Overland Storage

SnapSAN™ Path Manager

User Guide

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Preface

This user guide explains how to install, setup, and use the SnapSAN Path Manager software.

Path Manager is software that facilitates business backup operations by linking the Volume Shadow Copy Service (Path Manager) of Microsoft® Windows Server® 2003 or Microsoft® Windows Server® 2008 with data replication (Path Manager Volume Cloning or Path Manager Replication and Mirroring) and a snapshot function (Path Manager Snapshots).

This guide assumes that you are familiar with computer hardware, data storage, and network administration terminology and tasks. It also assumes you have basic knowledge of Internet SCSI (iSCSI), Serial-attached SCSI (SAS), Serial ATA (SATA), Storage Area Network (SAN), and Redundant Array of Independent Disks (RAID) technology.

This guide is intended for those who have basic knowledge of backup and recovery using Microsoft Windows Server 2003 or Microsoft Windows Server 2008 and the Path Manager snapshot function or data replication function.

This manual explains functions implemented by the following program products:

- Path Manager base product
- Path Manager Control Command

Product Documentation and Firmware Updates

Overland Storage SnapSAN product documentation and additional literature are available online, along with the latest release of the SnapSAN Path Manager software.

Point your browser to:

http://docs.overlandstorage.com/snapsan

Follow the appropriate link to download the **latest** software file or document. For additional assistance, search at http://support.overlandstorage.com.

Overland Technical Support

For help configuring and using your SnapSAN Path Manager, search for help at:

http://support.overlandstorage.com/kb

You can email our technical support staff at techsupport@overlandstorage.com or get additional technical support information on the Contact Us web page:

http://www.overlandstorage.com/company/contact-us/

For a complete list of support times depending on the type of coverage, visit our web site at:

http://support.overlandstorage.com/support/overland_care.html

Conventions

This document exercises several alerts and typographical conventions.

Alerts

Convention	Description & Usage
IMPORTANT	An *Important* note is a type of note that provides information essential to the completion of a task or that can impact the product and its function.
CAUTION	A *Caution* contains information that the user needs to know to avoid damaging or permanently deleting data or causing physical damage to the hardware or system.
WARNING	A *Warning* contains information concerning personal safety. Failure to follow directions in the warning could result in bodily harm or death.
ADVERTISSEMENT	Un Canadien avertissement comme celui-ci contient des informations relatives à la sécurité personnelle. Ignorer les instructions dans l'avertissement peut entraîner des lésions corporelles ou la mort.

Information contained in this guide has been reviewed for accuracy, but not for product warranty because of the various environments, operating systems, or settings involved. Information and specifications may change without notice.

Electrostatic Discharge Information

A discharge of static electricity can damage static-sensitive devices. Proper packaging and grounding techniques are necessary precautions to prevent damage. To prevent electrostatic damage, observe the following precautions:

- Transport products in static-safe containers such as conductive tubes, bags, or boxes.
- Cover the appliance with approved static-dissipating material.
- Use a wrist strap connected to the work surface and properly-grounded tools and equipment.
- Keep the work area free of non-conductive materials such as foam packing materials.
- Make sure you are always properly grounded when touching a static-sensitive component or assembly.
- Avoid touching pins, leads, or circuitry.

Licenses

PathManager can be installed with the contents in the following table. Please refer to License Agreement for details.

Software	Number of License
PathManager	1 operating system/license
PathManager (Bundle Edition)	There is no limitation for number of operating systems to install PathManager. However, only the storage units and connection methods supported by PathManager can be used.

Contents

Overview

Overview

This document describes how to use Path Manager for Windows.The Path Manager Storage is referred to as Path Manager in this User Guide unless otherwise specified. SnapSAN Path Manager is a software which allows multi-path connection between a server and a storage disk array subsystem. Using Path Manager, the following features are available:

- Path failover when a failure occurred on a path
- Load balancing using multiple paths
- MSCS (Microsoft Cluster Service) or WSFC (Failover Clustering on Windows Server 2008)

The Path Manager for Windows Storage disk array subsystem is referred to as a disk array.

Handling Path Failures

Path Manager can handle failures that occur in a HBA (Host Bus Adapter), a network interface card, a controller of a storage unit, a FC-cable, a FC-fabric, or a LAN cable (on iSCSI connection) using redundant paths.

When a failure occurs in a path and a storage unit can no longer be accessed during system operation, Path Manager will detect the event. Path Manager then switches the path to be used from the failed path to a normal path so that access to the storage unit can continue. I/O will not be lost during the course of switching the paths. Applications can continue their processing without being aware of the path failure.

Load Balancing Function

Path Manager has a load balancing function that uses redundant paths to distribute loads. Static load balancing and dynamic load balancing methods are used so that it is possible to take advantage of the features of Path Manger. Use this function to improve the access efficiency of storage.

Support for Application Servers

Path Manager supports application servers, MSCS, and WSFC environments. As a result, application servers and multiplexed paths are combined, and systems that are more solid than before can be constructed. Using Path Manager eliminates the necessity to use the failover function for nodes in application servers in order to avoid path failures.

Configuration of Path Manager

Path Manager operates on servers and monitors the paths connected by FC cables between the HBA or the NIC (network interface card) at the server and the HP (host port).

Path Manager consists of the following modules:

Path Manager driver

This is a group of drivers that forms the core of Path Manager. It controls basic functions of Path Manager such as redundant paths and load balancing.

Operation command (spsadmin)

This is a command used to check status or make settings for actions or paths of Path Manager. Use the command prompt to use this command. This operation command is used in most of the Path Manager related operations.

NOTE: There are restrictions on authority to use operation command. Please refer to “Part II 2.2.5Notice for Using Operation Command.”

Configuration check service (iSpmWatcher)

This service offers a configuration check function that automatically monitors the status of the paths. It collects the information from Path Manager driver, and writes to the eventlog when a path failure is detected.

Log service (_DsmLogger)

This service offers a log extract function that writes log information related to Path Manager in the event log. From internal information of Path Manager, it writes important information in the event log.

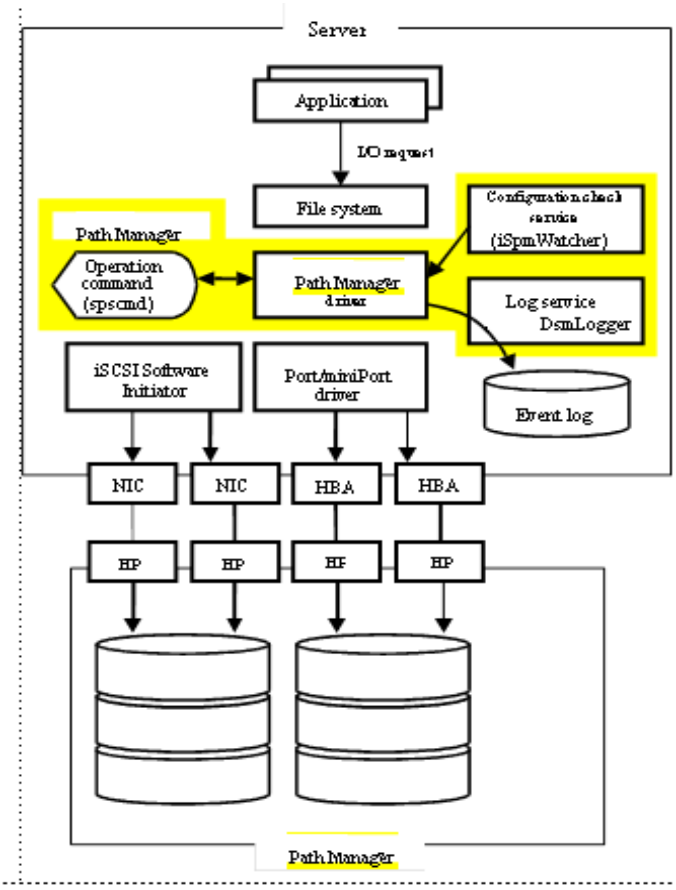

Figure 1-1: Path Manager Configuration

System Configuration

This section will describe the basic configuration of a system.

Single Server Configuration

In this configuration, a server and Path Manager are directly connected. The system is relatively small, and the configuration is the most common.

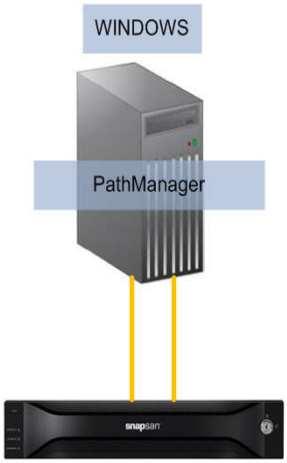

Figure 1-2: Single-server Configuration

Multiple-server Configuration

In this system, multiple servers are directly connected to Path Manager. This system configuration is used when multiple servers having different tasks share a relatively large storage. Exclusive control such as access control is necessary among logical units used by respective servers.

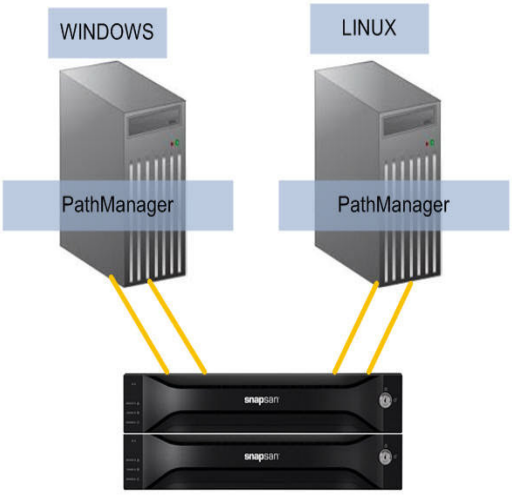

Figure 1-3: Multiple-server Configuration

Cluster Configuration

Below is an example of a cluster system configuration. There are FC switches between the server and Path Manager so that multiple servers will make the same logical unit visible.

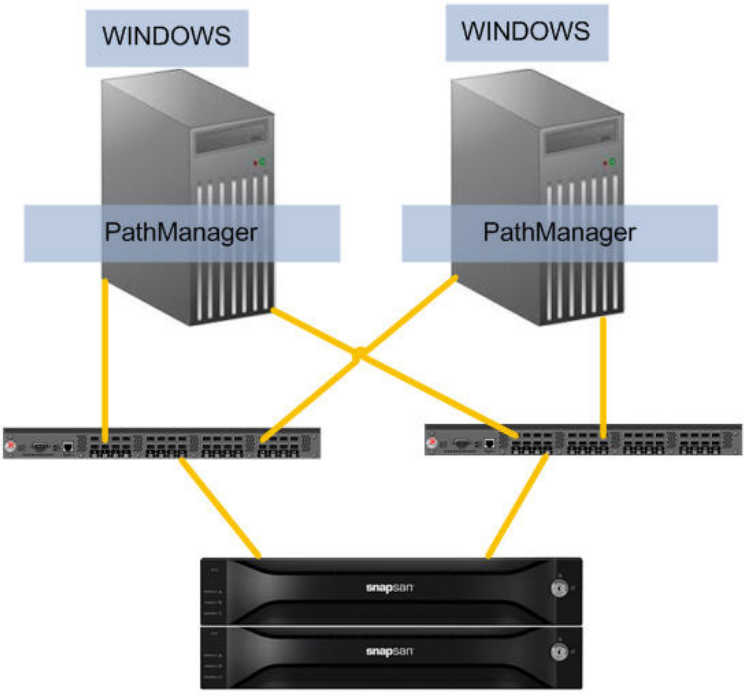

Figure 1-4: Cluster Configuration

Operating Environment

This section will describe the requirements before you start to use Path Manager.

System Requirements	
Operating System	Windows Server 2003 Standard Edition (with SP2) Windows Server 2003 Enterprise Edition (with SP2) Windows Server 2003 Standard x64 Edition (with SP2) Windows Server 2003 Enterprise x64 Edition (with SP2) Windows Server 2003 R2, Standard Edition (with SP2) Windows Server 2003 R2, Enterprise Edition (with SP2) Windows Server 2003 R2, Standard x64 Edition (with SP2) Windows Server 2003 R2, Enterprise x64 Edition (with SP2) Windows Server 2008 Standard (without SP, with SP2) Windows Server 2008 Enterprise (without SP, with SP2) Windows Server 2008 R2 Standard (without SP, with SP1) Windows Server 2008 R2 Enterprise (without SP, with SP1) Windows Server 2008 Datacenter (SP2) (*1) Windows Server 2008 R2 Datacenter (without SP, with SP1) (*1) Windows Storage Server 2003 (*2) Windows Storage Server 2008 (*2) (*1) Windows Server 2008 Datacenter and Windows Server 2008 R2 Datacenter can be used with scalable HA Server only. (*2) Windows Storage Server 2003 and Windows Storage Server 2008 can be used with NS series only. (*3) Express5800/ft series with Windows Server 2003 x86 edition can not be used SnapSAN S3000/S5000. (*4) Not supported MSCS environment.

System Requirements	
Memory	Memory required by OS + 10 MB
Disk capacity	Total capacity of programs:13MB Capacity required to use Path Manager: 43 MB or more
HBA initiator	FC-HBAs supported by the server and storage NICs (Network Interface Cards) supported by the server
Storage	SnapSAN S3000/S5000

System Requirements - Paths

SnapSAN S3000/S5000 Number of Paths and Logical Disks			
	FC	iSCSI	FC/iSCSI
Maximum number of paths per logical disk.	32 paths	8 paths	4 paths
Maximum number of logical disks.	255 disks	255 disks	255 disks
Maximum number of disk devices(*1)	4096	1020	1020

(*1) Total number of paths for all logical disks.

Available Cluster Software for Storage Units

Path Manager can be coordinated with application servers, MSCS and WSFC. Available cluster software is different by type of storage unit.

SnapSAN S3000/S5000 Available Cluster Software		
Application Servers	OK	OK (*1)
MSCS	OK (*2)	NG
WSFC	OK	OK (*1)

(*1) You have to enable the cluster mode and cannot use active failback of Path Manager.

(*2) You have to enable the MSCS mode and cannot use dynamic load balancing.

Available Load Balancing for Storage Units

With Path Manager, you can use 2 types of static load balancing and seven types of dynamic load balancing. Available load balancing types are different by the model of storage unit.

SnapSAN S3000/S5000 Load balancing types/Storage Units			
Failover Only	Available	Available	Available
Round Robin	Available(*1)	Available(*1)	Unavailable
Round Robin with Subset	Available	Available	Unavailable
Least I/O	Available	Available	Unavailable
Weighted Path	Available	Available	Unavailable
Least Size	Recommend	Recommend	Unavailable
LBA Region	Available	Available	Unavailable

(*1) I/O throughput may be degraded.

Notices

Notice for Using Operation Command

- Case of Windows Server 2003 environment
  - To execute spsadmin, authority of “administrators” is required. If you logon by non-administrative user, please launch command prompt by “Run as …” and execute spsadmin in the prompt.
- Case of Windows Server 2008 environment
  - To execute spsadmin, authority of Built-in Administrator is required (authority of “administrators” is not enough). If you logon by non-administrative user, please launch command prompt by “Run as administrator” and execute spsadmin in the prompt.

The following application event logs may be reported after the installation, during operation, and/or after uninstalling Path Manager.

Item	Description
Source	WinMgmt (Case of Windows Server 2003) WMI (Case of Windows Server 2008)
Event ID	10
Type	Error
Description	Event filter with query "select * from SPN_EVENTENTRY" could not be (re)activated in namespace "//./root/WMI" because of error 0x80041010. Events may not be delivered through this filter until the problem is corrected. For more information, see Help and Support Center at http://go.microsoft.com/fwlink/events.asp.

Item	Description
Source	WinMgmt (Case of Windows Server 2003) WMI (Case of Windows Server 2008)
Event ID	10
Type	Error
Description	Event filter with query "select * from OVERLAND_MAM_EVENTENTRY" could not be (re)activated in namespace "//./root/WMI" because of error 0x80041010. Events may not be delivered through this filter until the problem is corrected. For more information, see Help and Support Center at http://go.microsoft.com/fwlink/events.asp.

Chapter 2

Basic Installation

Install/Uninstall Overview

This section will describe how to install and uninstall Path Manager. To setup Path Manager, use the Setup CD.

Definitions:

Install
Installs the program on the server.

Uninstall

Completely removes Path Manager from the server.

Version upgrade
Users who are using previous versions of Path Manager can use this mode and prepare for installation of this version of Path Manager.

NOTE: Only Path Manager version 5.0 or later can be upgraded. If you use version 4.3 or older, can not upgrade to this version directly. For these cases, please uninstall older version, and after, install this version

Non-interactive installation
Install the program on the server.

Non-interactive uninstallation
Completely removes Path Manager from the server.

Non-interactive version upgrade

Users who are using previous versions of Path Manager can use this mode and prepare for installation of this version of Path Manager.When you upgrade from Path Manager 5.0 or earlier, uninstall existing version of Path Manager before install this version.
Note that the existing settings of Path Manager are not reflected across the upgrade this way.

Install Path Manager

Use the Setup CD and the following procedures to install Path Manager.

1. Turn the server off. Completely disconnect the server and Path Manager for Windows.
   If you update on the SAN boot environment, connect the server and Path Manager for Windows with one access path.
2. Turn the server on. Log in as an administrator of the server (if Windows Server 2008, must be built-in administrator).
3. Insert the Setup CD into the CD/DVD drive unit.

- If the dialog box shown below is appeared, click “Yes.”

- If the dialog box is not appeared, run “iSpmStarter.exe” in the root directory of Setup CD. (When you install on the Server Core environment, the dialog box will not be displayed.).

Figure 2-1: Setup Dialog Box

NOTE: You need to launch iSpmStarter.exe directly if your environment is Server Core. Move current directory to root of a CD/DVD drive before launching iSpmStarter.exe for this situation,

If you setup by non-built-in administrator account, the dialog box shown below may appear.

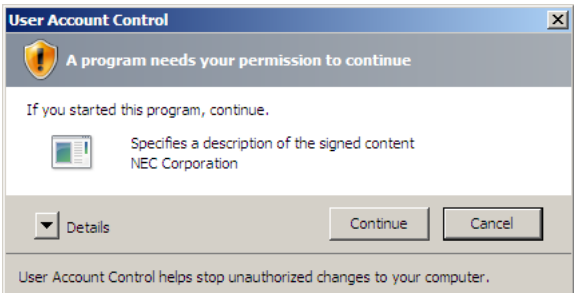

Figure 2-2: Permission to Continue Dialog Box

4. If you meet this dialog box, click “Continue”.
5. The dialog box confirming upgrade will be shown. Click “Next.”
6. If the dialog box displayed with some files is in use is shown. Select "Close automatically and restart the application" and click “OK.”The InstallShield Wizard for Path Manager will start. The Welcome to the InstallShield Wizard for Path Manager dialog box will be displayed.
7. Click “Next.” to start upgrade.

