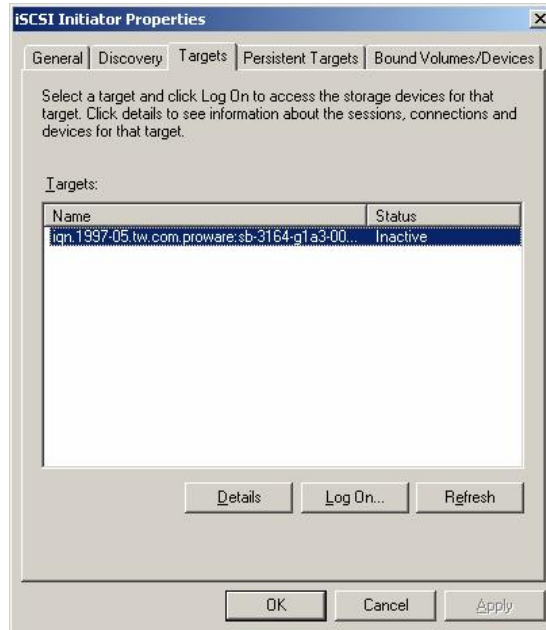


Figure F.13

- Enable “Enable multi-path” checkbox. Then click “Advanced”.



Figure F.14

- Select Target Portal to iSCSI data port 1 (192.168.11.229). Then click “OK”

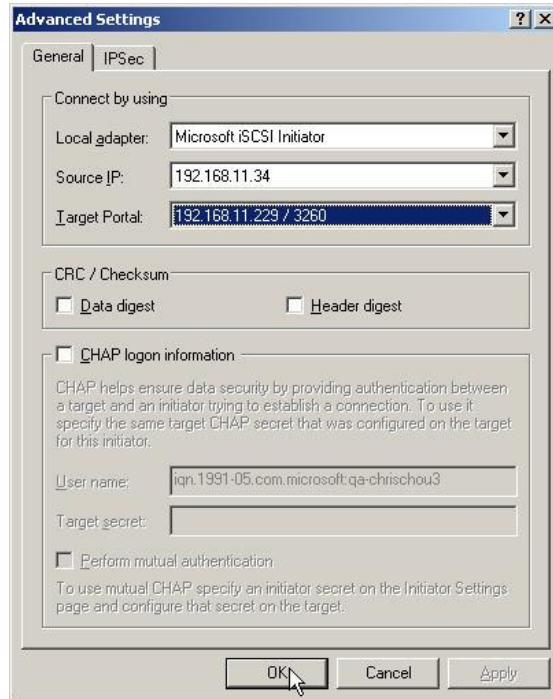


Figure F.15

- Log on again.

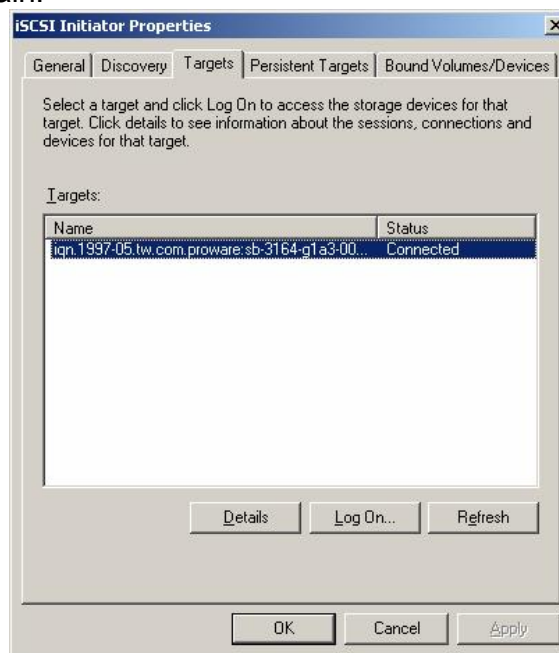


Figure F.16

- Enable “Enable multi-path” checkbox. Then click “Advanced”.

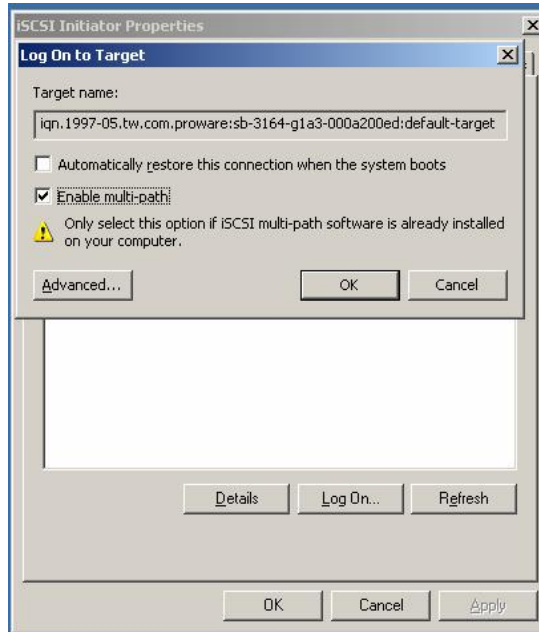


Figure F.17

- Select Target Portal to iSCSI data port 2 (192.168.12.229). Then select “OK”

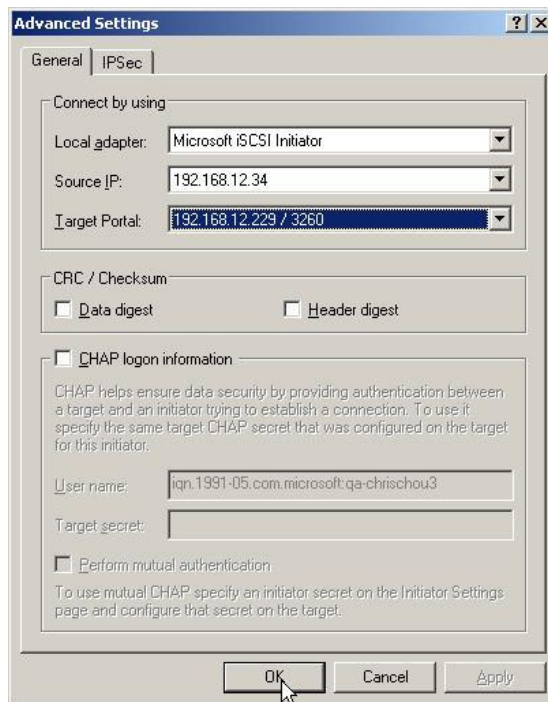


Figure F.18

- iSCSI device is connected. Click “Details”.

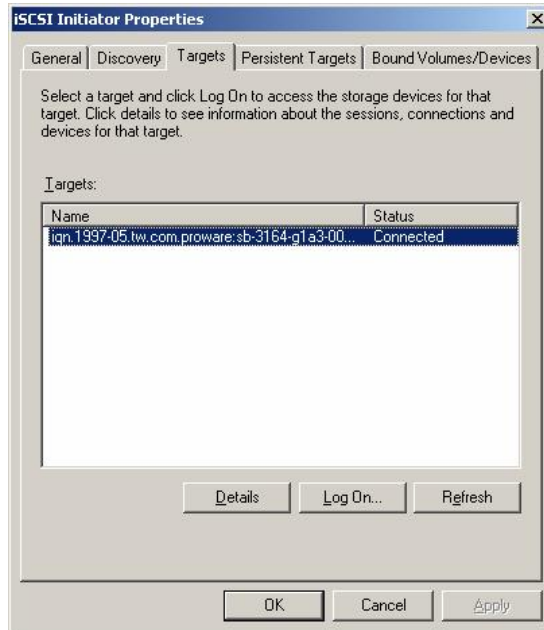


Figure F.19

- Click "Device" tab, then click "Advanced".

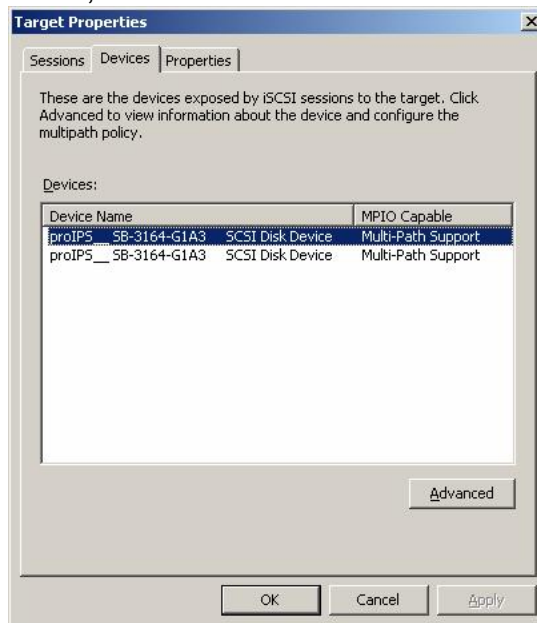


Figure F.20

- Click "MPIO" tab, select "Load Balance Policy" to "Round Robin".

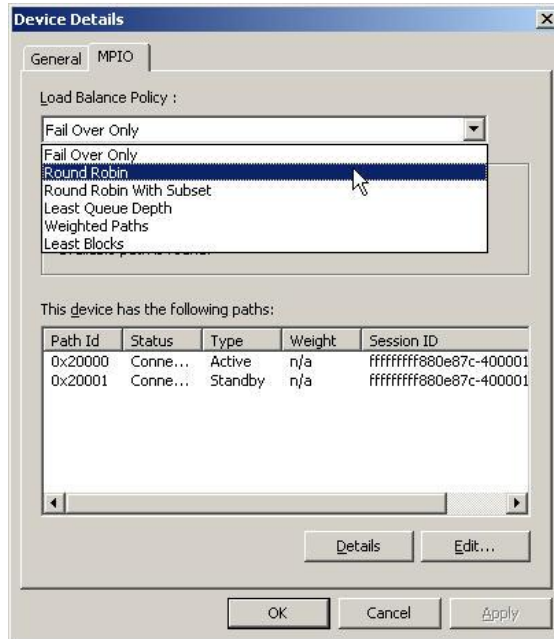


Figure F.21

- Click "Apply".

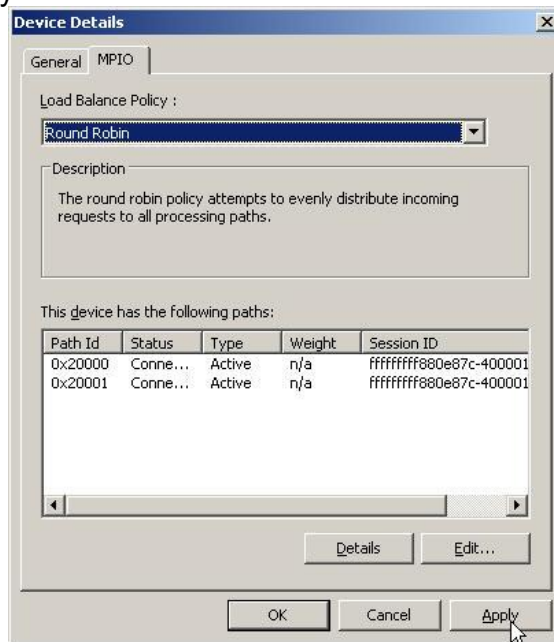


Figure F.22

- Run "Device Manage" in Windows. Make sure MPIO device is available. Then the disk can be tested performance by IOMETER.

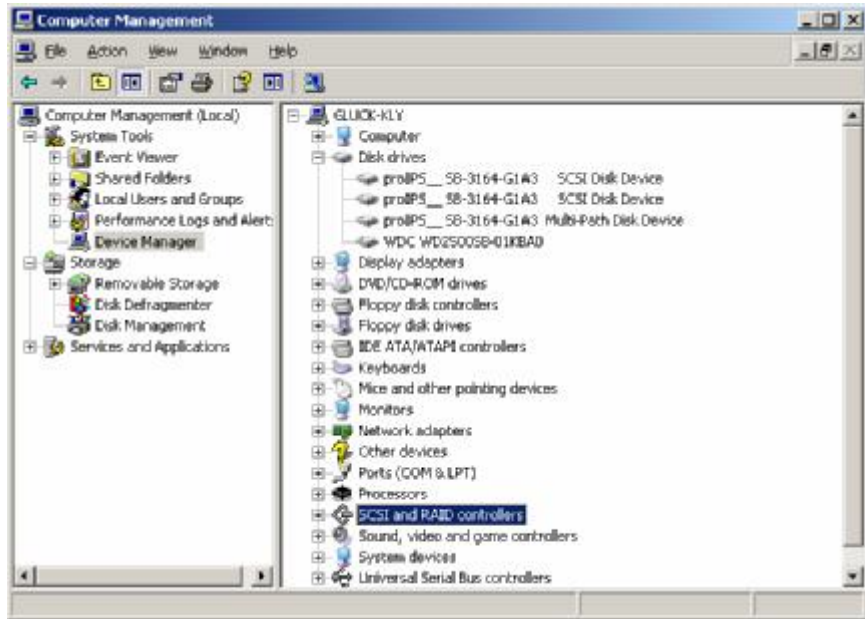


Figure F.23

The **MC/S** setup instructions are very similar to MPIO, detail steps are in the following figures. For the target side setting, the steps are exactly the same as MPIO. Please refer to **Figure F.1 to Figure F.9**.

- Create a VG with RAID 5, using 3 HDDs.
- Create a UDV by using RAID 5 VG.
- Run Microsoft iSCSI initiator 2.03 and check the Initiator Node Name.
- Attaching LUN to R5 UDV. Input the Initiator Node Name in Host field.
- The volume config setting is done.
- Check iSCSI settings. The IP address of iSCSI data port 1 is 192.168.11.229, port 2 is 192.168.12.229 for example.
- Add Target Portals on Microsoft iSCSI initiator 2.03.
- Input the IP address of iSCSI data port 1 (192.168.11.229 as mentioned in previous pages). For MC/S, there is only **ONE "Target Portals"** in the **"Discovery"** tab.

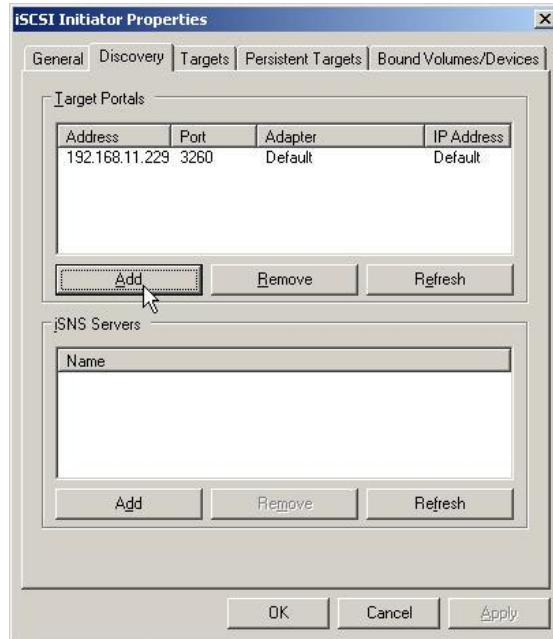


Figure F.24

- Log on.

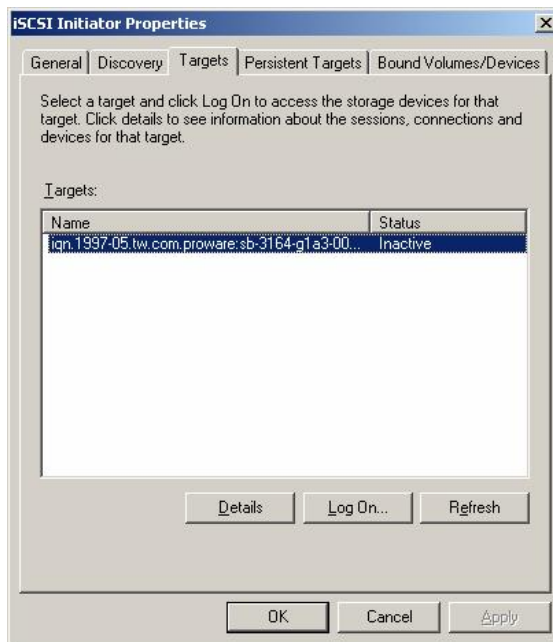


Figure F.25

- Then click "Advanced".