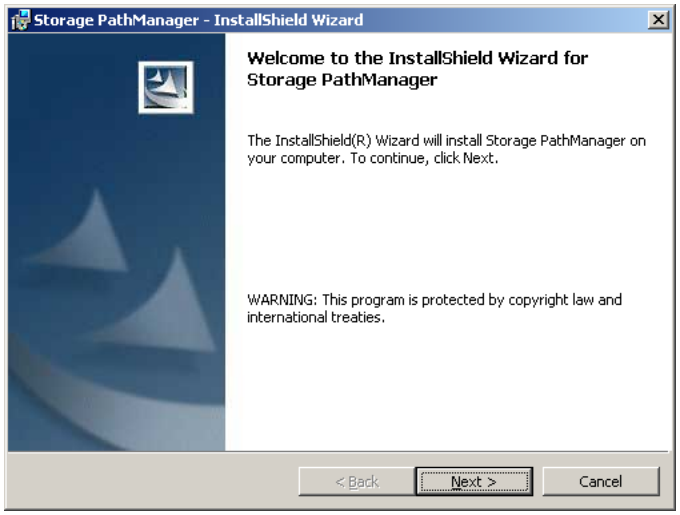

Figure 2-3: InstallShield Wizard Continue

8. The InstallShield Wizard Completed dialog box will be displayed. Click "Finish."

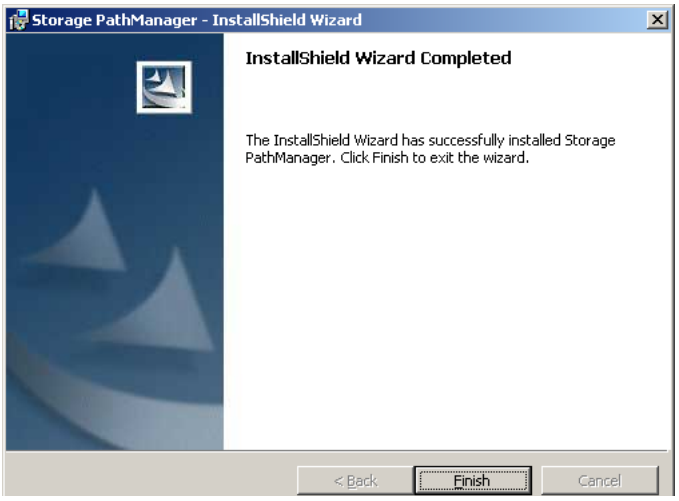

Figure 2-4: InstallShield Wizard Completed

9. The dialog box shown below will be displayed indicating a reboot is necessary. Click "Yes" to reboot the server.

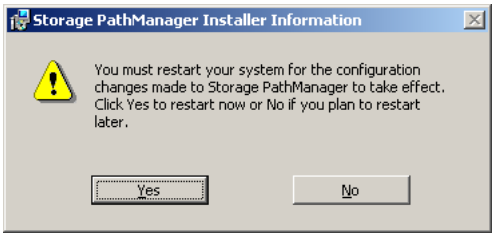

Figure 2-5: Restart Dialog Box

The installation of Path Manager is now complete.

After the server reboots, connect PathManage to the server. The upgrading of Path Manager is now complete Path Manager automatically recognizes disk subsystems and paths and starts operating.

Uninstall Path Manager

Use the following procedures to uninstall Path Manager

CAUTION: When turning on the server after the uninstallation of Path Manager, check that the connections between the server and Storage are not redundant. Turning on the server while there are redundant paths connecting to the Storage may result in unexpected damage to the file system.

1. Turn the server off. Completely disconnect the server and Path Manager.
   If you install on the SAN boot environment, connect the server and Path Manager with one access path.
2. Turn the server on. Log in as an administrator of the server. Then, insert the Serup CD into the CD/DVD drive unit.
   a. If the dialog box shown below appears, click "Yes." Proceed to Step 3.
   b. If the dialog box does not appear, run "iSpmStarter.exe" in the directory of Setup CD. (When you uninstall remotely on NS series, the dialog box will not appear)

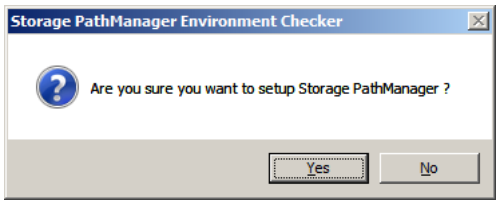

Figure 2-6: Uninstall - Setup Dialog Box

3. The welcome to the InstallShield Wizard for Path Manager dialog box will be displayed. Clock "Next" to continue.

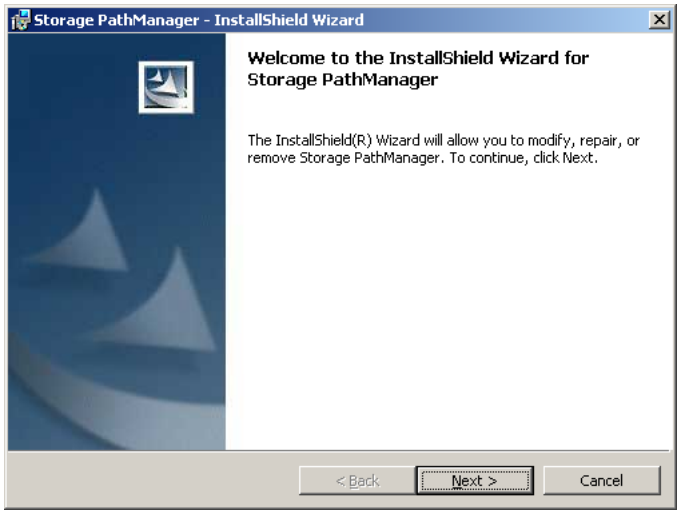

Figure 2-7: Uninstall - InstallShield Wizard Welcome

4. The **Remove the Program** dialog box will be displayed. Clock “Remove.”

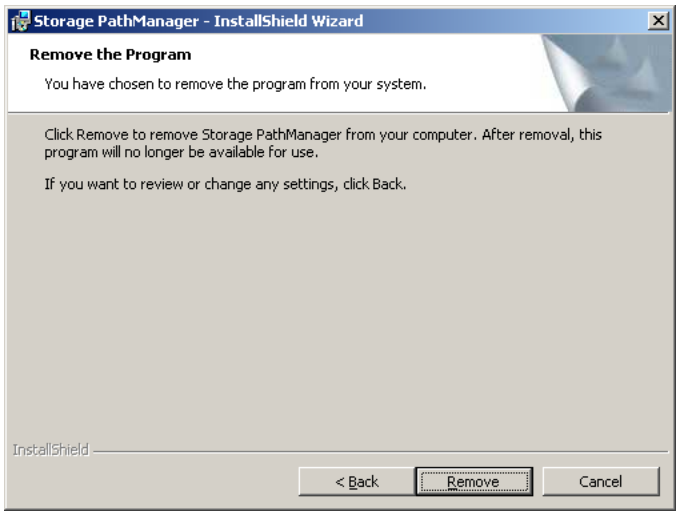

Figure 2-8: Uninstall - Remove Program

5. The **InstallShield Wizard Completed** dialog box will be displayed at the end of the uninstallation. Click "Finish.

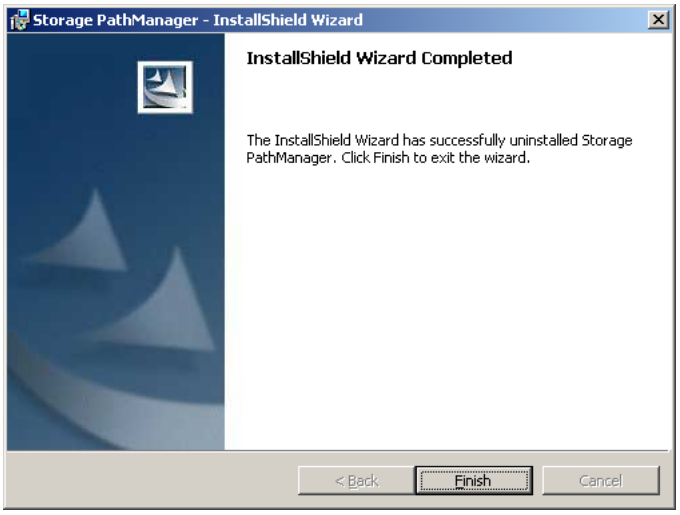

Figure 2-9: Uninstall - Completed

6. A dialog box will be displayed indicating a reboot is necessary. Remove the Setup CD and click “Yes.”

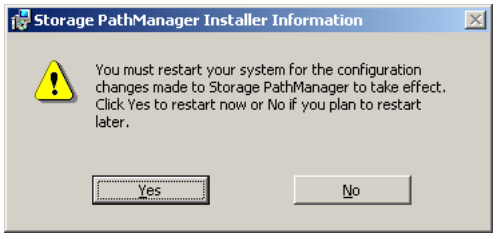

Figure 2-10: Uninstall - Restart Dialog Box

The uninstallation of Path Manager is now complate.

Non-interactive Version Upgrade

NOTE: Only Path Manager version 5.0 or later can be upgraded. If you use version 4.3 or older, can not upgrade to this version directly. For these cases, please uninstall older version, and after, install this version. On non-interactive version upgrading, the installer reboots the server at the end of the upgrading automatically and forcibly. Please close applications as the need arises before upgrading

1. Turn the server off. Completely disconnect the server and Path Manager. If you upgrade Path Manager on the SAN boot environment, connect the server and Path Manager Storage with one access path.
2. Turn the server on. Log in as an administrator of the server (if Windows Server 2008, must be built-in administrator). Then, insert the Setup CD into the CD/DVD drive unit.
3. Launch the command prompt and move current directory to root of CD/ DVD drive.

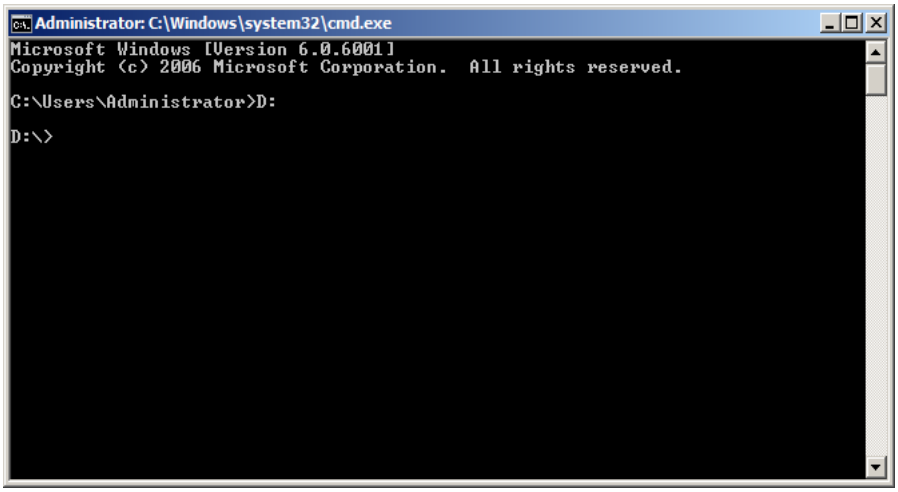

Figure 2-11: Non-interactive Installation - Current Directory

4. Execute the following command.

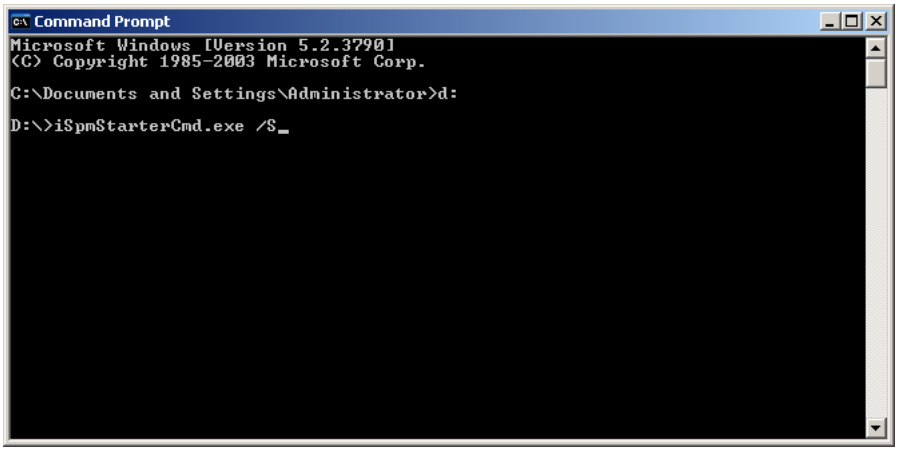

Figure 2-12: Non-interactive Installation - Reboot Command

5. Path Manager installer reboots the server automatically after the upgrade is completed.

Non-interactive Uninstallation

Use the following procedures to uninstall Path Manager with no interaction.

NOTE: When turning on the server after uninstalling Path Manager, verify that the connections between the server and Storage unit are not redundant. Turning on the server while there are redundant paths connecting to the storage may result in unexpected damage to the file system.On non-interactive uninstallation, the installer reboots the server at the end of the uninstallation automatically and forcibly.Close applications as the need arises before uninstallation.Turn the server off. Completely disconnect the server and Path Manager. If you upgrade Path Manager on the SAN boot environment, connect the server and Path Manager with one access path.

6. Turn the server on. Log in as an administrator of the server (if Windows Server 2008, must be built-in administrator). Then, insert the Setup CD into the CD/DVD drive unit.
7. Launch the command prompt and move current directory to root of CD/ DVD drive.

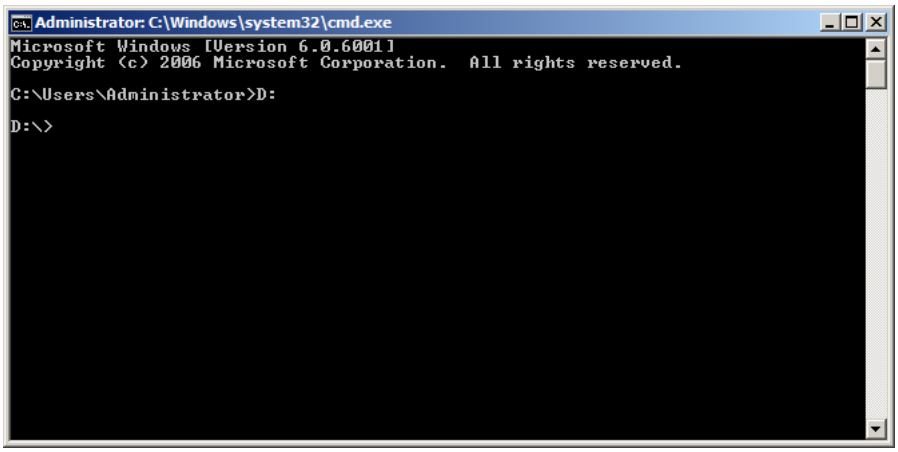

Figure 2-13: Non-interactive Uninstallation - Current Directory

8. Execute the following command.

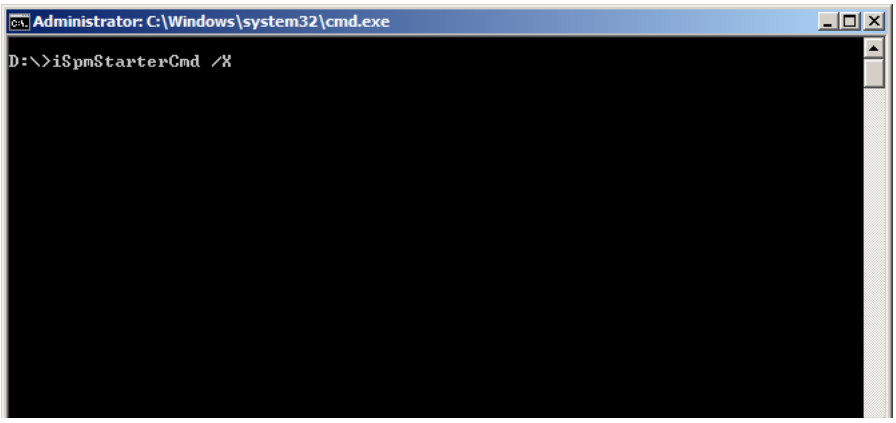

Figure 2-14: Non-interactive Uninstallation - Reboot Command

9. Path Manager installer reboots the server automatically after the uninstallation is completed.

Chapter 3

Installation - Various Environments

Installation

Before Installation

CAUTION: Do not connect the server and Path Manager for Windows via multiple paths until the setup of Path Manager is complete. Turning on the server while multiple paths connect the server and Path Manager for Windows may result in fatal damage to file systems.

This section describes the installation of Path Manager in a variety of environments.

- If "Alert Manager Main Service" is active temporarily stop the service and then set up Path Manager to ensure a successful registration of liaison functions.
- When using application servers, or MSCS or WSFC, set up Path Manager first and then application servers, or MSCS or WSFC usually.
- If you want to install or upgrade Path Manager to the servers that clustering software is already running on, see "Chapter X, Setting Up Path Manager to Cluster Environment"
- If you use iSCSI models of Path Manager for Windows, setup iSCSI initiator after the installation of Path Manager.
- If you use ft series before you set up Path Manager, make sure you stop "HAS Volume Monitoring Service" and close all applications.
- If you use ft series with Windows Server 2003 x86 edition, make sure you setup HBA Registration.
- If you setup Path Manager by non-interactive mode on Windows Server 2008 environment, you must do it by built-in administrator account. You can't use non-interactive mode by any other user. (even if the user belongs to Administrators group) The existing settings of Path Manager are not reflected across the upgrade this way.
- When you upgrade from Path Manager 5.0 or earlier, uninstall existing version of Path Manager before install this version.The existing settings of Path Manager are not reflected across the upgrade this way.

This section describes how to install and uninstall Path Manager.

Definitions:

Installation Installs the program on the server.

Uninstallation Completely removes Path Manager from the server.

Version upgrade Users who are using previous versions of Path Manager can use this mode and prepare for installation of this version of Path Manager.

Non-interactive installation Install the program on the server.

Non-interactive uninstallation Completely removes Path Manager from the server.

Non-interactive version upgrade Users who are using previous versions of Path Manager can use this mode and prepare for installation of this version of Path Manager.

Setup CD

Use the Setup CD and the following procedures to install Path Manager.

1. Turn the server off. Completely disconnect the server and Path Manager for Windows.
   If you install on the SAN boot environment, connect the server and Path Manager for Windows with one access path.
2. Turn the server on. Log in as an administrator of the server (if Windows Server 2008, must be built-in administrator).
3. If you are going to setoup Path Manager, stop "HAS Volume Monitoring Service" before installation, and restart after completion, see "Chapter 6 HAS Volume Monitoring Service".
4. Insert the Setup CD into the CD/DVD drive unit.
   a. If the dialog box shown below appears, click "Yes." Proceed to Step 5.
   b. If the dialog box does not appear, run "iSpmStarter.exe" in the root directory of Setup CD(When you install on the Server Core environment or NS series, the dialog box will not be displayed.). Proceed to Step 5.

Figure 3-1: Environment Checker

NOTE: You need to launch iSpmStarter.exe directly if your environment is Server Core. Move current directory to root of a CD/DVD drive before launching iSpmStarter.exe for this situation, If you setup by non-built-in administrator account, the dialog box may appear.

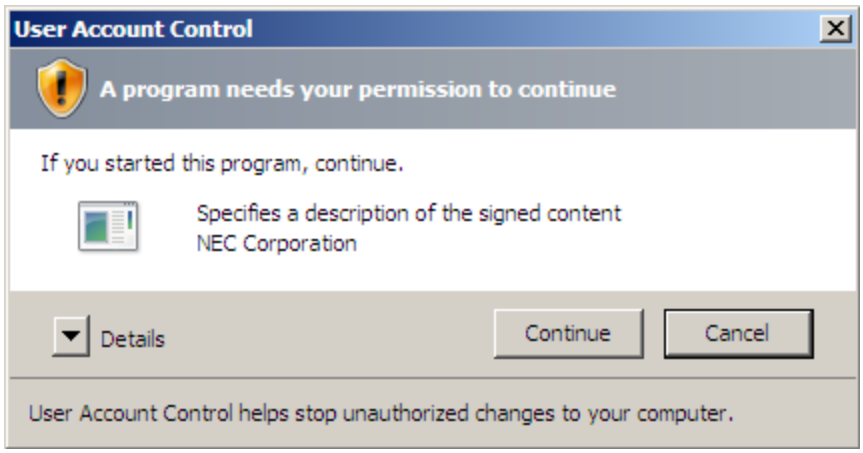

Figure 3-2: User Account Control

5. Click "Continue".
6. The InstallShield Wizard for Path Manager will start. Depending on the state of your server, the wizard shows one of the two dialogs shown below:

First - time installation

1. If you are installing Path Manager on the server for the first time, the **Welcome to the InstallShield Wizard for Path Manager** dialog box will be displayed.

Figure 3-3: InstallShield Welcome Screen (1)

a. Click "Next" and continue to Step 8.

Path Manager Previously Installed

If this version of Path Manager is already installed, the **Path Manager Maintenance** dialog box will be displayed.