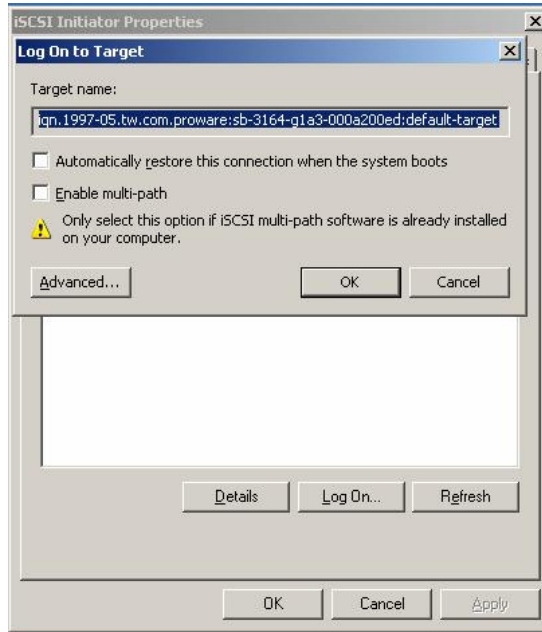


Figure F.26

- Select set Local Adapter, Source IP, and Target Portal to iSCSI data port 1 (192.168.11.229). Then click “OK”

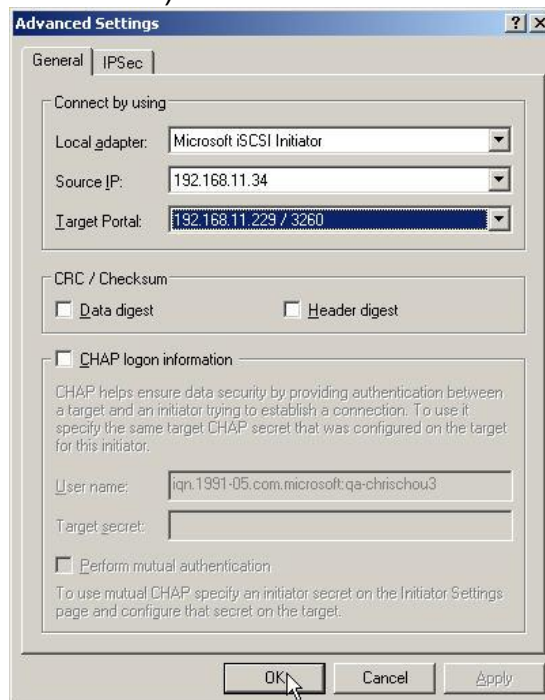


Figure F.27

- After connected, click “Details”, then in the “Session” tab, click “Connections”

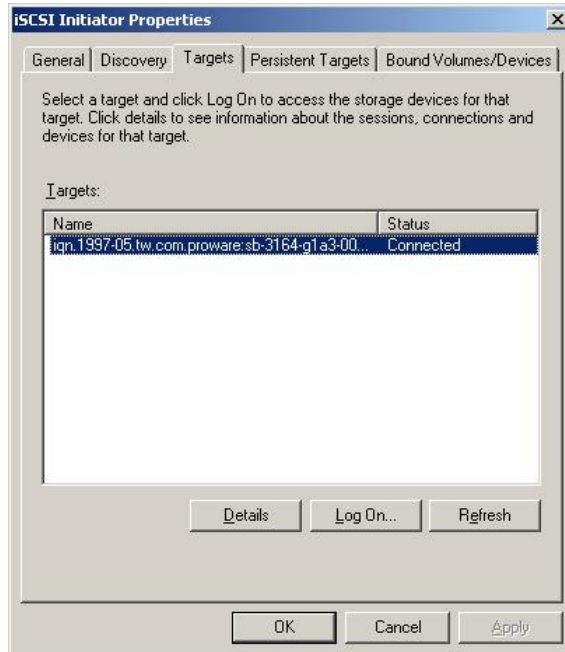


Figure F.28

- Choose "Round Robin" for Load Balance Policy

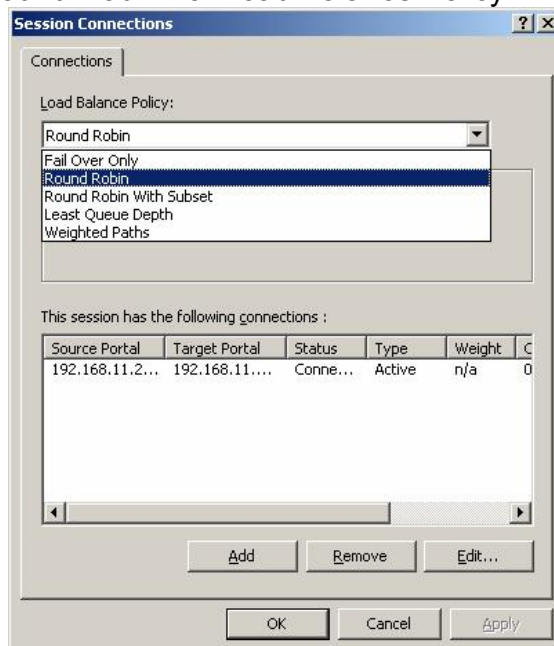


Figure F.29

- "Add" Source Portal for the iSCSI data port 2(192.168.12.229)

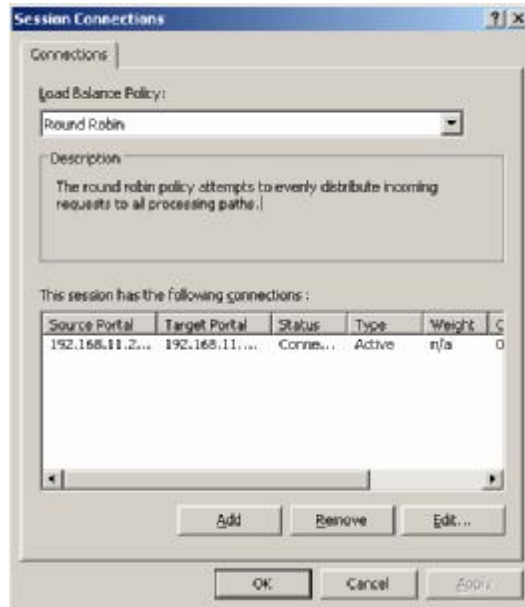


Figure F.30

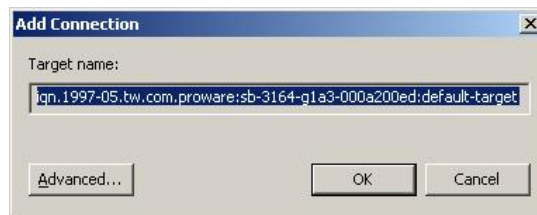


Figure F.31

- Select Local adapter, Source IP, and Target Portal to iSCSI data port 2 (192.168.12.229). Then select “OK”

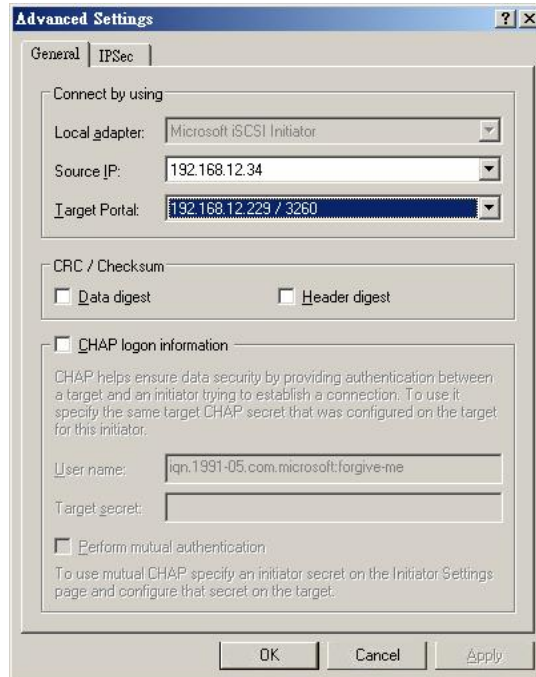


Figure F.32

- The MC/S setting is done.

G. QLogic QLA4010C setup instructions

The following is the step by step setup of Qlogic QLA4010C.

- Log on the iSCSI HBA Manager and the current state shows “**No Connection Active**”.

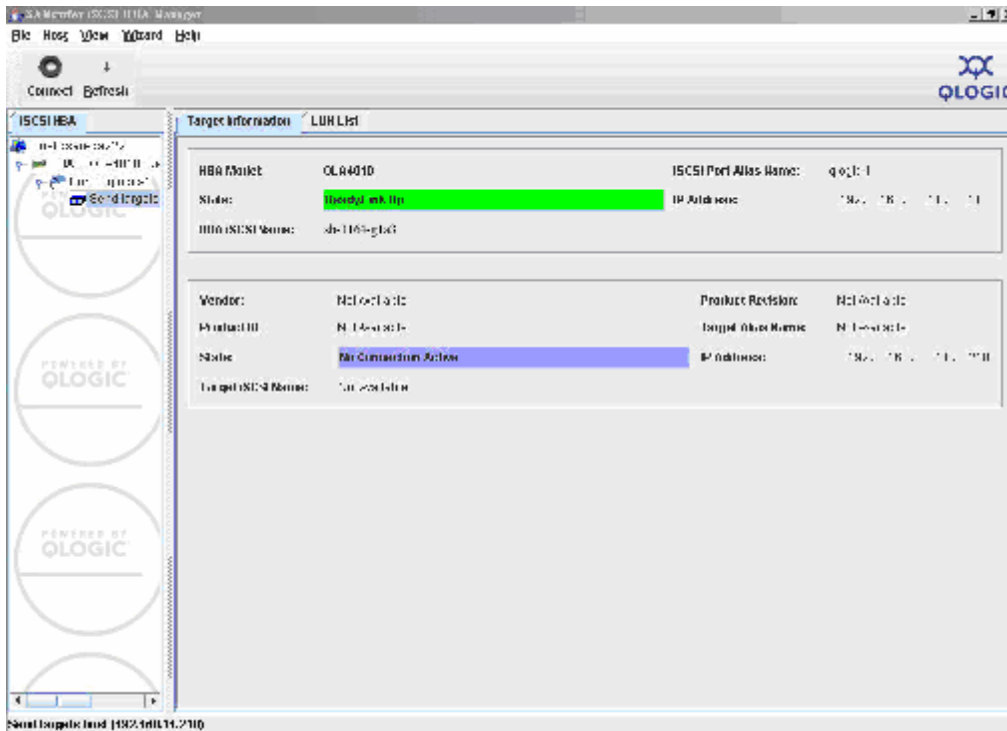


Figure G.1

- Click “Target settings”. Then select the target and click “Config Parameters”.

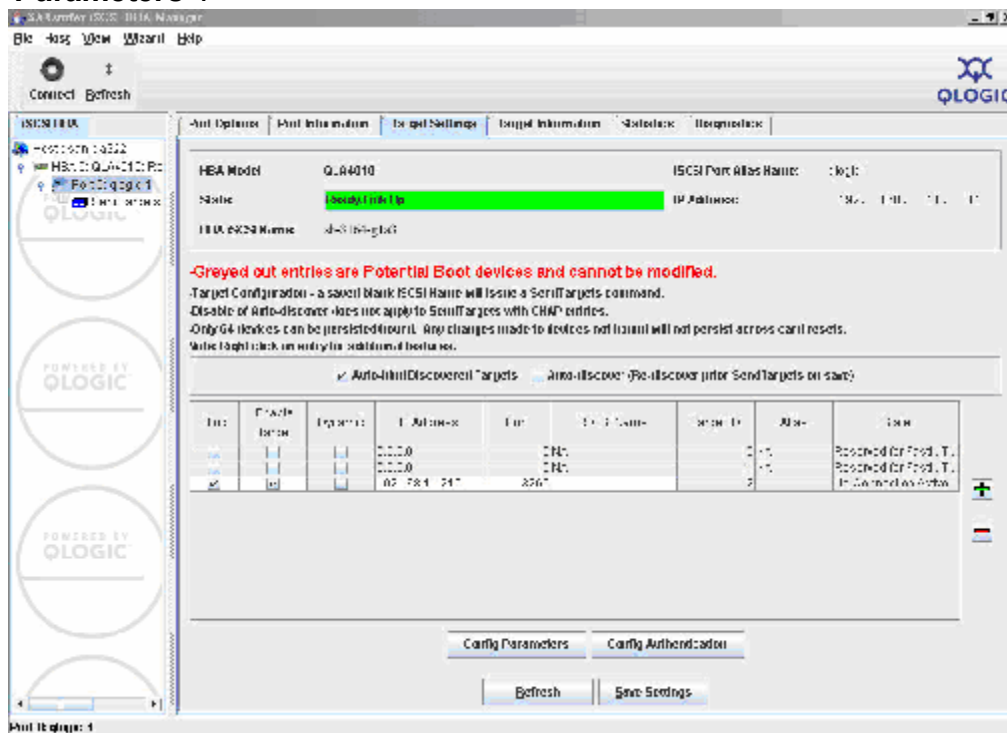


Figure G.2

- Disable **“Immediate Data”** and enable **“Initial R2T”**.

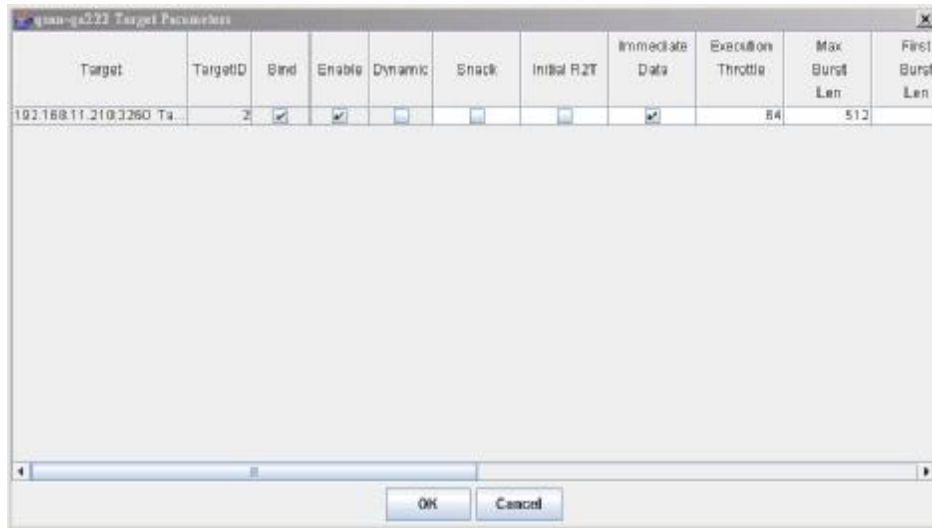


Figure G.3

- Click **“OK”**.

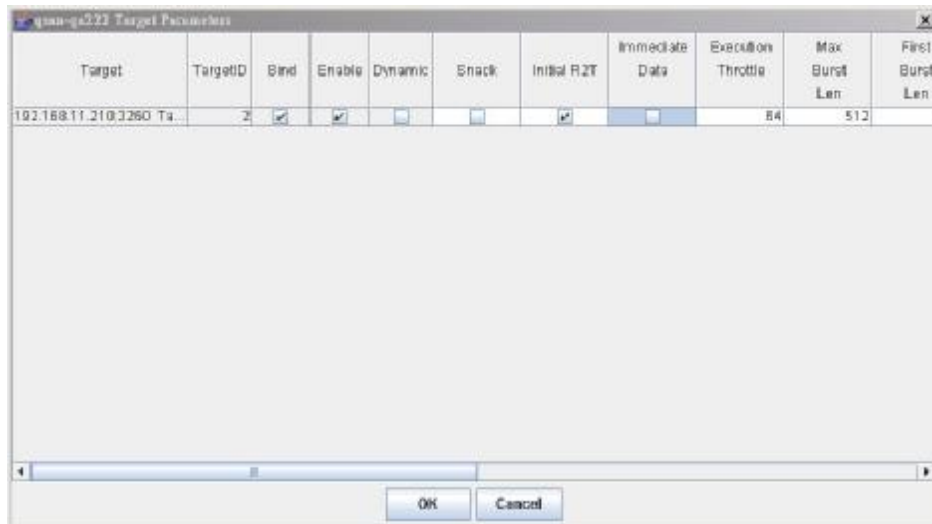


Figure G.4

- Click **“Save settings”** and click **“Yes”** on next page.