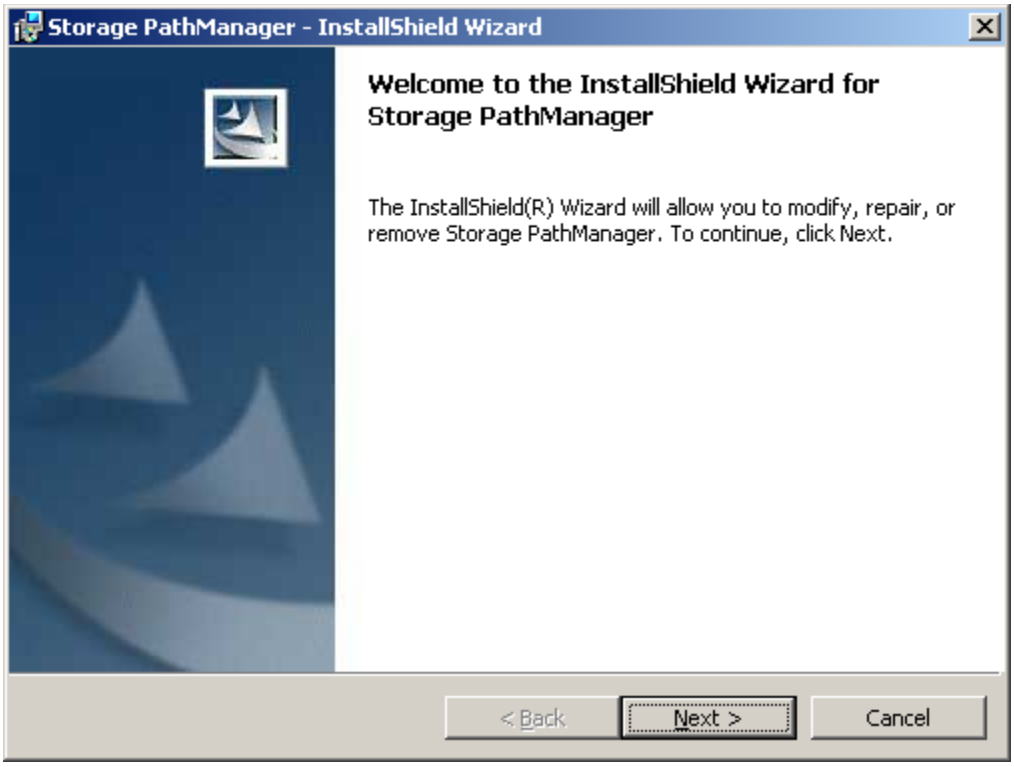

Figure 3-4: InstallShield Wizard

b. Click "Cancel." To uninstall the installed Path Manager, refer to "Uninstall."

If you are going to setup old ft server, the **License Agreement** dialog box will be displayed.

2. Review the license agreement and select the option "I accept the terms in the license agreement." Click "Next." Proceed to Step 9.

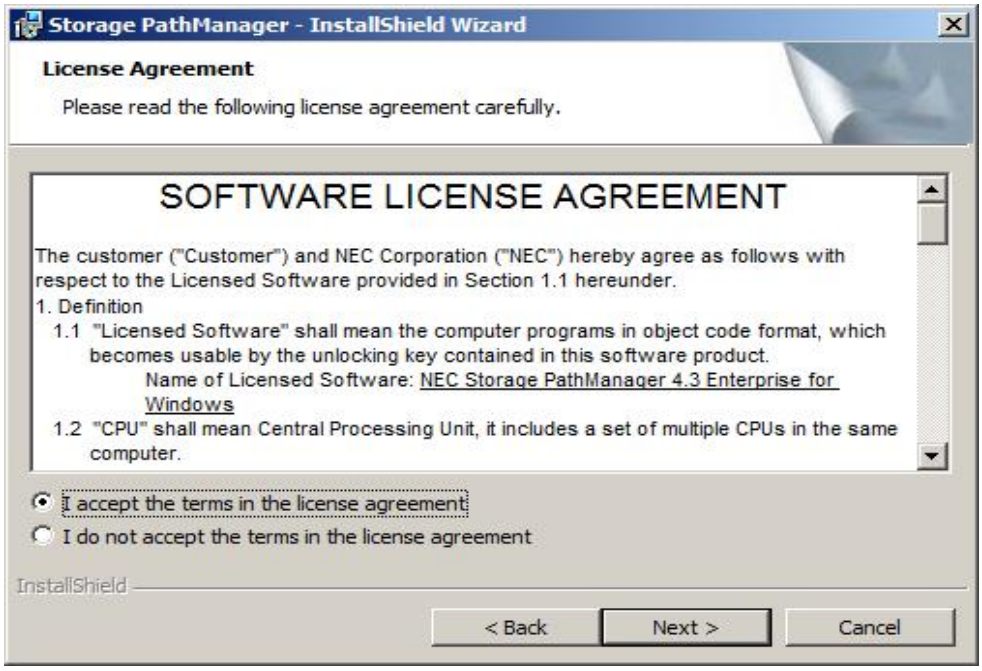

Figure 3-5: License Agreement

If you are going to setup old ft server, the dialog box shown below will be displayed.

3. Click "Next." Proceed to Step 9.

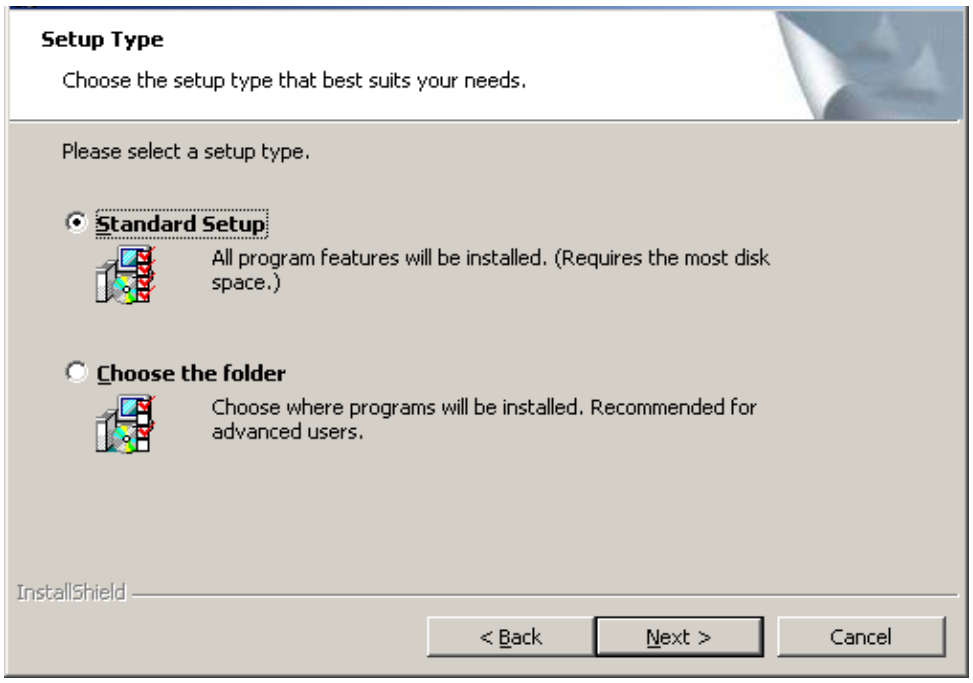

Figure 3-6: Setup Type

4. The **Ready to Install the Program** dialog box will be displayed. Click "Install" to start installation.

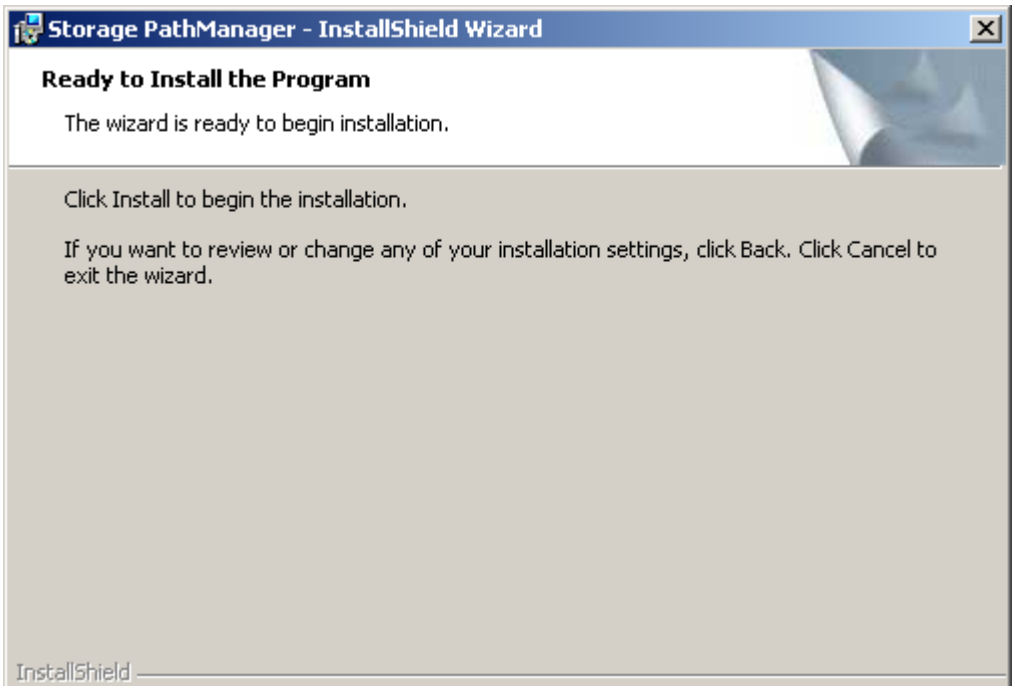

Figure 3-7: Ready to Install the Program

On installing Path Manager, setup program also installs the option "MultiPath I/O" feature of the Windows. You can confirm which features are installed in the Server Manager.

5. If you are going to setup old ft server, the dialog box shown below will be displayed. see “Chapter 7 HBA Registration”.

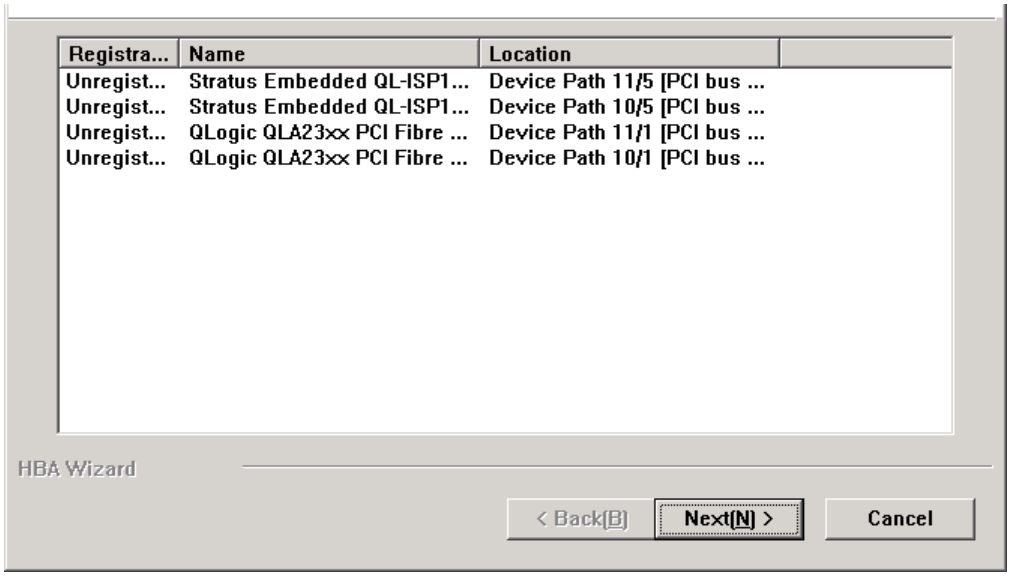

Figure 3-8: Registration Dialog Box

6. The **InstallShield Wizard Completed** dialog box will be displayed. Click “Finish.

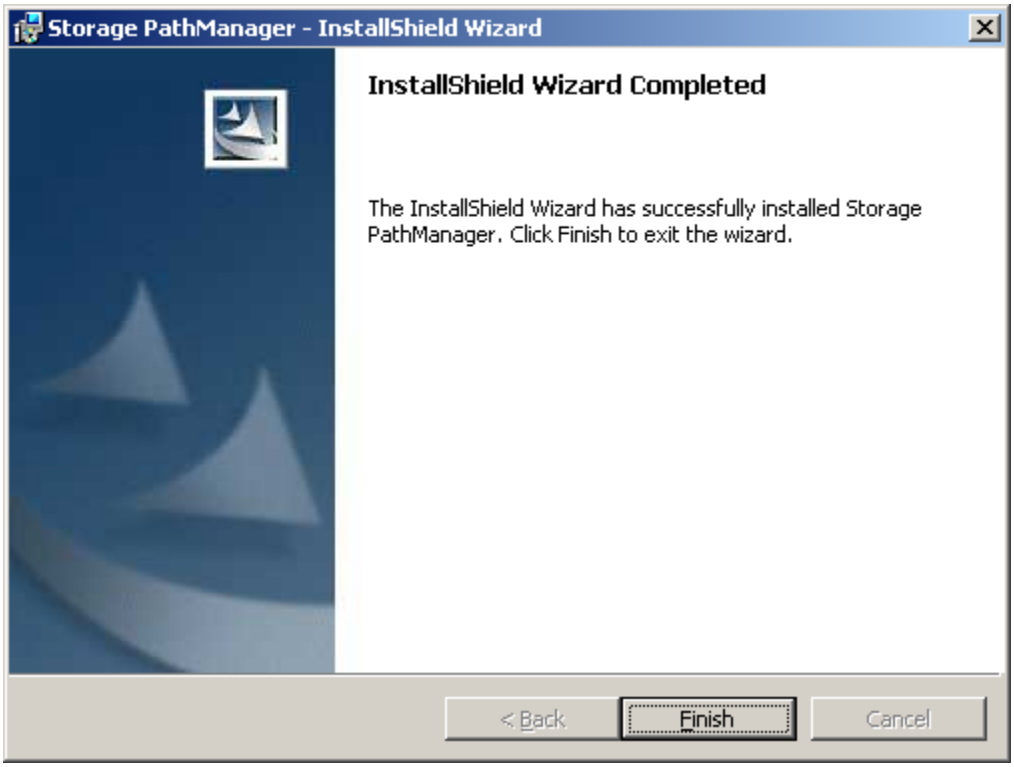

Figure 3-9: InstallShield Wizard Completed

7. The dialog box shown below will be displayed indicating a reboot is necessary. Click “Yes” to reboot the server.

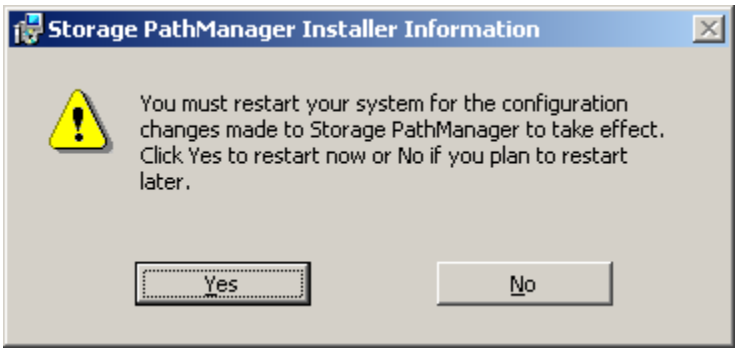

Figure 3-10: Installer Information

NOTE: Do not re-setup Path Manager before reboot the server. Be sure to reboot the server if you re-setup Path Manager.

8. After the server reboots, connect Path Manager for Windows to the server.
   Path Manager automatically recognizes disk subsystems and paths and starts operating.

If your environment is Windows Server 2008 or Windows Server 2008 R2, apply the following MPIO hotfix:

[The MPIO driver fails over all paths incorrectly when a transient single failure occurs in Windows Server 2008 or in Windows Server 2008 R2]:

`http://support.microsoft.com/kb/2522766`

The installation of Path Manager is now complete.

Starting Path Manager

This section will describe the procedures when you start the operations of Path Manager.

Checking operation status

This section describes the method checking if the server and Path Manager for Windows are connected with multiple paths.

Checking with spsadmin.exe (expect old ft server)

Follow the procedures below to check the operation status using spscmd.exe:

1. Activate the command prompt.
2. Input “spsadmin /lun” and press the return key.
3. Confirm the output.

If Path Manager works well in a redundant path configuration, multiple paths are displayed under each **Logical Unit**. The example below shows that there are three logical units and two corresponding paths to the Path Manager for Windows. Refer to your instruction manual for Path Manager for Windows for details.

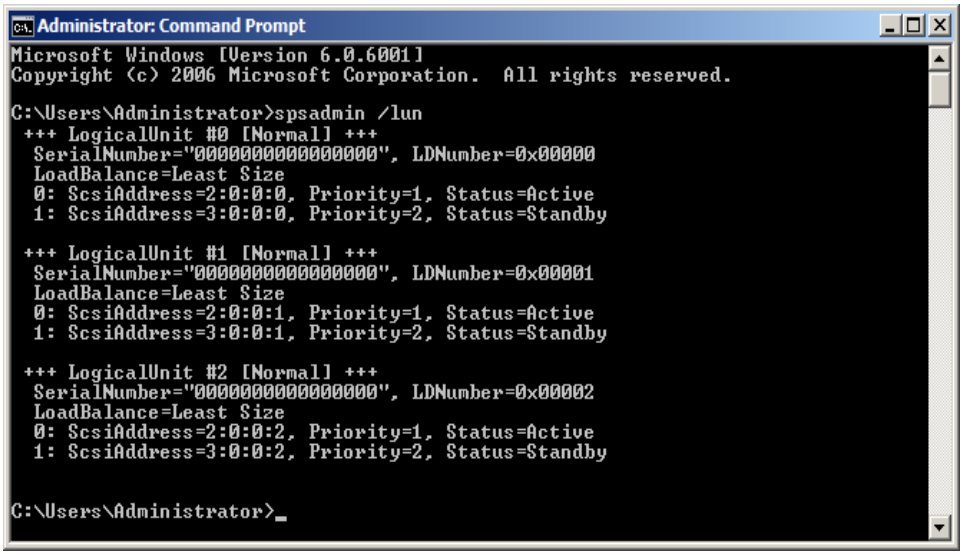

Figure 3-11: Administer Command Prompt

Checking with spscmd.exe (old ft server)

Follow the procedures to check the operation status using spscmd.exe.

1. Activate the command prompt.
2. Input “spscmd –getlun” and press the return key.
3. Confirm the output.

   If Path Manager works well in a redundant path configuration, multiple paths are displayed under each **Logical Unit**. The example below shows that there are three logical units and two corresponding paths to the Path Manager for Windows. Refer to your instruction manual for Path Manager for Windows for details.

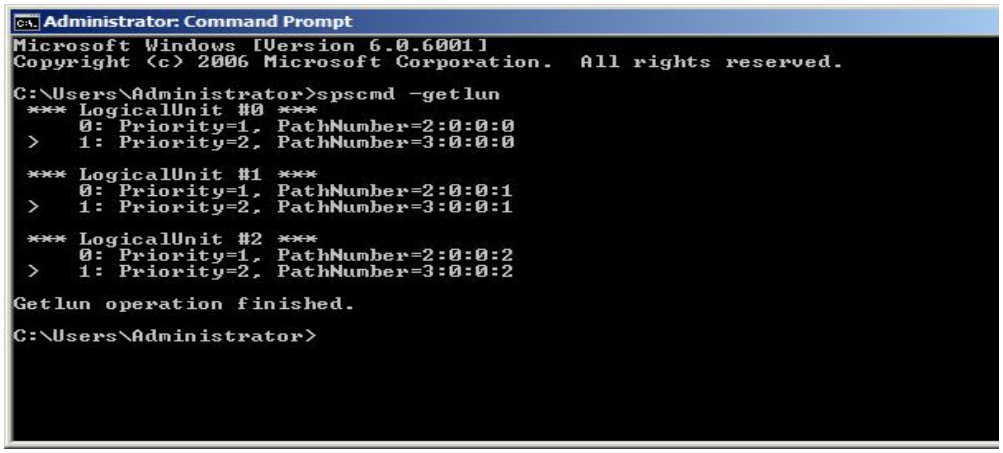

Figure 3-12: Redundant Path Configuration Confirmation

Checking with the Device Manager

Follow the procedures below to check the operation status using the device manager:

1. Execute the device manager.
2. Confirm the devices under the “Disk Drives.”
   If you have a problem in the displayed information, refer to “FAQs and Troubleshooting”
   Confirm the following for the devices under the “Disk Drives.”

- The number of “XXXX Multi-Path Disk Device” is as same as that of LUNs.
- The number of “XXXX SCSI Disk Device” equals to [number of LUNs] x [number of paths]. (SCSI Disk Devices are displayed only on Windows Server 2003.)
  (The above “XXXX” means arbitrary strings.)

Example: 3 LUNs connected with 2 paths on Windows Server 2003.

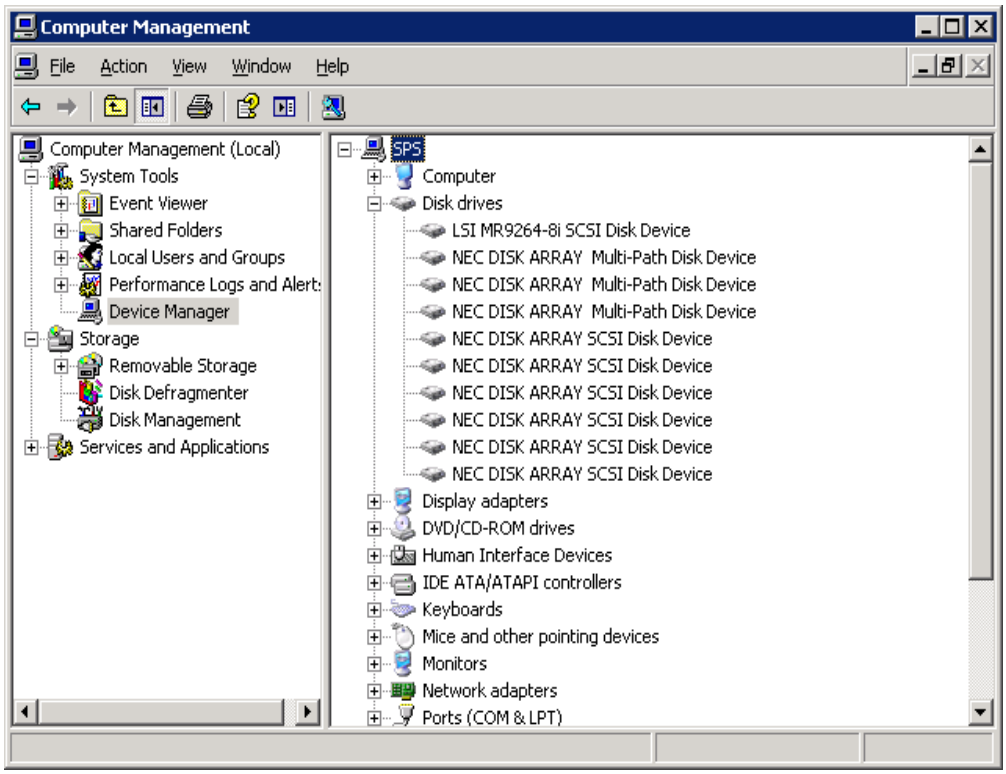

Figure 3-13: Computer Management

Example: Windows Server 2008:

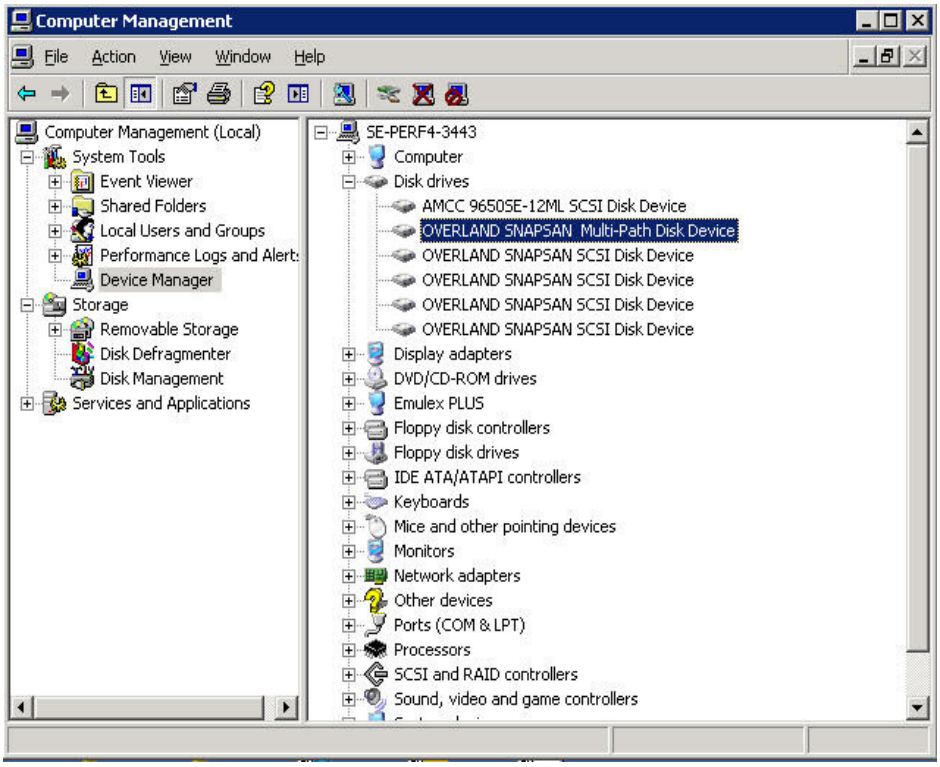

Figure 3-14: Computer Management Application Servers

After confirming Path Manager is installed, and before starting operation, follow the procedure below.

Pre-Operation (expect old ft server)

Before starting operation on Path Manager, follow the procedures below.

1. Activate the command prompt.
2. Input “spsadmin /deletemissing” and press the return key.

If you use storage units and a cluster software (Application Servrs or WSFC) on Windows Server 2008, follow the procedure below.

3. Input "spscmd -setclustermode E" and press the return key.

Preparation before starting operations (old ft server)

Before starting operation on Path Manager, follow the procedures below.

4. Activate the command prompt.
5. Input “spscmd -deletemissing” and press the return key.
6. On the environment without a cluster software, the preparation is now finished.

If you use MSCS on Window Server 2003, follow the procedure below.

7. Input “spscmd -lbmode ::: foa” and press the return key.

8. Input “spscmd -setmscsmode E” and press the return key.

If you use storage units and a cluster software (Application Servrs or WSFC) on Windows Server 2008, follow the procedure below.

9. Input "spscmd -setclustermode E" and press the return key.

Troubleshooting - Post Installation

After you install Path Manager and before starting the operations, the frequently asked questions and answers will be shown in the table below. Refer to the descriptions in the table before making inquiries.

Inquiry (event)	Points to check	Handling
spsadmin /lun is failed. Only one path is visible. Some devices are missing at disk drives in device manager. spscmd -getlun or spscmd –avail option is failed. Only one path is visible. Some devices are missing at disk drives in device manager.	Is the installed HBA driver an appropriate one?	Reinstall the appropriate HBA driver.
	If you use the Path Manager for Windows that can be set the call function, is the cross call function set to Off?	Set the cross call function of Path Manager for Windows to On. Use SnapSAN Manager to change the settings.
	Is Path Manager for Windows connected with the server?	Confirm the connection between Path Manager for Windows and the server
	Is Path Manager for Windows turned on?	Confirm Path Manager for Windows is turned on.
	If you use the FC fabrics, are those fabrics are turned on?	Confirm those FC fabrics are turned on.
	Have you changed the connection between Path Manager for Windows and the server? Is Path Manager for Windows connected with the server?	Confirm the connection between Path Manager for Windows and the server. If you intend to change the connection, execute *"spsadmin /deletemissing" or "spscmd –deletemissing"* after the changes. Confirm the connection between Path Manager for Windows and the server.
	If you use the iSCSI connections, you must configure the iSCSI Initiator. Can you access Path Manager for Windows from the server?	Confirm whether the setting of iSCSI Initiator is correct. Confirm whether ping command to the IP addresses of the port of Path Manager for Windows successes.
	Is the configuration of Access Control of Path Manager for Windows correctly set?	Confirm the configuration of Access Control of Path Manager for Windows. Confirm also the server and Path Manager for Windows connected logically.
	Is the configuration of zoning of the FC switch correctly set?	Confirm the configuration of zoning of the FC switch.
Event ID 280 is generated in the System Event log	Have you changed the connection between Path Manager for Windows and the server? Is Path Manager for Windows connected with the server?	Confirm the connection between Path Manager for Windows and the server. If you intend to change the connection, execute *"spsadmin /deletemissing" or "spscmd –deletemissing"* after the changes. Confirm the connection between Path Manager for Windows and the server.

Setting up the iSCSI Initiator

This section describes how to setup iSCSI Initiator when you use Path Manager with iSCSI models of Path Manager for Windows.

Setup to Windows Server 2003

On Windows Server 2003, iSCSI Initiator is not installed with default. When you use iSCSI connections, iSCSI Initiator must be installed. Before you setup, download the iSCSI Initiator from the Microsoft website.

Installation of iSCSI Initiator

This section will describe how to install iSCSI Initiator.

1. Start the setup program, the windows shown below will be appeared. Click 'Next'.

Figure 3-15: Software Update Installation Wizard

2. Confirm "Initiator Service" and "Software Initiator" is checked, and click "Next".
   Do not check "Microsoft MPIO Multipathing Support for iSCSI".

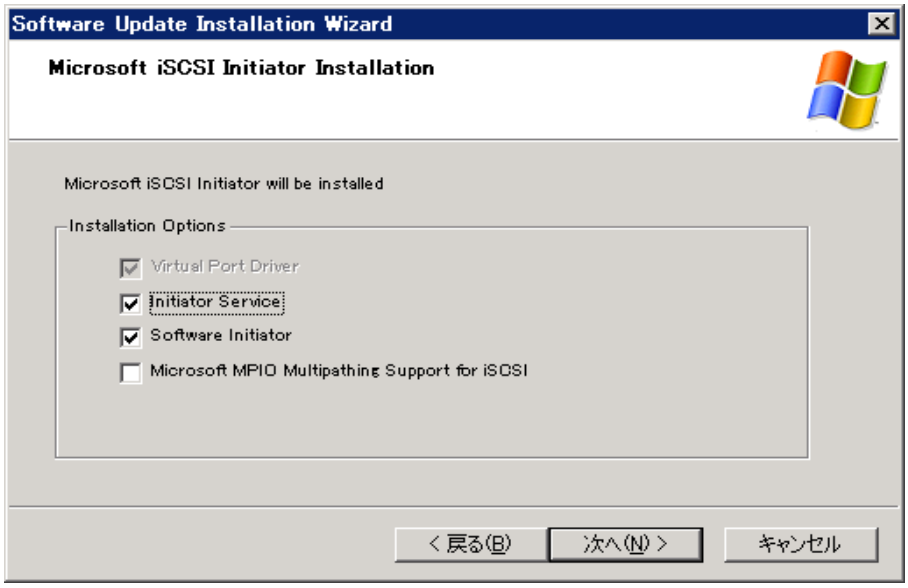

Figure 3-16: iSCSI Initiator Installation

3. Confirm the description of License Agreement. If you agree, check "I Agree" radio button, and click "Next".

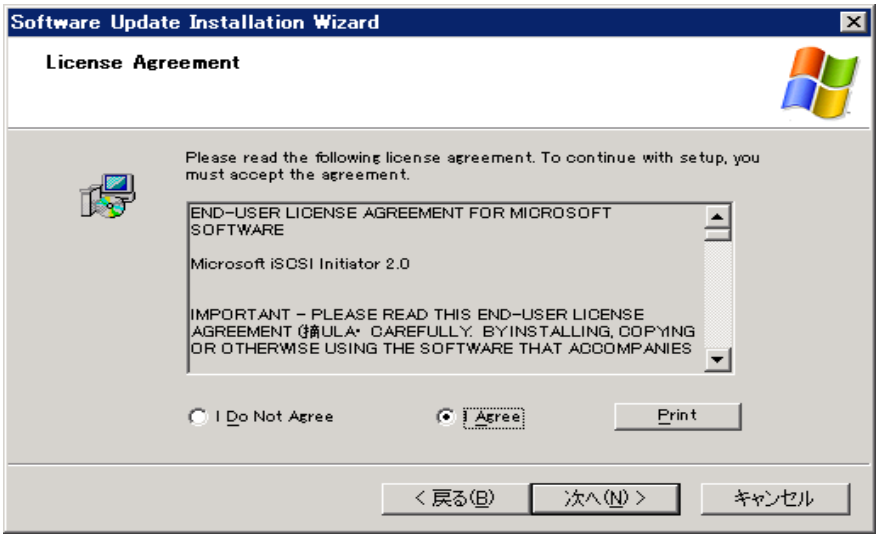

Figure 3-17: License Agreement

The installation will be executed.

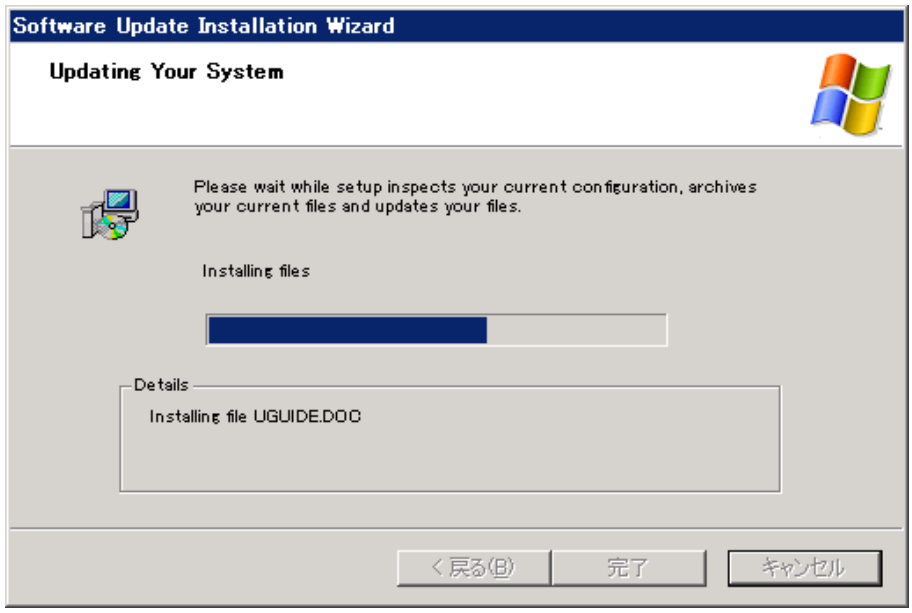

Figure 3-18: System Update

When the installation is finished, the windows shown below will appear. Click “Finish”, and close the setup. The installation of iSCSI Initiator is now finished.

Figure 3-19: Installation Wizard Complete

Configure the iSCSI Initiator

This section will show how to configure the iSCSI Initiator. For the configuration, the procedure is different depending on the model of the storage unit.

NOTE: You must configure the iSCSI Initiator after the Path Manager installation is finished.

1. Connect all the paths between the server installed Path Manager and the storage unit.
2. Set the Initiator Name on the server installed Path Manager, register it with Path Manager.
3. On the Server installed Path Manager, run "iSCSI Initiator" from [Control Panel]. Select "General" tab of iSCSI Initiator Properties Box, and click "Change".