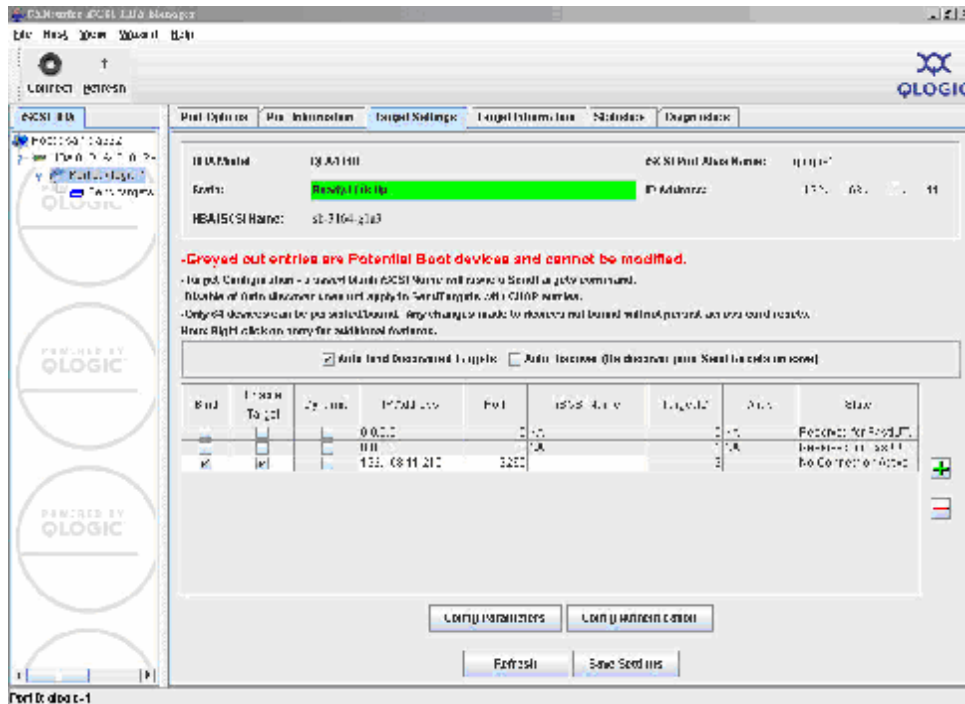


Figure G.5

- Click **“Refresh”** and find a new target with iSCSI name.

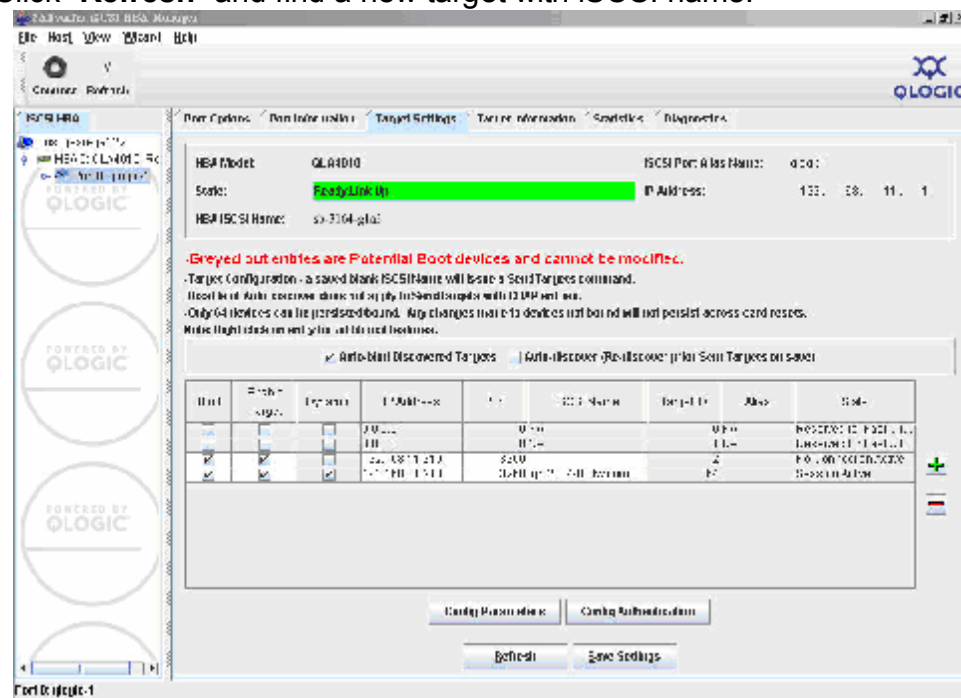


Figure G.6

- Check the parameters which **“Initial R2T”** are enabled.

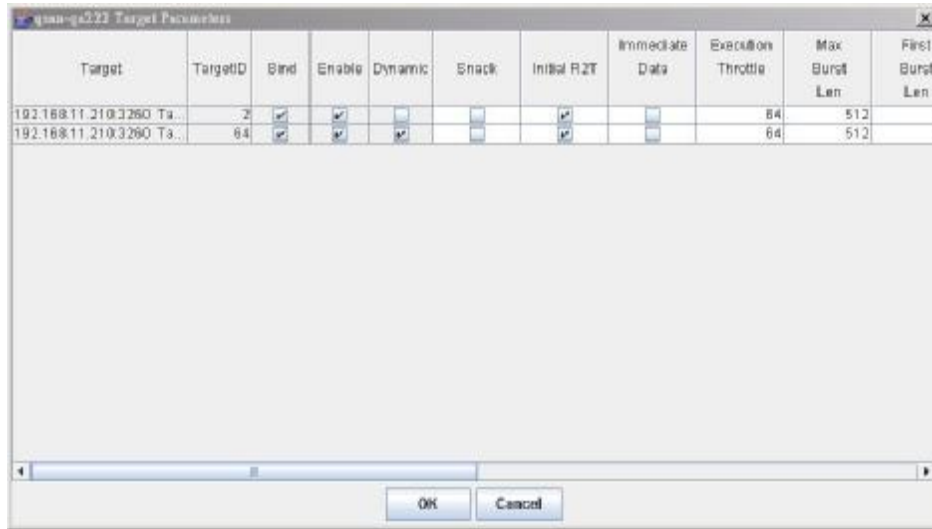


Figure G.7

- Check **“Target Information”** again and the state changed to **“Session Active”**.

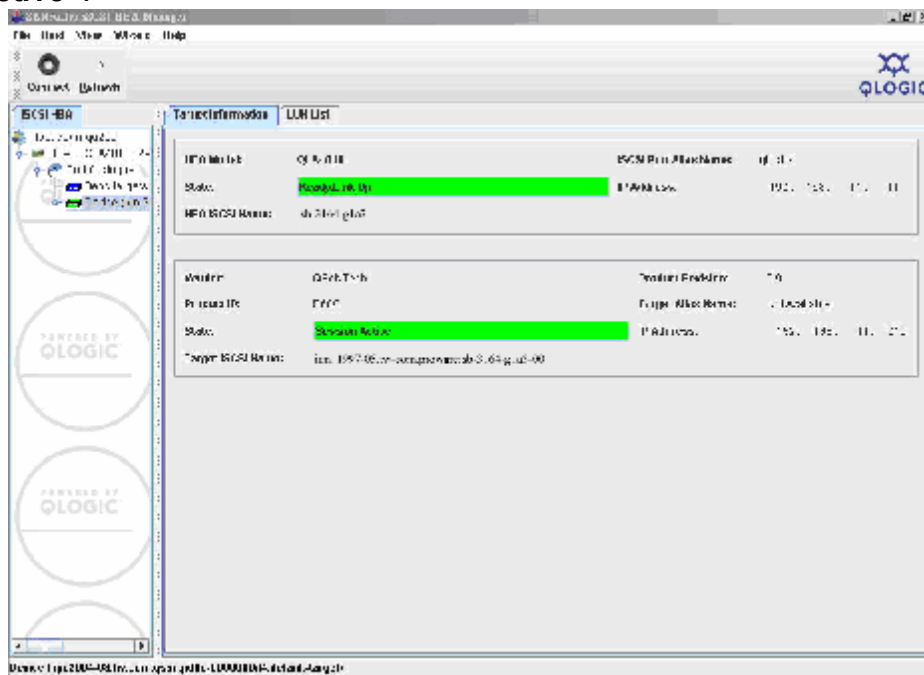


Figure G.8

- Then, run **“Computer Management”** in Windows. Make sure the disk appears.