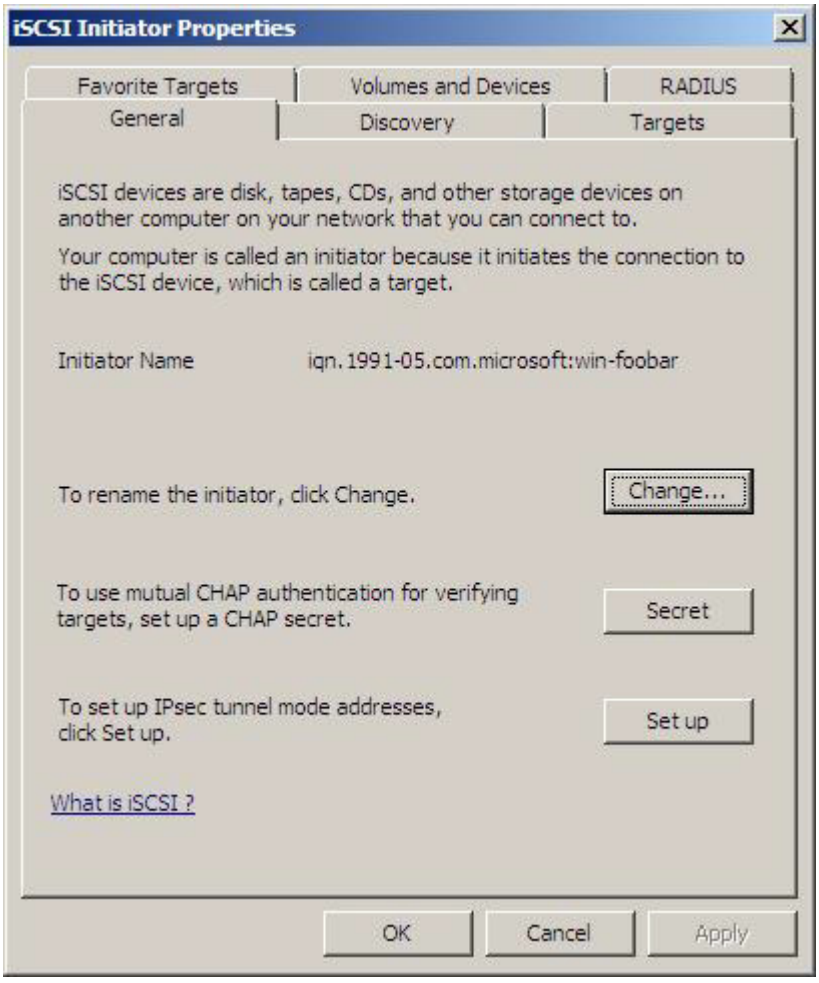

Figure 3-20: General Tab

4. Input the previously registered Initiator Name and click “OK”.

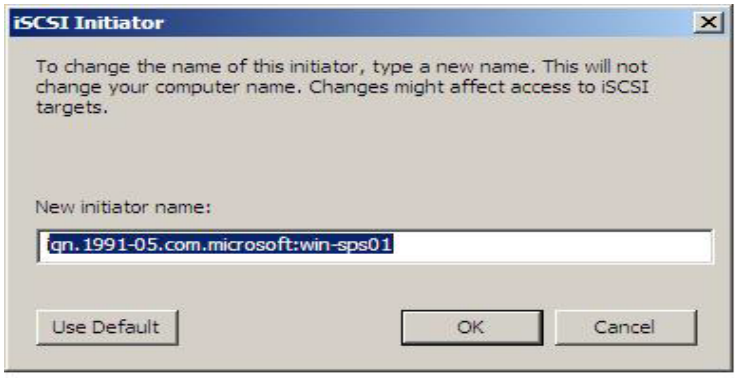

Figure 3-21: New Indicator Name

5. Confirm that the Initiator Name is changed correctly.

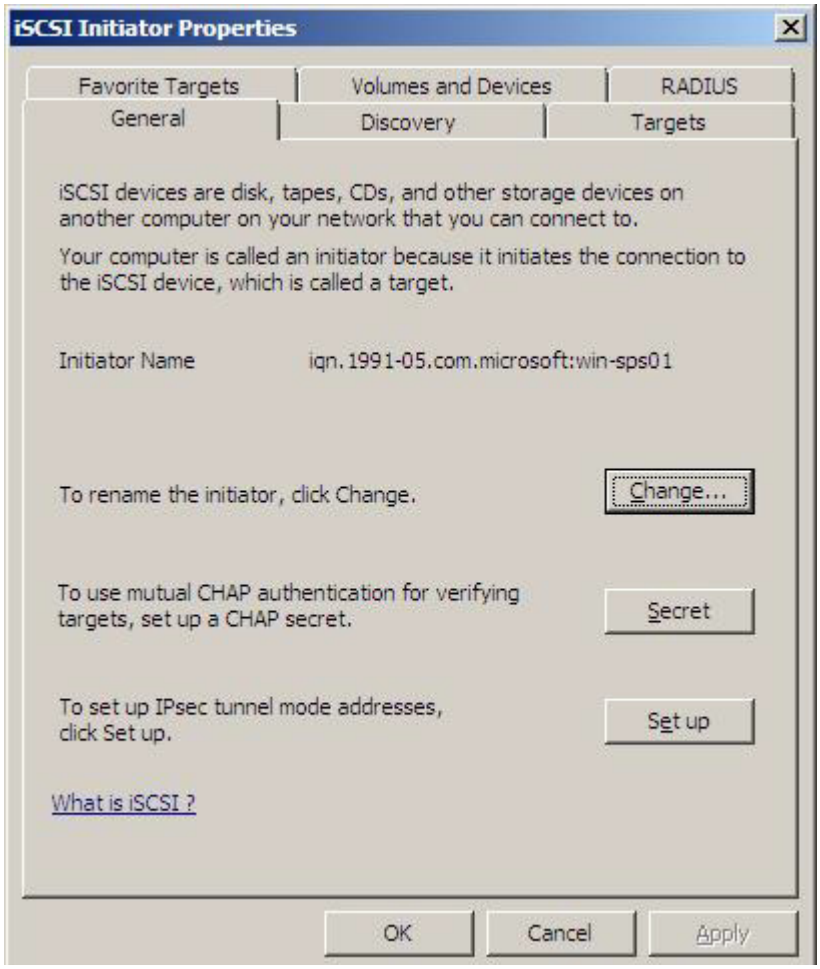

Figure 3-22: Initiator Name Configuration

6. Select “Discovery” tab, and click “Add Portal…” in Target portals group.

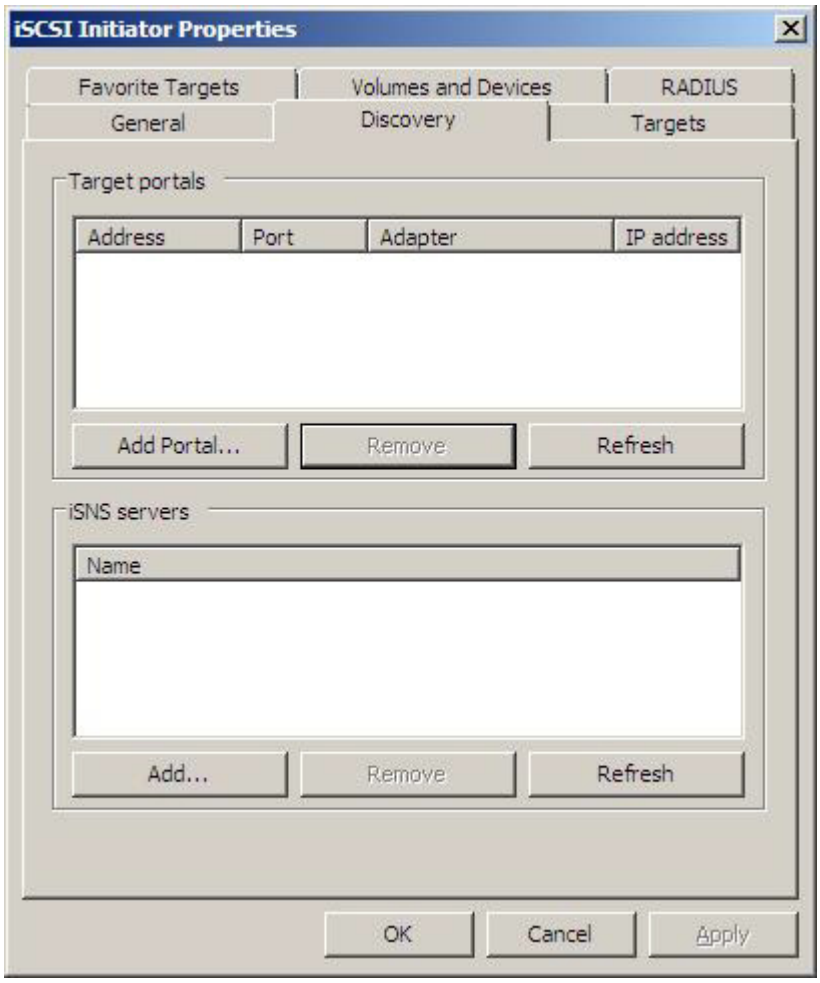

Figure 3-23: Discovery Tab

7. Input one of the IP addresses of the ports on the storage unit connected to the server, and click "OK".

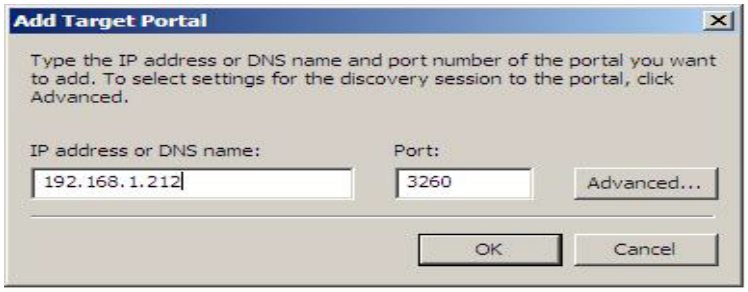

Figure 3-24: IP Address

8. Confirm the specified IP address is added in "Target portals".

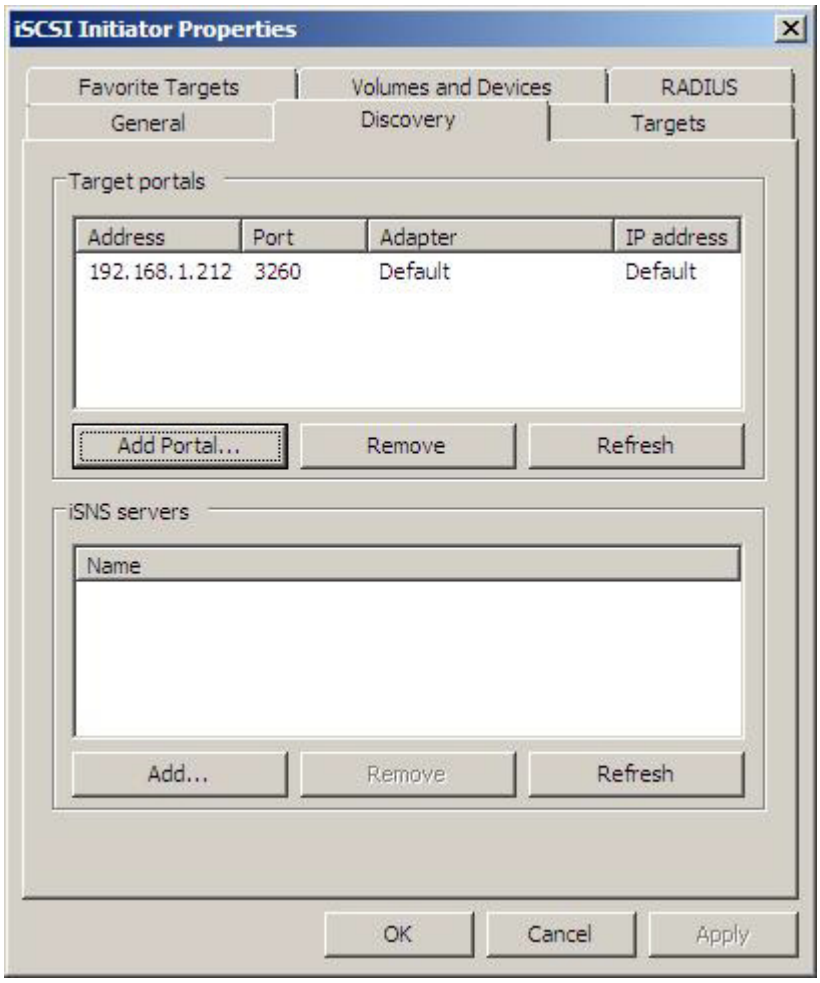

Figure 3-25: Discovery Tab

NOTE: IP address may be wrong if the dialog box shown below appears. In this case, check the connections of LAN cables and IP addresses of the port on the storage unit.

Figure 3-26: Add Target Portal

1. Select the "Targets" tab and click "Log on" with a target is selected.

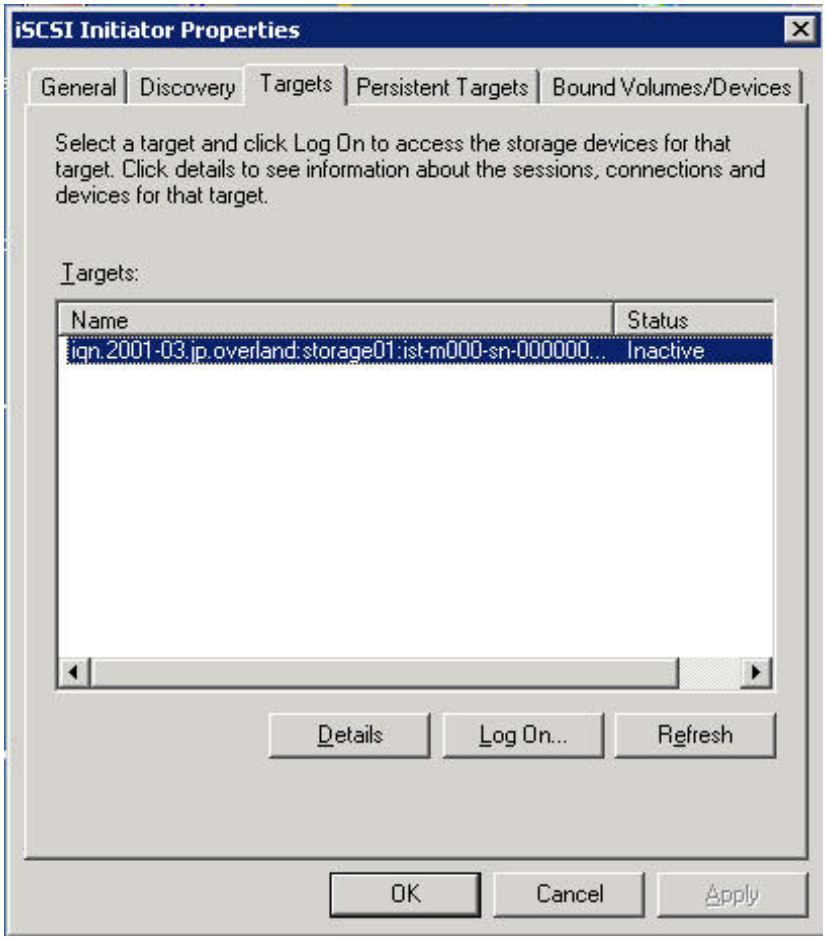

Figure 3-27: Targets Tab

2. Check both checkboxes and click "Advanced…".

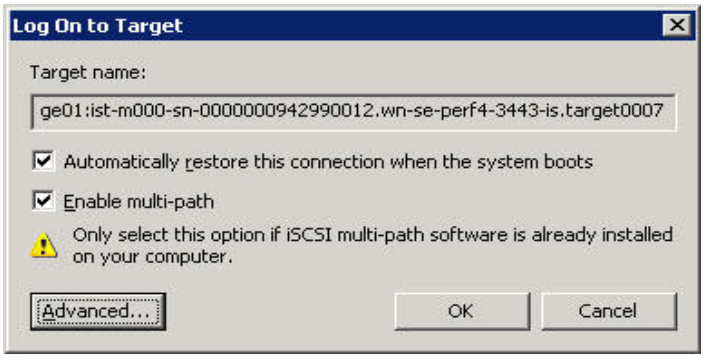

Figure 3-28: Log on to Target

3. "General" tab, choose the IP address specified in procedure 7, and click "OK".

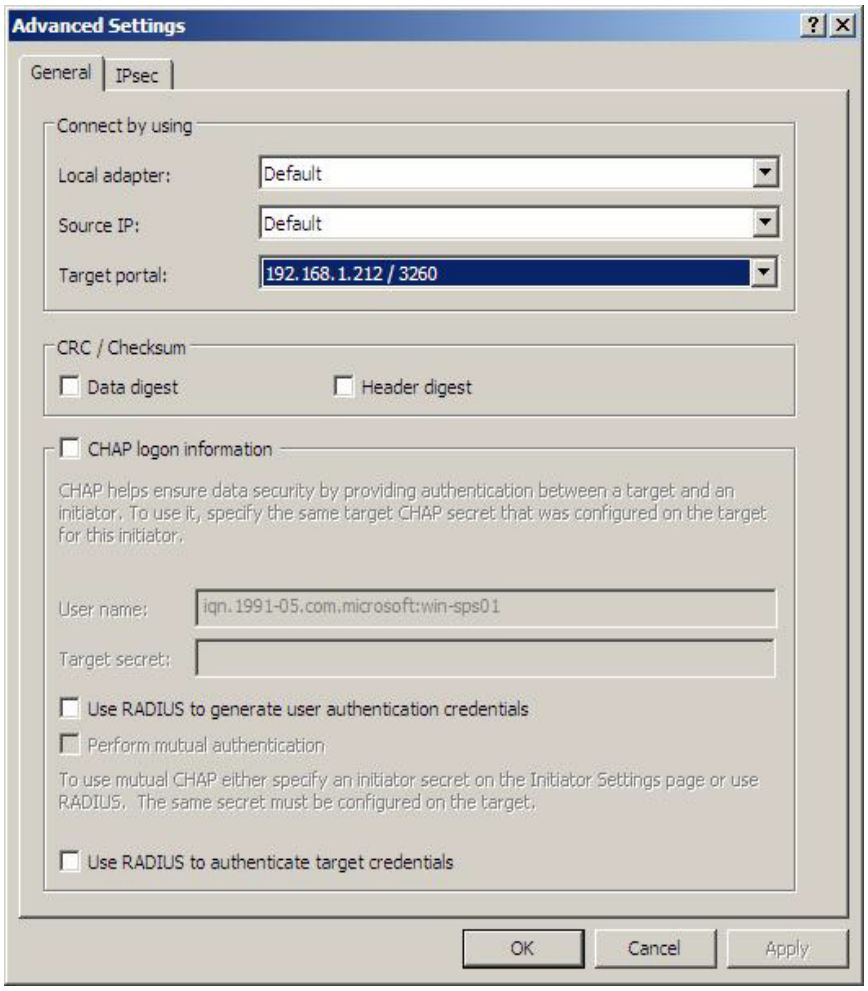

Figure 3-29:

4. Then, return to the "Log On to Target" dialog box. Click "OK".

5. Confirm that the "Status" column of the target is "Connected".

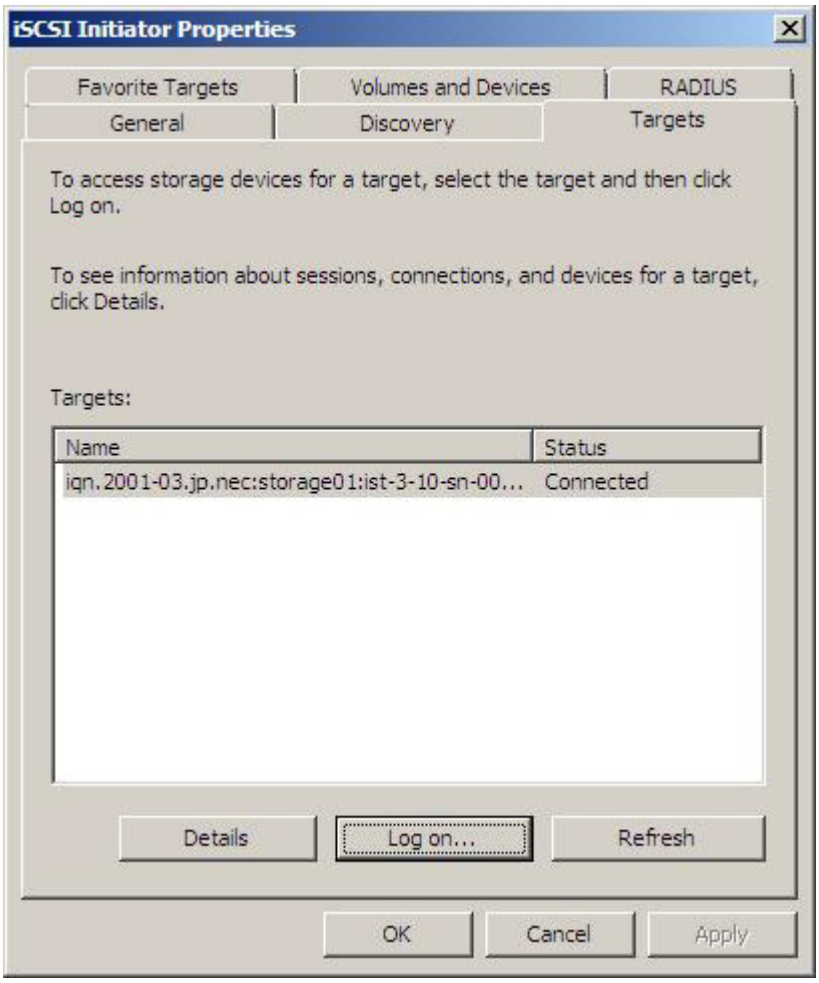

Figure 3-30: Targets Tab

6. Repeat the procedures from 6 to 13 for all the connected ports
7. Reboot the server after the settings for all ports are completed.

Through the above procedures, the OS recognizes each iSCSI path and Path Manager can manage the multipath.

Setup to Windows Server 2008

- On Windows Server 2008, iSCSI Initiator is installed with default. Installation of the iSCSI initiator on the Windows Server 2003 is unnecessary.
- For the configuration, the procedure is different depending on the model of the storage unit.

Configure the iSCSI Initiator

This section will describe how to configure the iSCSI Initiator.

NOTE: You must configure the iSCSI Initiator after the Path Manager installation is finished.

1. Connect all the paths between the server installed Path Manager and the storage unit.
2. Set the Initiator Name on the server installed Path Manager, register it with Path Manager.
3. On the Server installed Path Manager, run “iSCSI Initiator” from [Control Panel]. Select “General” tab of iSCSI Initiator Properties Box, and click “Change”.

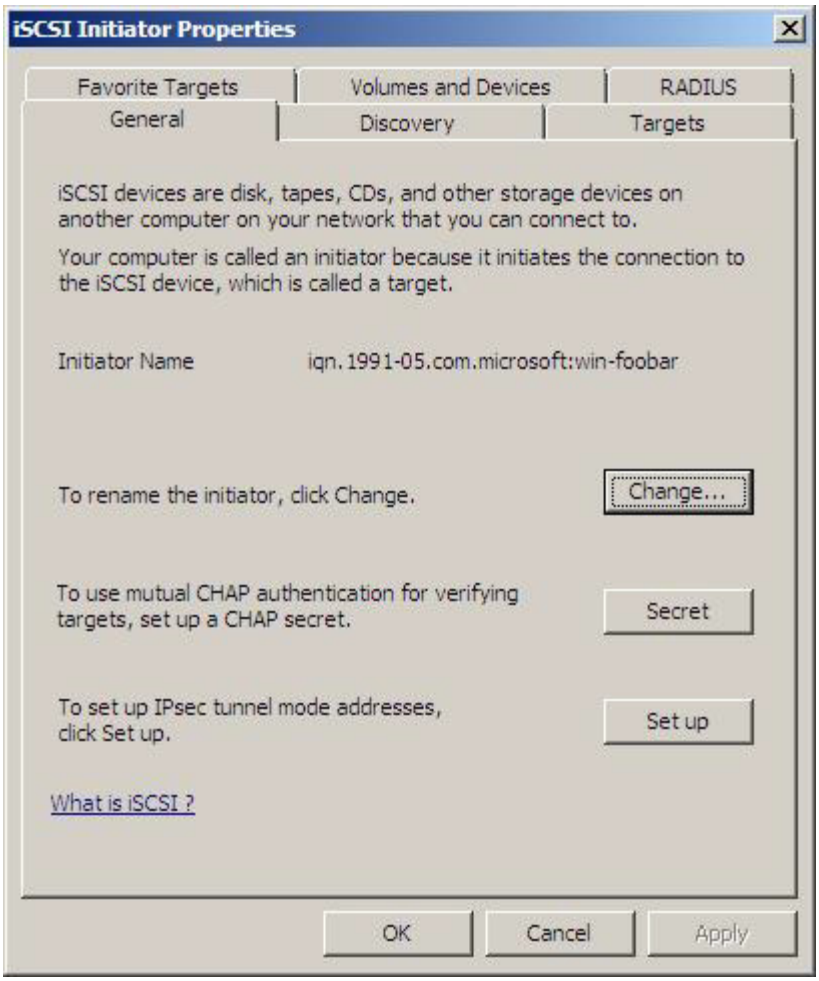

Figure 3-31: General Tab

4. Input the previously registered Initiator Name, and click “OK”.

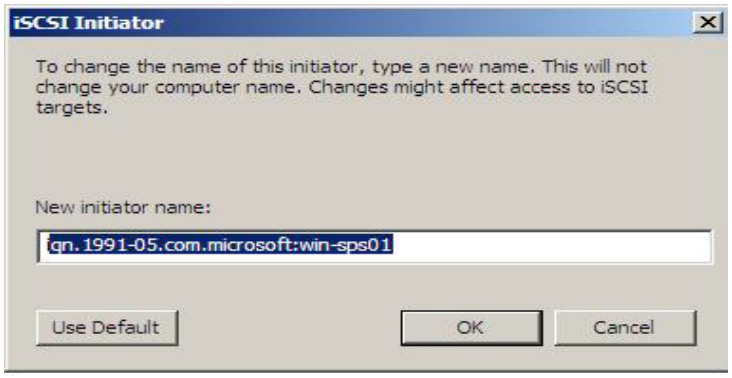

Figure 3-32: Initiator Name

5. Confirm that the Initiator Name is changed correctly.

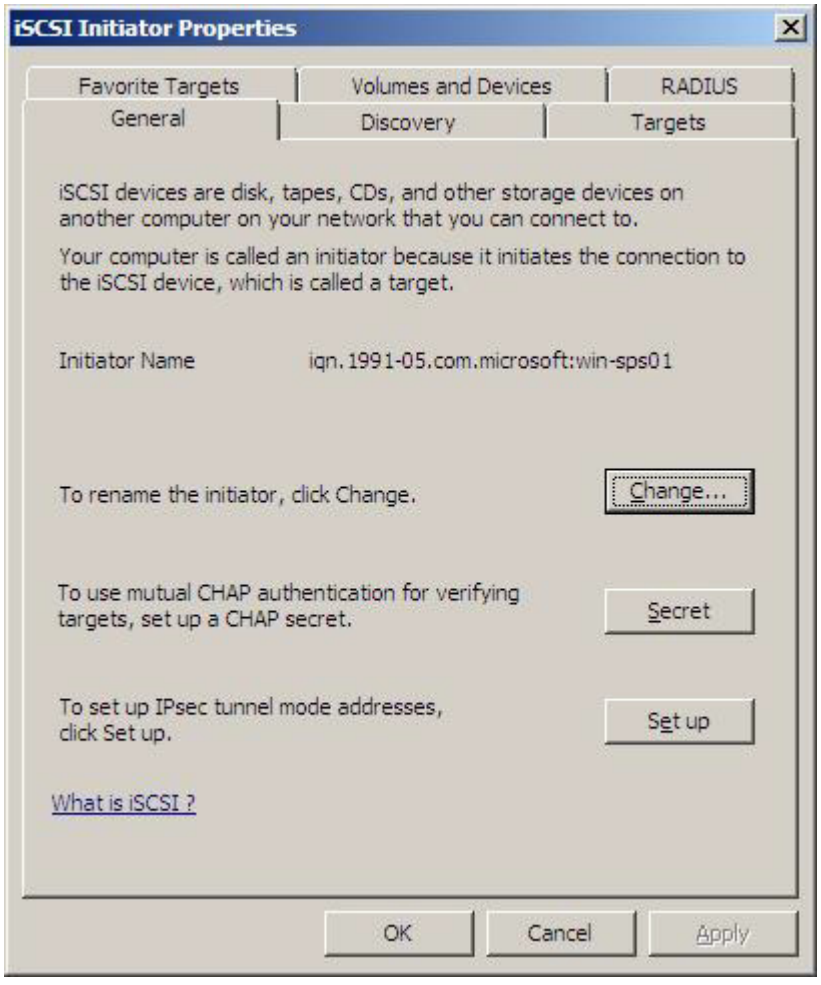

Figure 3-33: Initiator Name Shown

1. Select “Discovery” tab, and click “Add Portal…” in Target portals group.

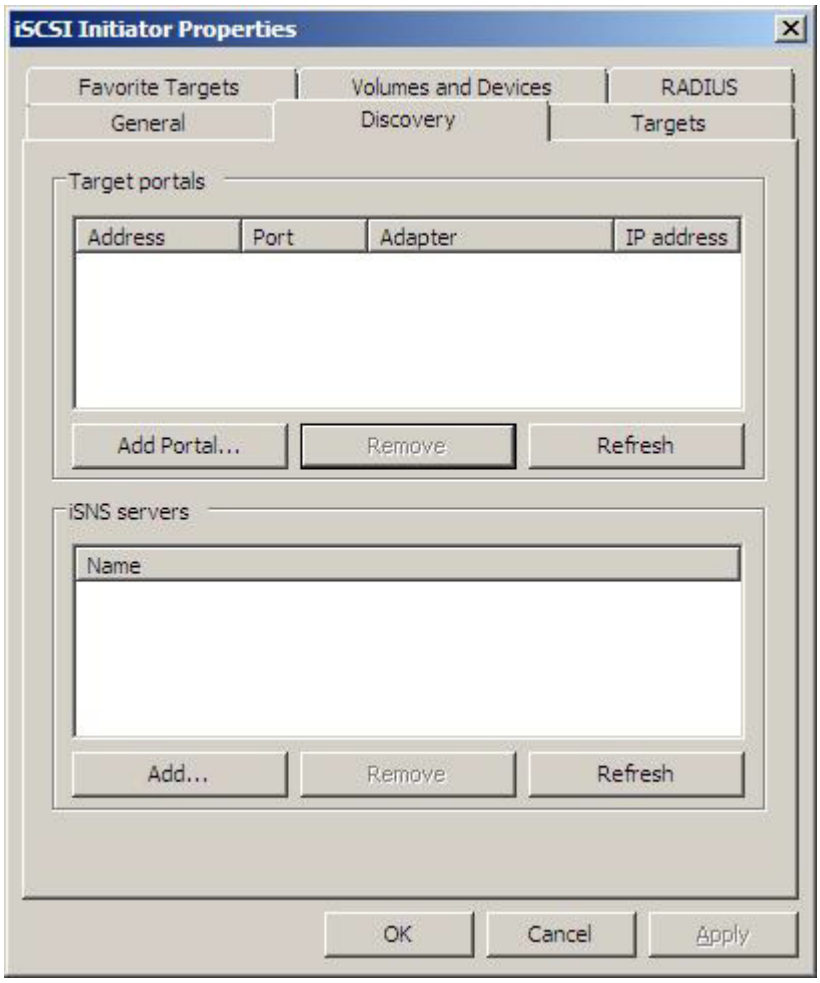

Figure 3-34: Discovery Tab

2. Input one of the IP address of the ports on the storage unit connected to the server, and click "OK".

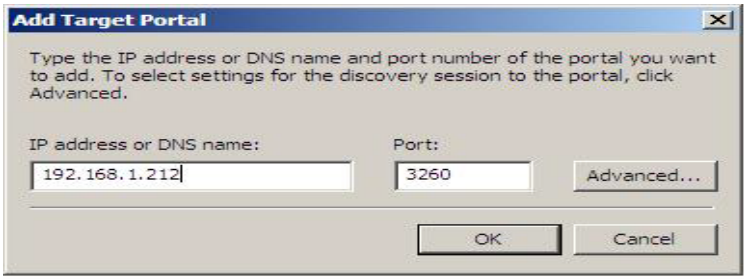

Figure 3-35: Add IP Address

3. Confirm the specified IP address is added in "Target portals".

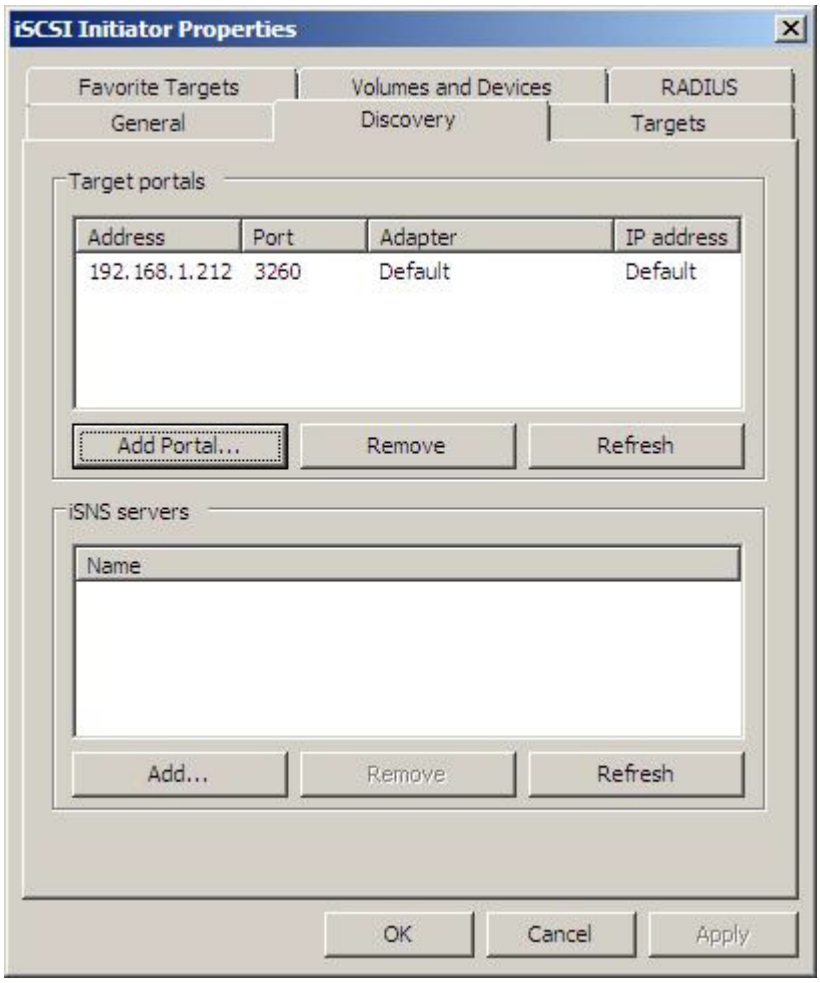

Figure 3-36: Target Portal Confirmation

NOTE: IP address may be wrong if the dialog shown below is appeared. In this case, check the connections of LAN cables and IP addresses of the port on the storage unit.

4. Select the "Targets" tab and click "Log on" with a target is selected.

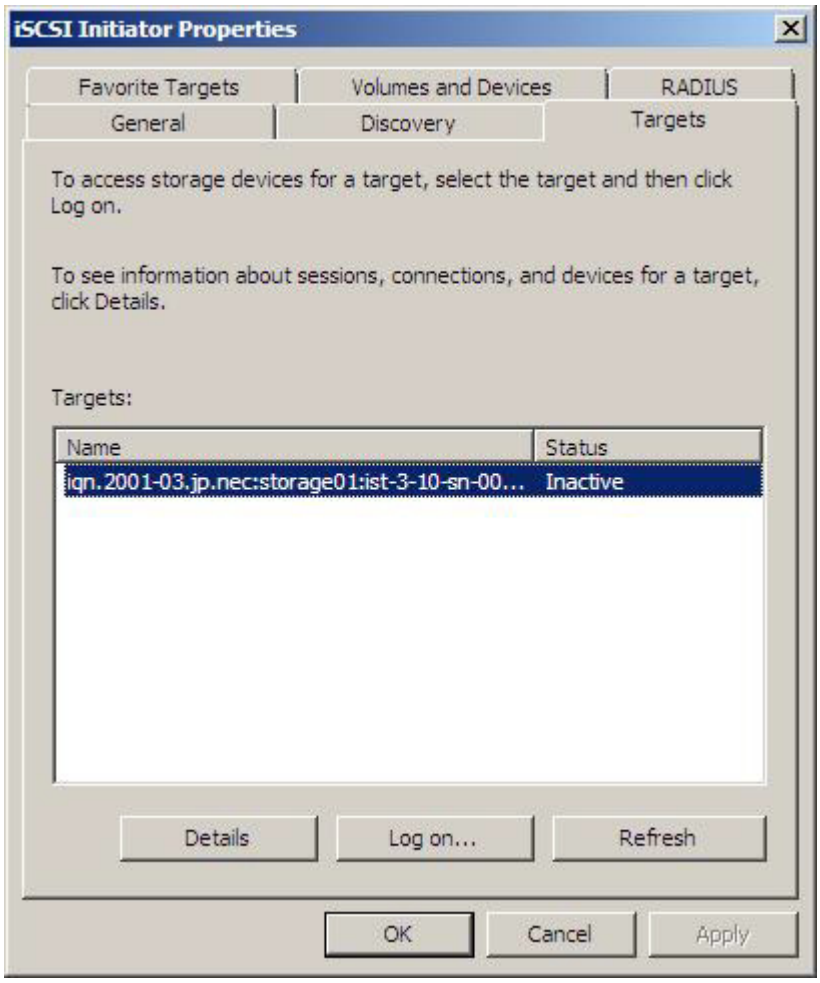

Figure 3-37: Target Name

5. Check both checkboxes and click "Advanced…".

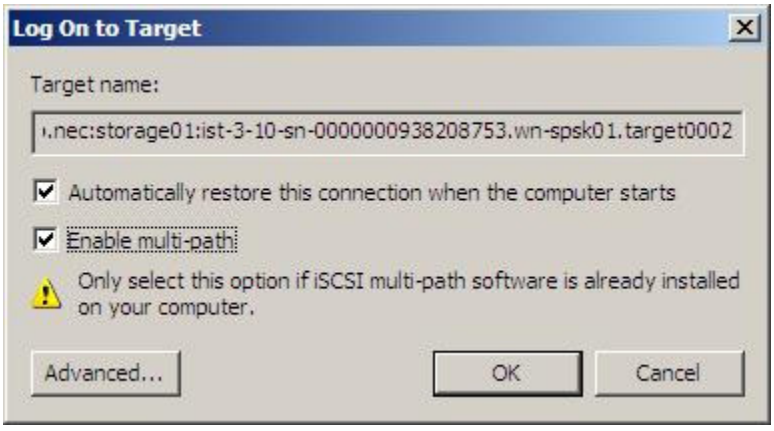

Figure 3-38: Target Options Checked

6. In "General" tab, choose the IP address specified in procedure 7, and click "OK".

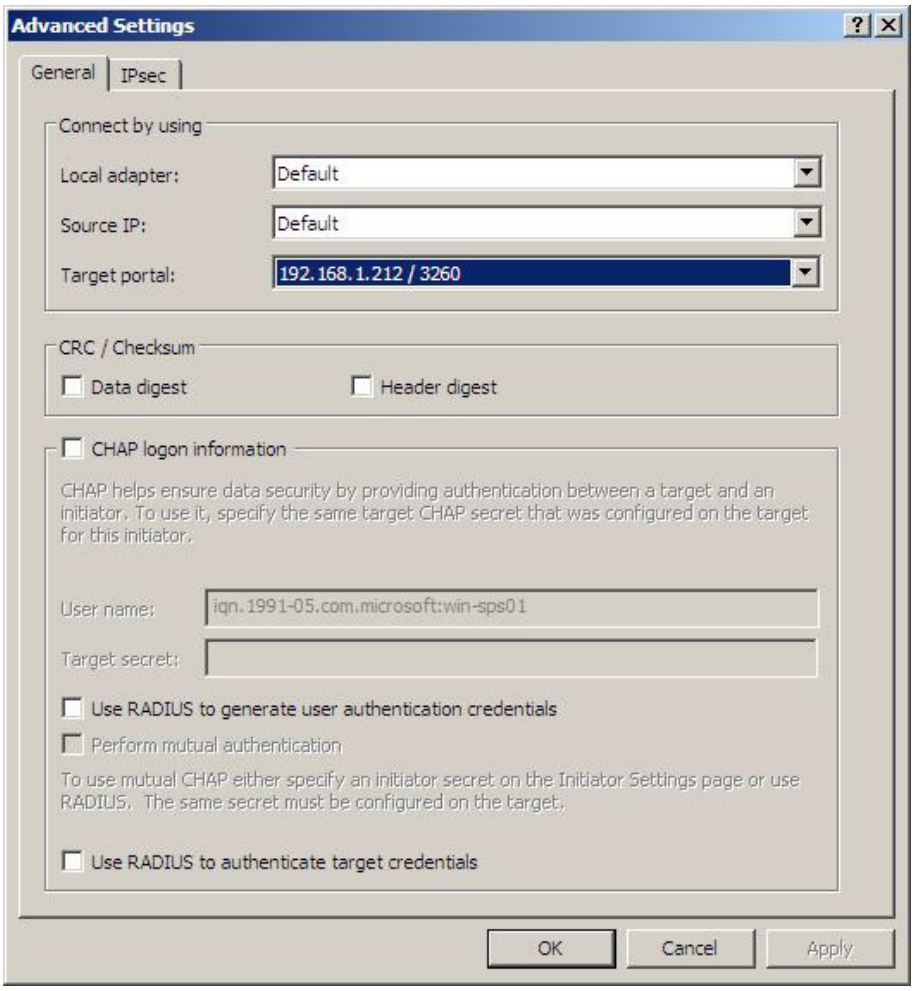

Figure 3-39: Target Portal

7. Then, return to the "Log On to Target" dialog box. Click "OK".
8. Confirm that the "Status" column of the target is "Connected".

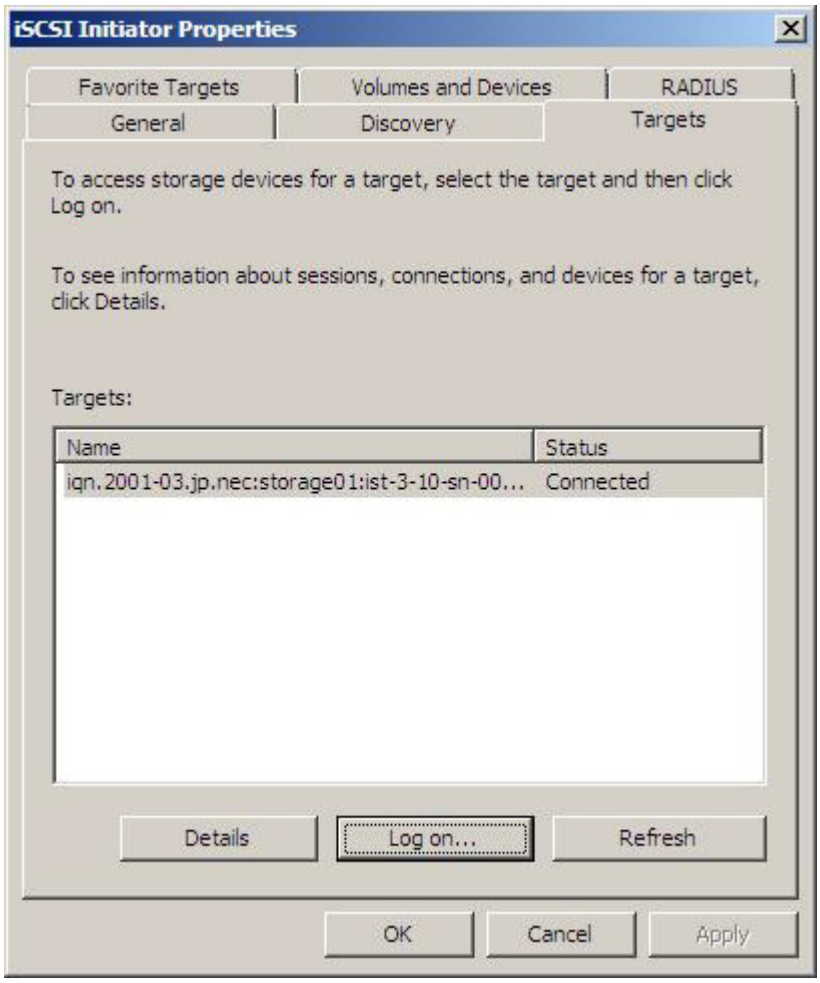

Figure 3-40: Targets Status

9. Repeat the procedures from 6 to 13 for all the connected ports.
10. Reboot the server after the settings for all ports are completed.