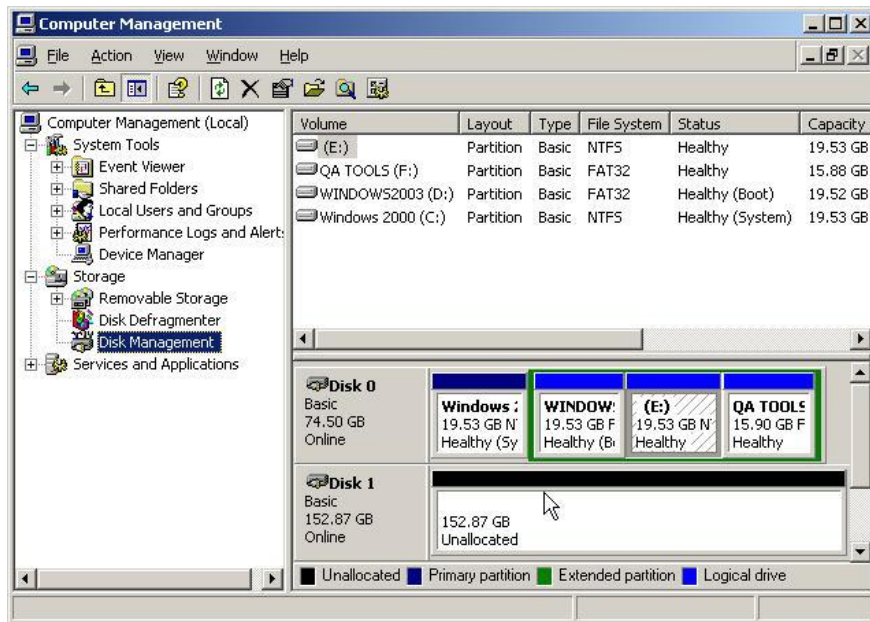


Figure G.9

H. Installation Steps for Large Volume (TB)

Introduction:

IS16GL are capable to support large volumes (>2TB) on all product lines. When connecting IS16GL to 64bit OS installed host/server, the host/server is inherently capable for large volumes from the 64bit address. On the other side, if the host/server is installed with 32bit OS, user has to change the block size to 1KB, 2KB or 4KB to support volumes up to 4TB, 8TB or 16TB, for the 32bit host/server is not LBA (Logical Block Addressing) 64bit supported. For detail installation steps, please check below.

Before starting, prepare the following items.

1. IS16GL.
2. Refer to **User Manual** for certification list of:
 - RAM
 - iSCSI Initiator (Software), NIC, or iSCSI HBA card
 - SATA hard drive
3. Server, refer to **OS_HBA_Initiator_List.pdf** for OS versions and HBA/Initiator driver/BIOS versions
4. CAT 5e, or CAT 6 network cables for management port and iSCSI data ports. Recommend CAT 6 cables for best performance. SCSI cables and terminators.
5. Prepare storage system configuration plan.
6. Management and iSCSI data ports network information. When using static IP, please prepare static IP addresses, subnet mask, and default gateway.

7. Gigabit LAN switches. (Recommended) or Gigabit LAN switches with VLAN/LACP/Trunking functions. (Optional)
8. CHAP security information, including CHAP usernames and secrets. (Optional)
9. Setup the hardware connection before power up servers and IS16GL. Connect console cable, management port cable, SCSI cables, terminators, and iSCSI data port cables first.

Step A: configure your target

1. Go to \Volume config\Volume group, create a VG.

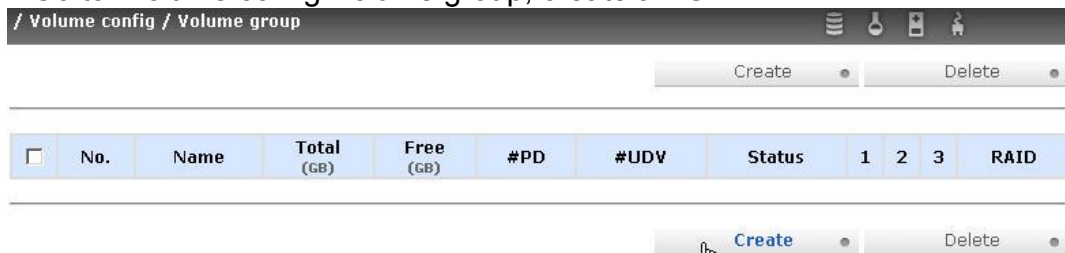


Figure H.1: create VG.



Figure H.2: choose RAID level and disks.



Figure H.3: confirm VG settings.

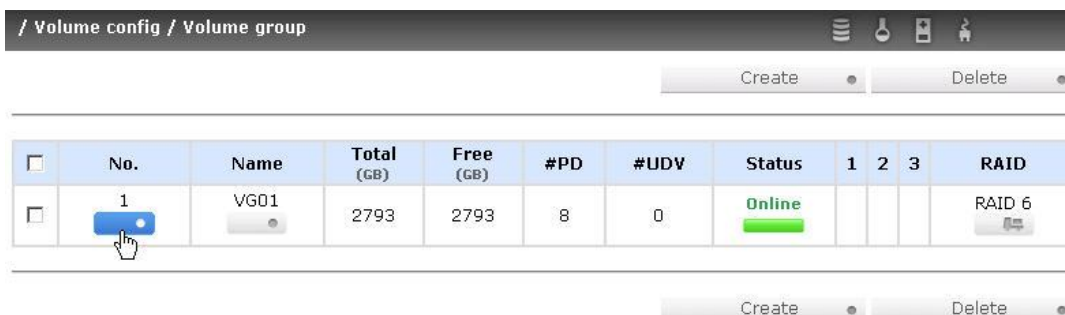


Figure H.4: a RAID 6 (size 2793G) VG is created.

2. Go to \Volume config\User data volume, create a UDV



Figure H.5: create UDV.



Figure H.6: setup capacity, stripe height, and block size for UDV.

Notice: When the OS is 64bit, user can set the block size to any available value. If the OS is 32bit, user has to change the block size to larger values than 512B. There will be a confirmation pop-up when UDV size is over 2TB for reminding.

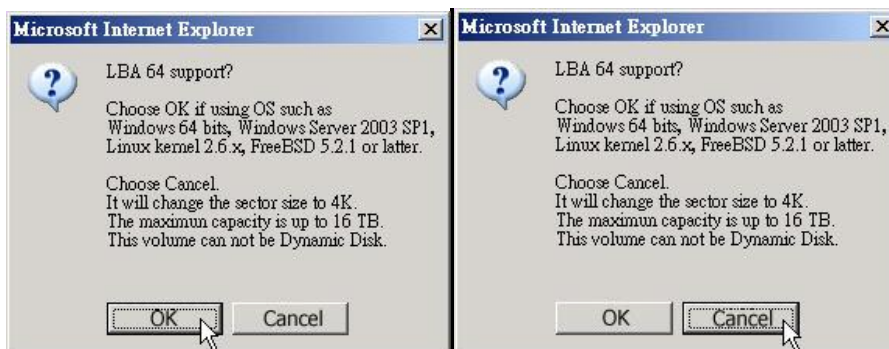


Figure H.7: choose "OK" for 64bit OS, choose "Cancel" for 32bit OS, this step will change block size to 4K automatically.

/ Volume config / User data volume

Attach Create Delete

No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	VG name	CV (MB)
1	UDV01	2793	Online	WB	HI	I	1%	RAID 6	0	VG01	136

Attach Create Delete

Figure H.8: a 2793G UDV is created.
 You may want to check the detail information of this UDV, go to click No. 1 icon.

/ Volume config / User data volume / More information

UDV:

ID	No.	Name	Size (GB)	Status	1	2	3	R %	Strp (KB)	RAID	#LUN	Snap (GB)	Type	VG ID	VG Name	CV ID	CV (MB)	Config	Block Size	Create Time
1021826050	1	UDV01	2793	Online	WB	HI	I	1%	64	RAID 6	0	0.00	NORMAL	345494528	VG01	452869120	136	41	512	1173345654

<< Back

Figure H.9: block size = 512B, for 64bit OS setting.

/ Volume config / User data volume / More information

UDV:

ID	No.	Name	Size (GB)	Status	1	2	3	R %	Strp (KB)	RAID	#LUN	Snap (GB)	Type	VG ID	VG Name	CV ID	CV (MB)	Config	Block Size	Create Time
991804674	1	UDV01	2793	Online	WB	HI	I	1%	64	RAID 6	0	0.00	NORMAL	345494528	VG01	452869120	136	41	4096	1173347651

<< Back

Figure H.10: block size = 4K, for 32bit OS setting.

/ Volume config / User data volume

Attach Create Delete

No.	Name	Size (GB)	Status	1	2	3	R %	RAID	#LUN	VG name	CV (MB)
<input checked="" type="checkbox"/> 1	UDV01	2793	Online	WB	HI	I	1%	RAID 6	0	VG01	136

Attach Create Delete

Figure H.11: attach LUN for iSCSI controller.

/ Volume config / User data volume / Attach

UDV :

Host :

LUN :

Permission : Read-only Read-write

Figure H.12: attach LUN.

Step B: configure your host/server

1. User needs to setup software iSCSI initiator or iSCSI HBA first.
2. Below is the configuration for Windows Server 2003 R2 with Microsoft iSCSI initiator. Please install the latest Microsoft iSCSI initiator from below link.
<http://www.microsoft.com/downloads/details.aspx?FamilyID=12cb3c1a-15d6-4585-b385-befd1319f825&DisplayLang=en>

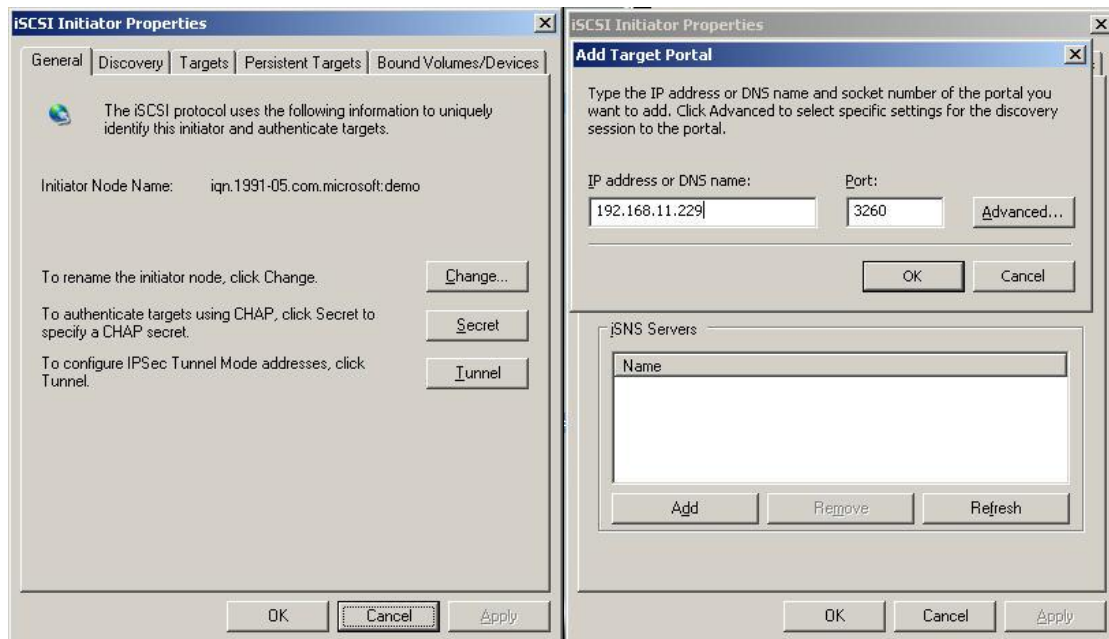


Figure H.13: run MS iSCSI initiator, go to “Discovery” tab, add target portal (iSCSI data port).

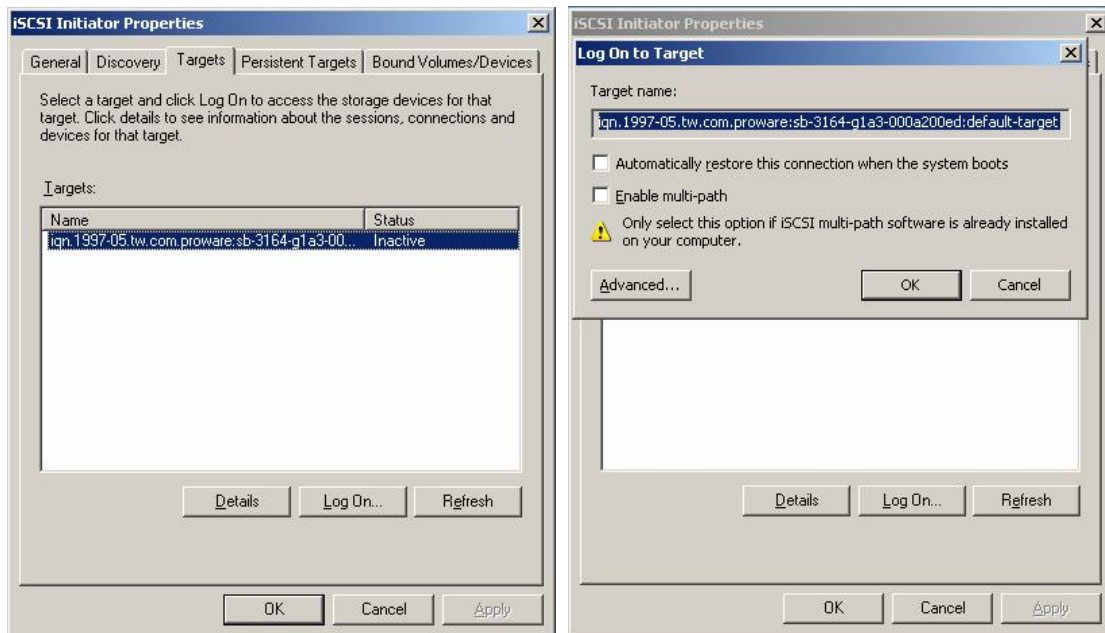


Figure H.14: go to “Targets” tab, click “Refresh”, and then “Log On...” the target.

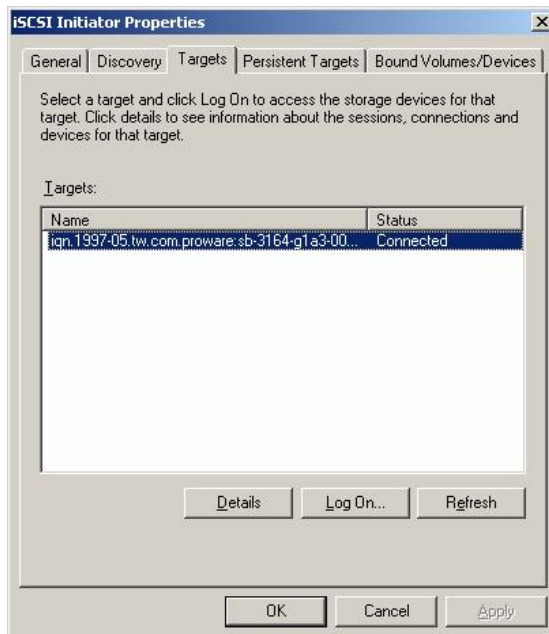


Figure H.15: Status is “Connected”, the initiator setting is done.