Through the above procedures, the OS recognizes each iSCSI path and Path Manager can manage the multipath.

Windows Server 2008 R2 Setup

On Windows Server 2008 R2, iSCSI Initiator is installed with default. So the installation of the iSCSI initiator such you have to do on Windows Server 2003 is unnecessary.

For the configuration, the procedure is different depending on the model of the storage unit.

Configure the iSCSI Initiator

This section will show how to configure the iSCSI Initiator.

NOTE: You must configure the iSCSI Initiator after the Path Manager installation is finished.

1. Connect all the paths between the server installed Path Manager and the storage unit.
2. Set the Initiator Name on the server installed Path Manager, register it with Path Manager. Refer to the manual of Path Manager for the details.
3. On the Server installed Path Manager, run “iSCSI Initiator” from [Control Panel]. Select “Configuration” tab of iSCSI Initiator Properties Box, and click “Change…”.

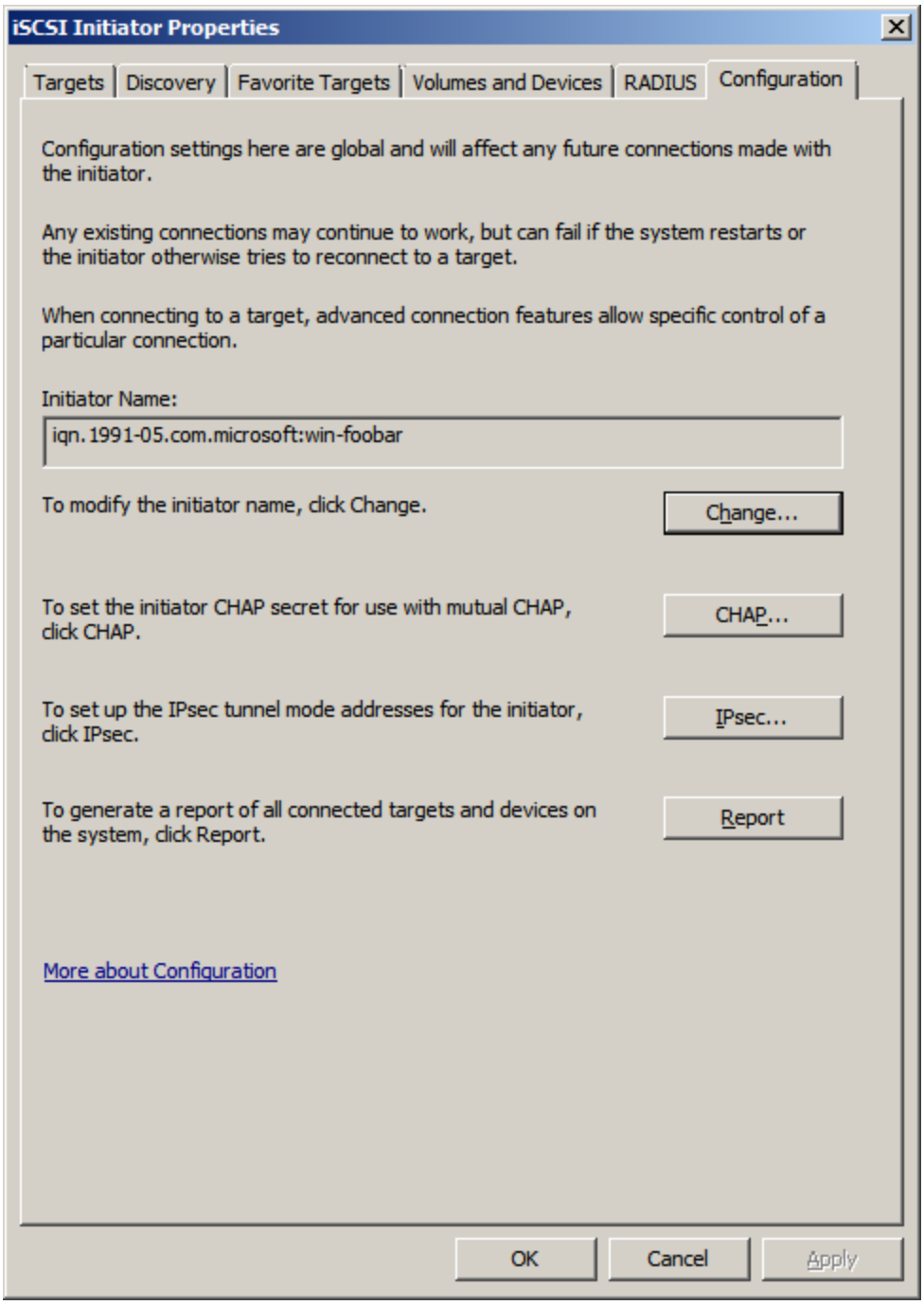

Figure 3-41: Initiator Name Confirmation

4. Input the Initiator Name registered at procedure 2, and click “OK”.

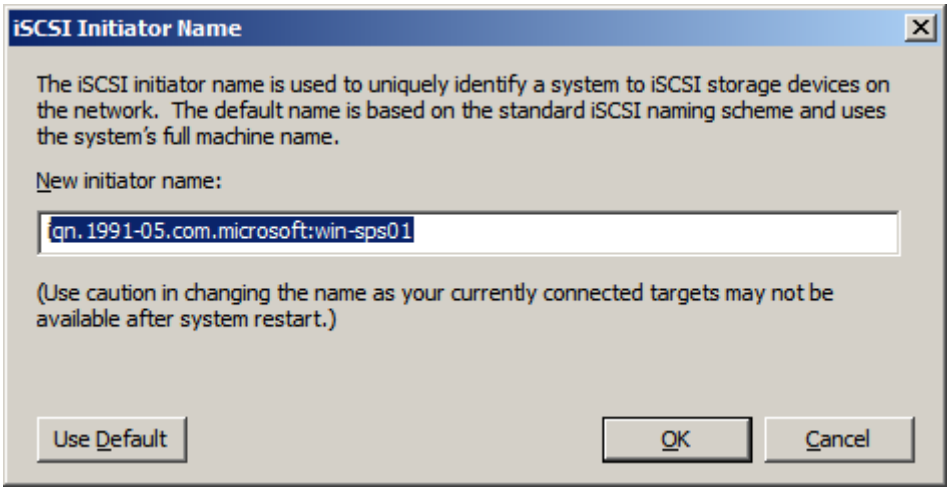

Figure 3-42: Initiator Name

5. Confirm that the Initiator Name is changed correctly.

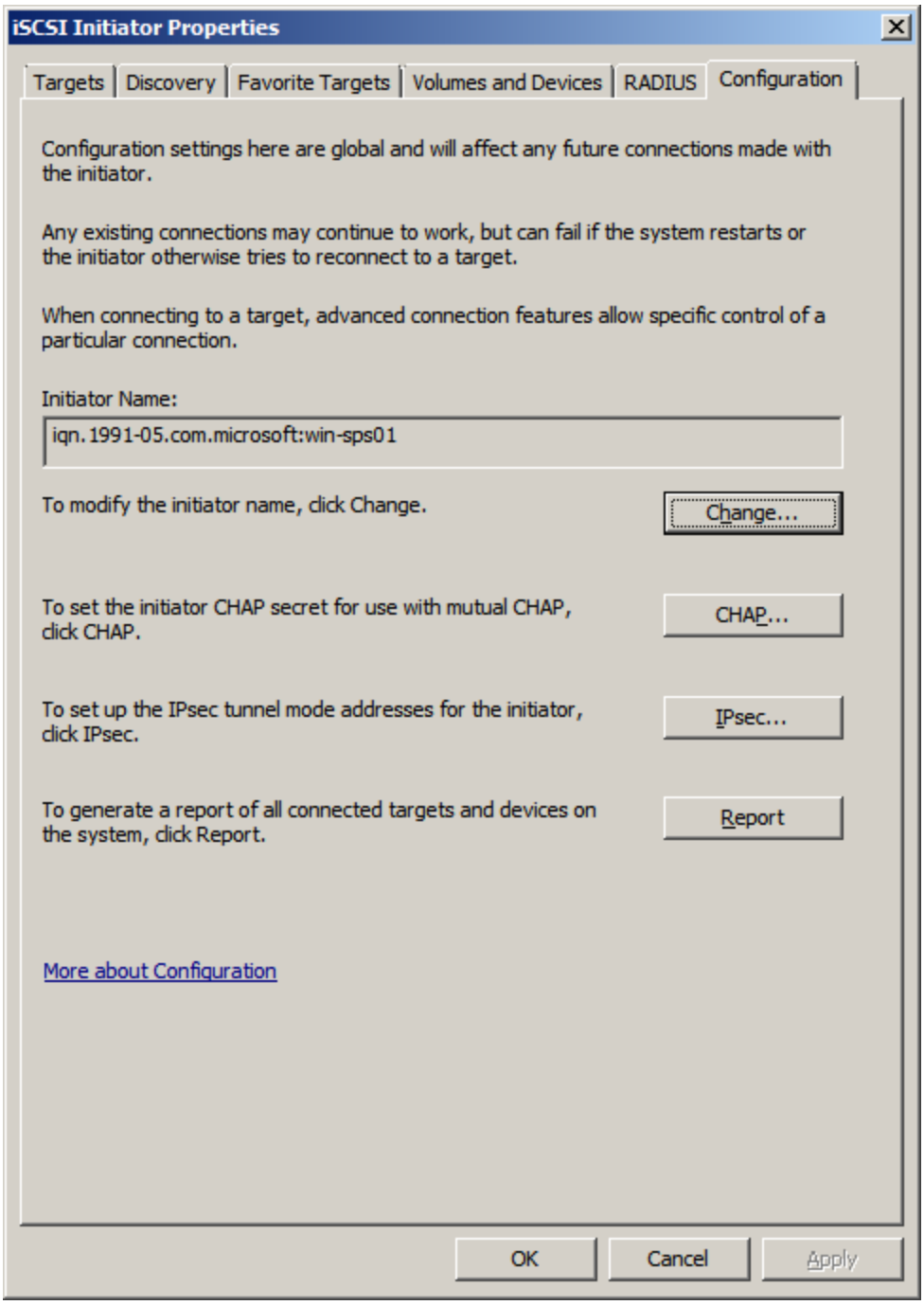

Figure 3-43: Configuration Tab

6. Select “Discovery” tab, and click “Discover Portal…” in Target portals group.

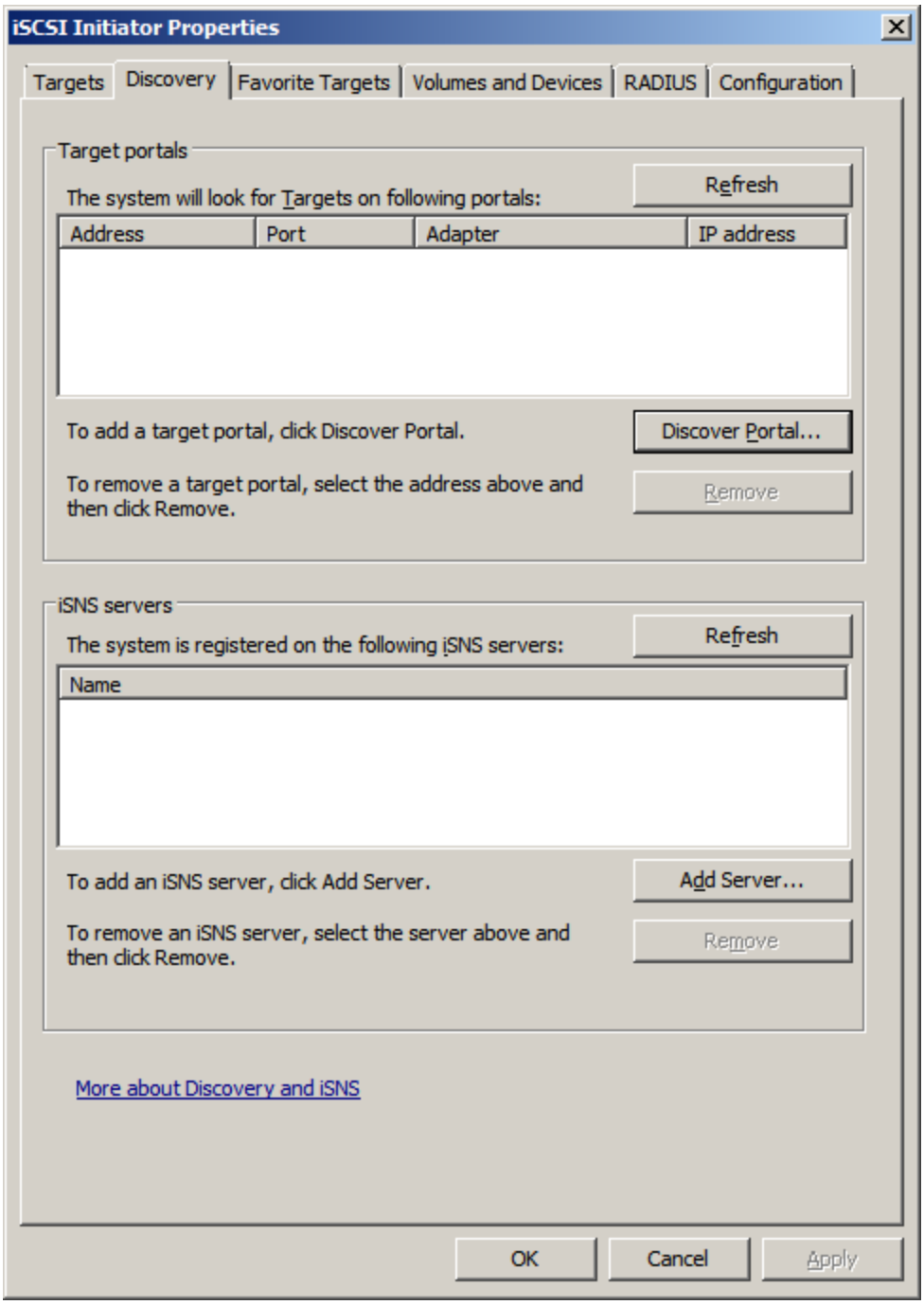

Figure 3-44: Discovery Tab

7. Input one of the IP address of the ports on the storage unit connected to the server, and click "OK".

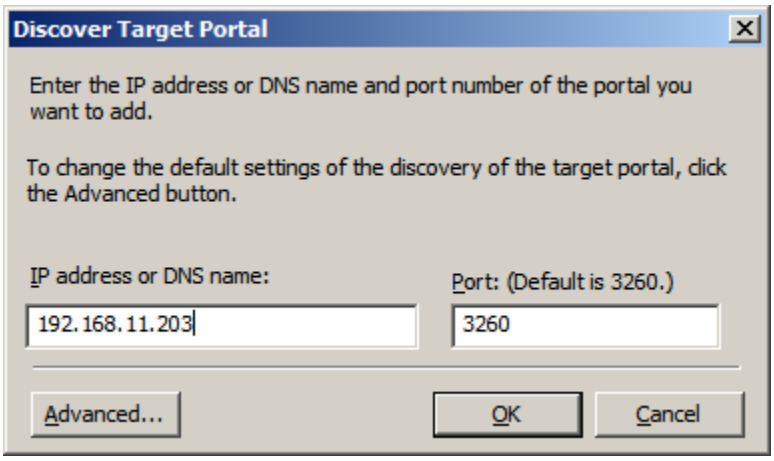

Figure 3-45: Add IP Address and Port

8. Confirm the specified IP address is added in "Target portals".

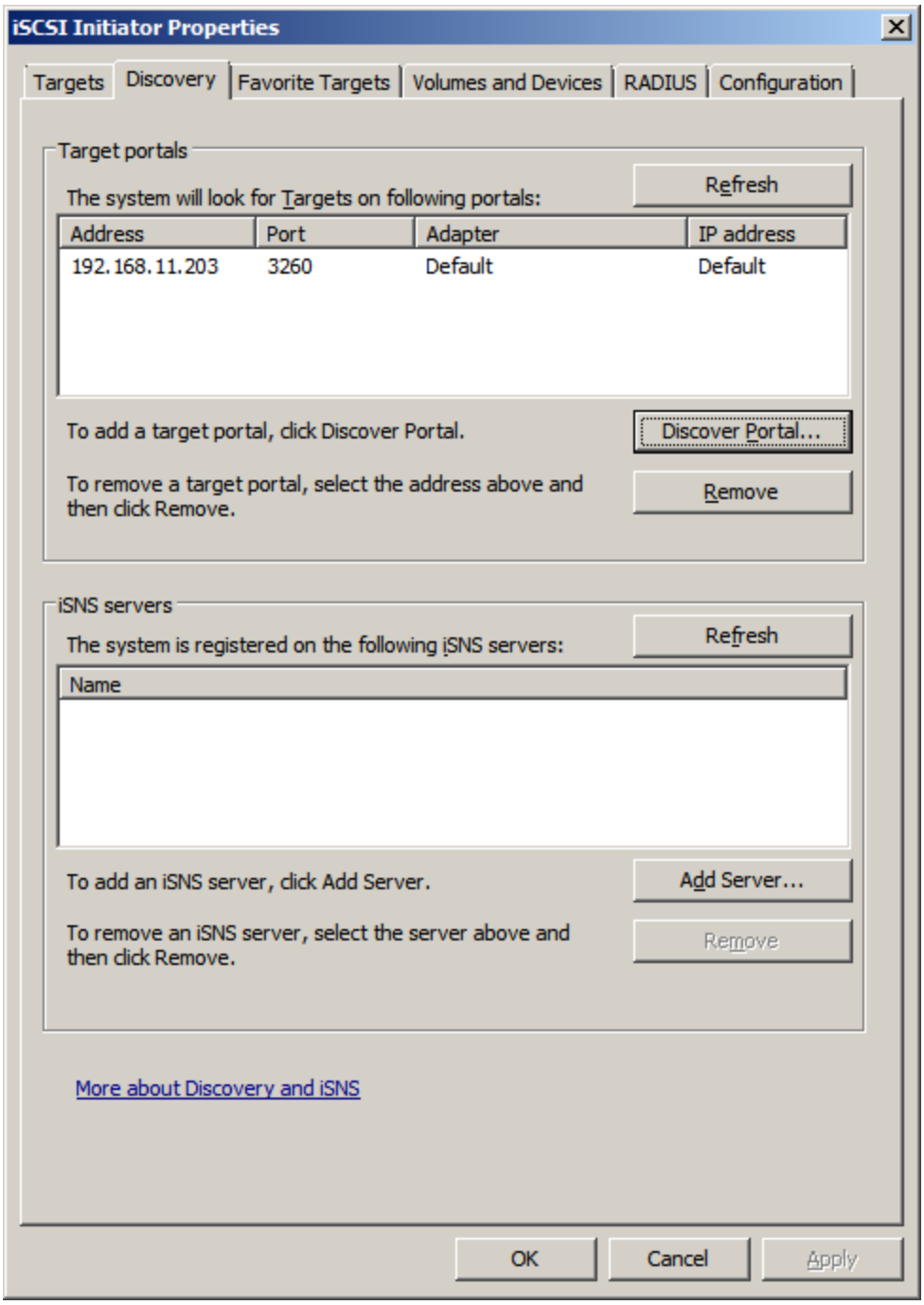

Figure 3-46: IP Address and Port Confirmation

NOTE: IP address may be wrong if the dialog shown below is appeared. In this case, check the connections of LAN cables and IP addresses of the port on the storage unit.