Step C: Initialize/Format/Mount the disk

1. Go to Control Panel \Computer Management\Device Manger\Disk drives



Figure H.16: Disk drive status of IS16GL

2. Go to Control Panel \Computer Management\Disk Management

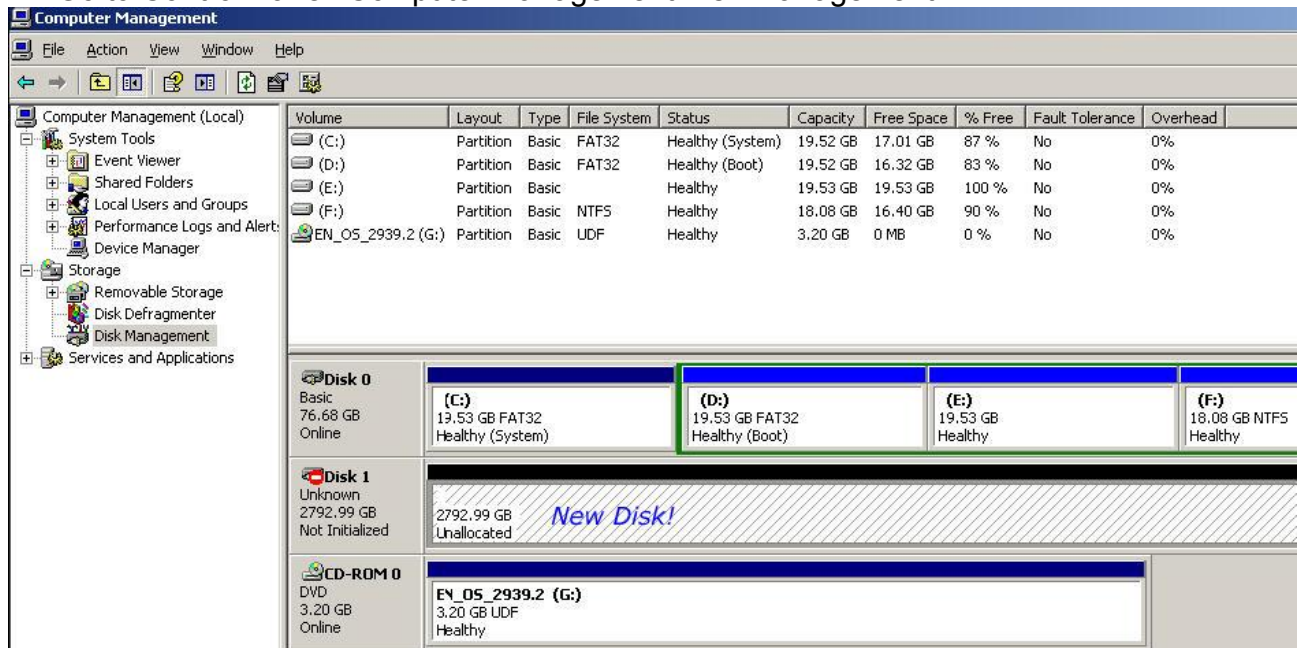


Figure H.17: New Disk!



Figure H.18: Initialize disk.

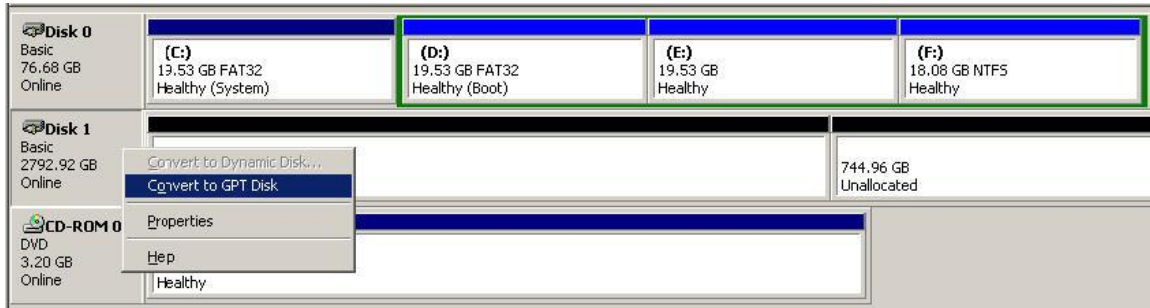


Figure H.19: Convert to GPT Disk for over 2TB capacity.
For more detail about GPT, please visit
http://www.microsoft.com/whdc/device/storage/GPT_FAQ.mspx.



Figure H.20: format disk.

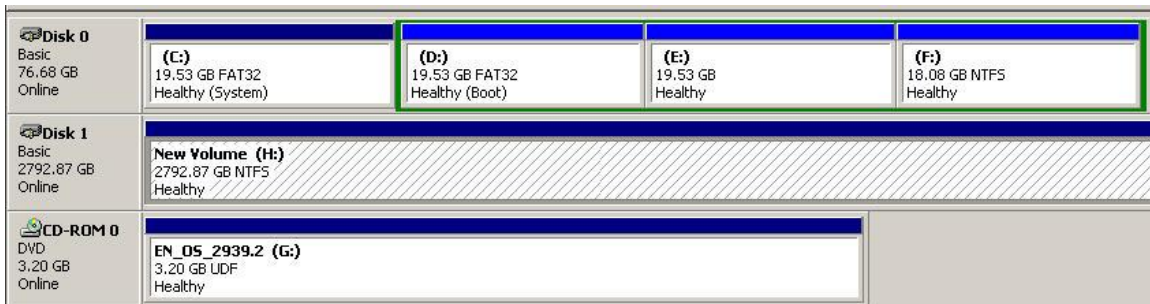


Figure H.21: format is done.

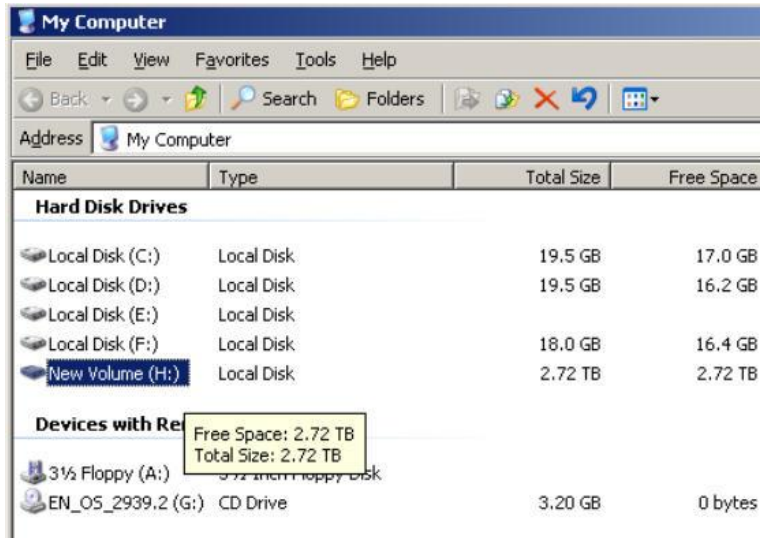


Figure H.22: the new disk is ready to go, available size = 2.72TB.

Notice: if user setup 512B block size for UDV and the host/server OS is 32bit, in the last step of formatting disk, user will find OS cannot format the area after 2048GB (2TB).

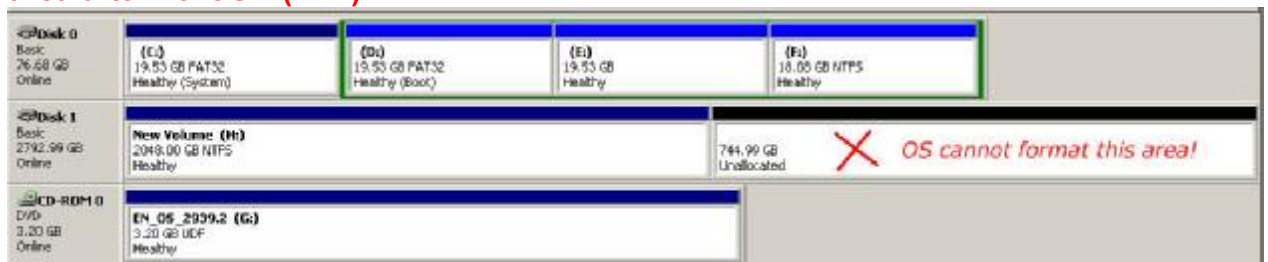


Figure H.23: wrong setting result: OS cannot format area after 2048GB (2TB)!

System information

	IS16GL
SW version	2.2.1 Build 20070531

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