Figure 3-47: Connection Failed Message

9. Select the "Targets" tab and click "Connect" with a target is selected.

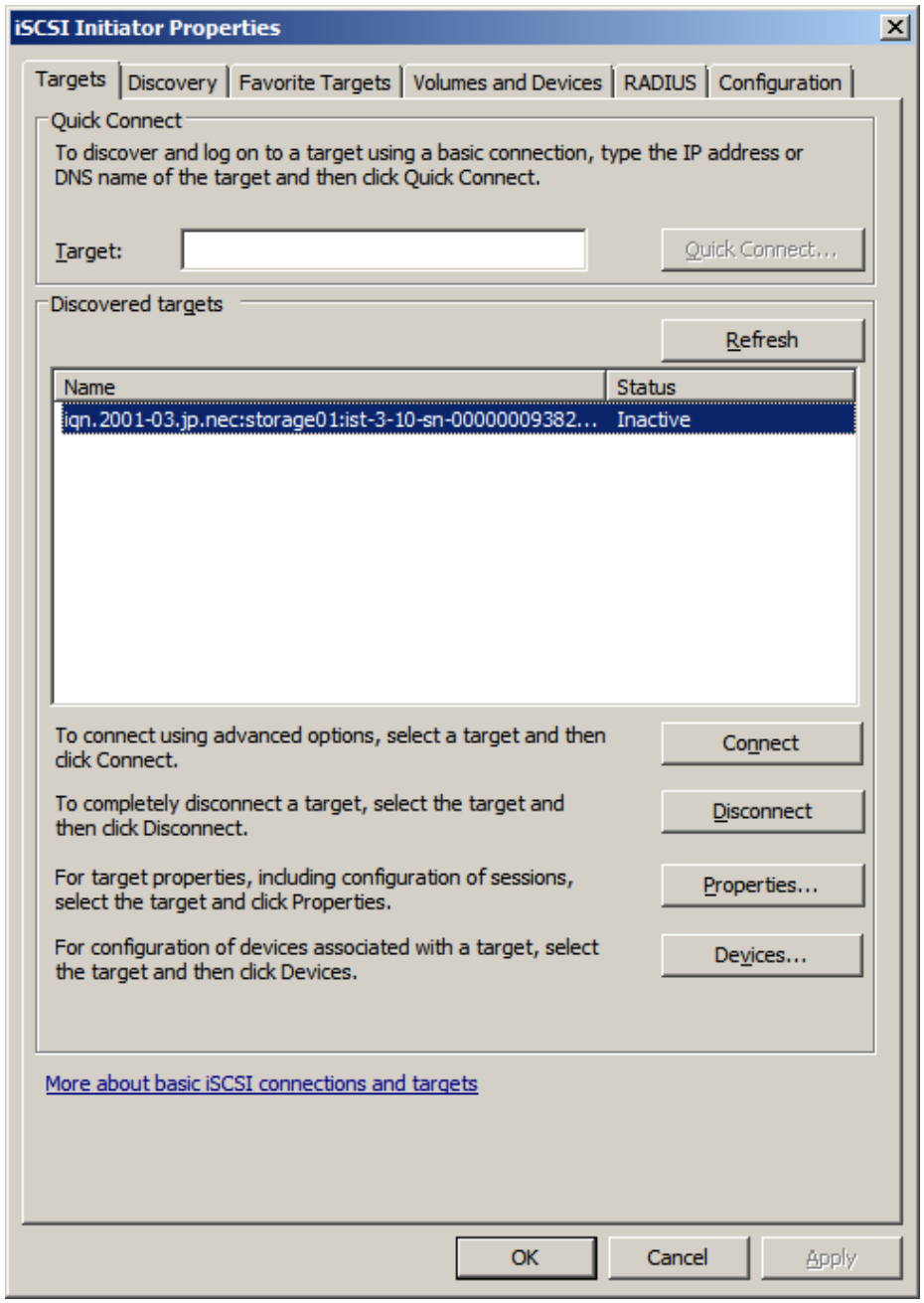

Figure 3-48: Discovered Targets

1. Check both checkboxes and click "Advanced…".

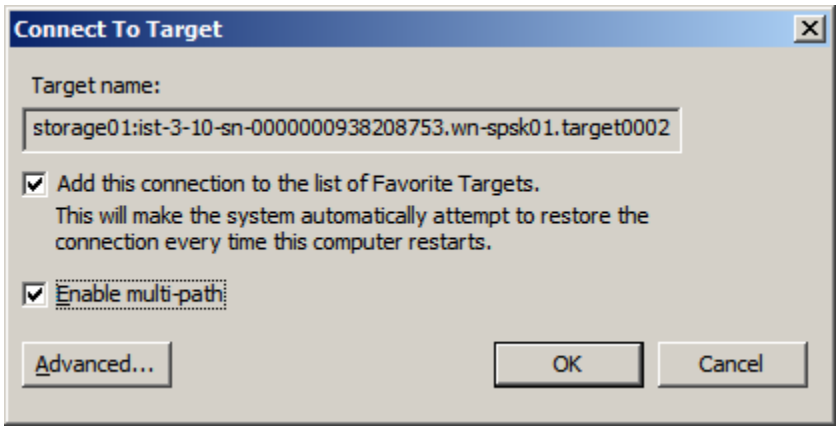

Figure 3-49: Connect to Target

2. In "General" tab, choose the IP address specified in procedure 7, and click "OK".

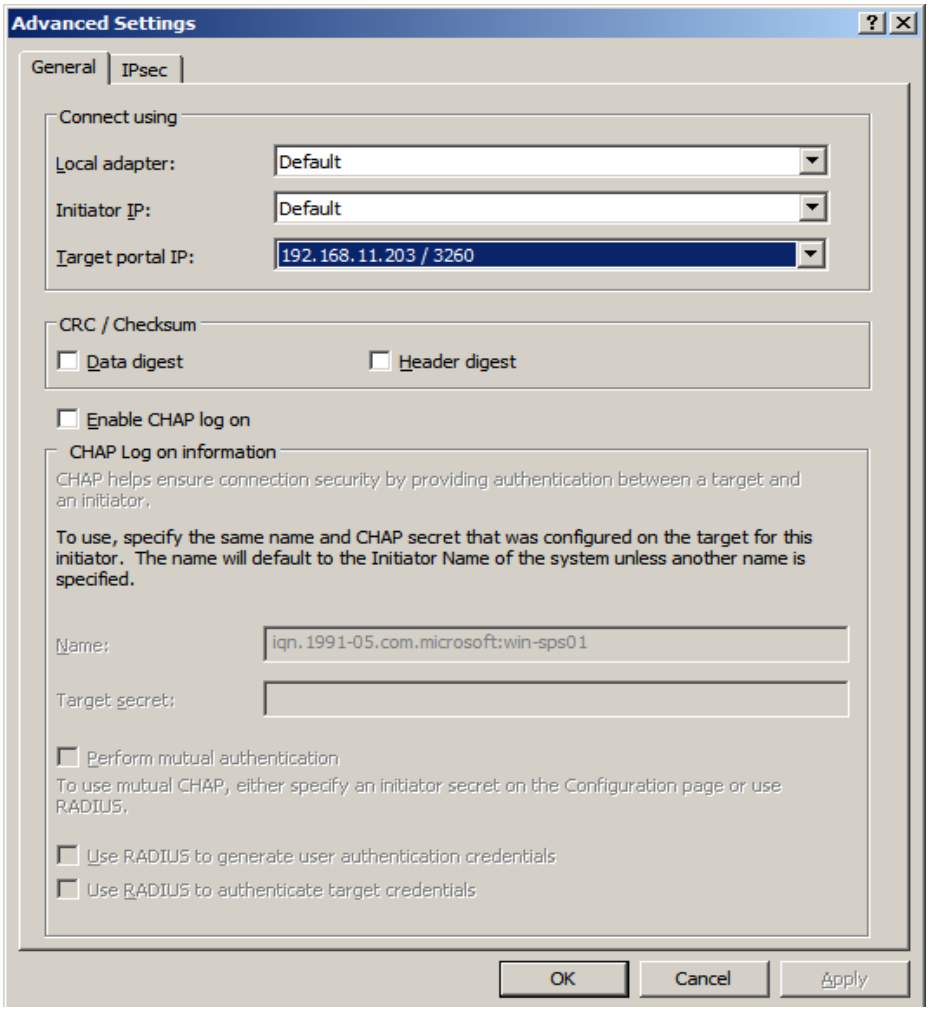

Figure 3-50: Target Portal IP

3. Then, return to the "Log On to Target" dialog box. Click "OK".

4. Confirm that the "Status" column of the target is "Connected".

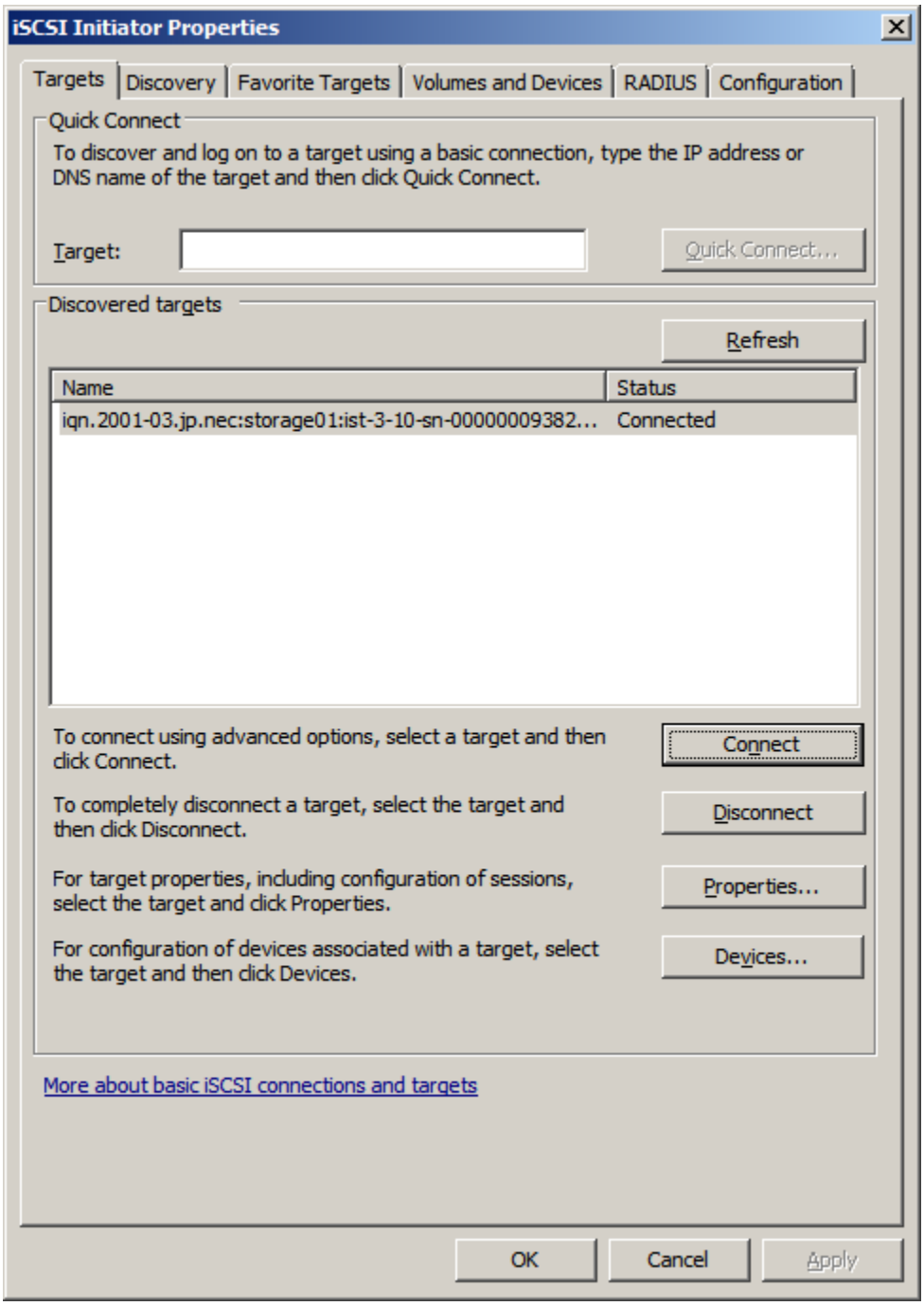

Figure 3-51: Discovered Targets Status

5. Repeat the procedures from 6 to 13 for all the connected ports.
6. Reboot the server after the settings for all ports are completed.

Through the above procedures, the OS recognizes each iSCSI path and Path Manager can manage the multipath.

Setting up Path Manager to Cluster Environment

This section shows how to setup Path Manager to cluster environment. Path Manager can be used with application servers, MSCS and WSFC.

Setting Up To Application Servers Environment

This section shows how to setup Path Manager to application servers environment. About the detailed operations of application servers see a manual of application servers

CAUTION: If you setup Path Manager to application servers environment, you need to stop the cluster completely.

NOTE: When adding HBA to the server, it's necessary to establish filtering of EXPRSSCLUSTER to added HBA. Refer to a system building guide of application servers about setting change in application servers.

Installation to Application Servers X1.0/X2.0/X2.1/X3.0 Environment

Initial Installation

1. Make sure that the cluster status is normal.
2. Launch WebManager from the application servers, and stop the clusters. If the logical disks to be managed by Path Manager ("PM disk") are connected only by some of the servers, stop the clusters on these servers.
3. Change ‘Startup type’ of ‘application servers’ to ‘Manual’ on the servers connected with PM disks by using “Service”.
4. Shutdown and turn off the servers connected with PM disks.
5. For each server to be installed Path Manager, disconnect all the FC/LAN cables between the server and the storage unit of PM disks.

Installation

1. Install Path Manager to the servers
2. Do not connect the FC/LAN cables. Installations can be done in parallel with each server.
3. Shutdown and turn off the servers that Path Manager is installed, and connect all the needed FC/LAN cables.
4. Boot only one server and confirm that the driver letter of each PM disks is as same as before installation by "Disk Management." If a drive letter has been changed, restore manually.
5. In the same way as procedure 8, confirm partition settings about the other servers.
6. Launch Builder of application servers.
7. If some partitions are not to be access-controlled by application servers open 'HBA' tab in 'Properties', and click 'Connect', and then add these partitions to 'Partition excluded from cluster management' on each server connected to the storage unit.

8. If some of the servers run as cluster, stop cluster by using WebManager.
9. Click 'Upload the configuration file' from 'File' menu of Builder to reflect information of cluster configuration to application servers.
10. If you use Path Manager for Windows E1-10 for the cluster, make Path Manager's cluster mode 'Enable' by using spscmd on all servers connected to the storage unit.
11. Change 'Startup type' of 'application servers' to 'Automatic' on the servers connected with PM disks.
12. Launch WebManager and start cluster.

Upgrading Path Manager on Application Servers X1.0/X2.0/X2.1/X3.0

1. Make sure that the cluster status is normal.
2. Launch WebManager of application servers and stop the clusters. If the logical disks to be managed by Path Manager (called "PM disk") are connected only by some of the servers, stop the clusters on these servers.
3. Change
4. 'Startup type' of 'application servers' to 'Manual' on the servers connected with PM disks by using "Service".
5. Shutdown and turn off the servers connected with PM disks.
6. For each server to be installed Path Manager, disconnect all the FC/LAN cables between the server and the storage unit of PM disks.

Upgrade

1. Upgrade Path Manager to the servers
2. following the descriptions in this manual. This time, keep the FC/LAN cables disconnected. Upgrading can be done in parallel with each server.
3. Shutdown and turn off the servers that Path Manager is installed, and connect all the needed FC/LAN cables.
4. Boot only one server and confirm that the driver letter of each PM disks is as same as before installation by "Disk Management." If a drive letter has been changed, restore manually.
5. In the same way as procedure 8, confirm partition settings about the other servers.
6. Launch Builder of application servers.
7. If some partitions are not to be access-controlled by application servers, open 'HBA' tab in 'Properties', and click 'Connect', and then add these partitions to 'Partition excluded from cluster management' on each server connected to the storage unit.
8. If some of the servers run as cluster, stop cluster by using WebManager.
9. Click 'Upload the configuration file' from 'File' menu of Builder to reflect information of cluster configuration to application servers.

10. If you use Path Manager for Windows E1-10 for the cluster, make Path Manager's cluster mode 'Enable' by using spscmd on all servers connected to the storage unit
11. Change 'Startup type' of 'application servers' to 'Automatic' on the servers connected with PM disks.
12. Launch WebManager and start cluster.

Setting up to MSCS environment

This section shows how to setup Path Manager to MSCS(Microsoft Cluster Service – function of failover clustering equipped to Windows Server 2003 Enterprise) environment.

Installation Path Manager to MSCS environment.

1. Make sure that the cluster status is normal.
2. Launch 'Cluster Administrator'.
3. Choose one of the servers to be installed Path Manager (called 'target server'). Move all resource groups on the target server to another server.
4. Right click the target server on
5. 'Cluster Administrator', and choose 'Stop Cluster Service'.
6. Confirm that cluster service on the target server has been stopped.
7. Disconnect the cables connected between the target server and the storage unit.
8. Confirm that all disks on the storage units disappeared by using 'Disk Management' or 'Device Manager'. ID530 Event logs are recorded to system event log. ignore them.

Installation

1. Install Path Manager to the target server following the descriptions of this manual.
2. Connect the cables in the 6th procedure when you reboot the target server after installation. At this time, don't set up a redundant configuration yet..
3. Change load balancing mode of all logical disks on the target server to 'No load balancing' or 'Static load balancing' by spscmd.
4. On the target server, make Path Manager's MSCS mode 'Enable' by spscmd.
5. Check 'Cluster Administrator' to confirm that the target server has been returned to the cluster.
6. Repeat the procedures from to for each server that Path Manager will be installed to.
7. After Path Manager is installed to each server, connect all the needed cables, and complete to set up a redundant configuration.

- If needed, change the load balancing policies and the current paths by spscmd.
- If needed, get the moved resource groups back to the original servers..

Upgrade to MSCS Environment

1. Make sure that the cluster status is normal.
2. Launch ‘Cluster Administrator’.
3. Choose one of the servers to be installed Path Manager (called 'target server'). Move all resource groups on the target server to another server.
4. Right click the target server on ‘Cluster Administrator’, and choose ‘Stop Cluster Service’.
5. Confirm that cluster service on the target server has been stopped.
6. Disconnect the cables connected between the target server and the storage unit.
7. Confirm that all disks on the storage units disappeared by using ‘Disk Management’ or ‘Device Manager’. ID530 Event logs are recorded to system event log. ignore them.
8. Uninstall Path Manager from the target server by using Path Manager’s setup CD of installed version,
9. After the reboot by uninstallation, stop cluster service again by using ‘Cluster Administrators’.

Installation

1. Install new version of Path Manager along description of this manual.
2. Connect the cables in the 6th procedure when you reboot the target server after installation. At this time, don't set up a redundant configuration yet.
3. Change load balancing mode of all logical disks on the target server to ‘No load balancing’ or ‘Static load balancing’ by spscmd.
4. On the target server, make Path Manager’s MSCS mode ‘Enable’ by spscmd.
5. Check ‘Cluster Administrator’ to confirm that the target server has been returned to the cluster.
6. Repeat the procedures from to for each server that Path Manager will be installed to.
7. After Path Manager is installed to each server, connect all the needed cables, and complete to set up a redundant configuration.
   - If needed, change the load balancing policies and the current paths by spscmd.
   - If needed, get the moved resource groups back to the original servers..

Setting up to WSFC environment

This section shows how to setup Path Manager to WSFC(Windows Server Failover Clustering – function of failover clustering equipped to Windows Server 2008 Enterprise) environment.

Installation of Path Manager to WSFC environment.

1. Make sure that the cluster status is normal.
2. Launch 'Failover Clustering Management'.
3. Choose one of the servers to be installed Path Manager (called 'target server'). Move all services and applications on the target server to another server by using 'Failover Clustering Management'.
4. Right click the target server on 'Failover Clustering Management', choose 'More Actions' and 'Stop Cluster Service'.
5. Confirm that cluster service has been stopped on the target server by using 'Failover Clustering Management'.
6. Disconnect the cables connected between the target server and the storage unit.
7. Confirm that all disks on the storage units disappeared by using 'Disk Management' or 'Device Manager'. ID530 Event logs are recorded to system event log. ignore them.

Installation

1. Install Path Manager to the target server.
2. Connect the cables in the 6th procedure when you reboot the target server after installation. At this time, don't set up a redundant configuration yet.
3. If you will use Path Manager for Windows E1-10 for the cluster, make Path Manager's cluster mode 'Enable' by using spscmd on the target server.
4. Check 'Failover Clustering Management' to confirm that the target server has been returned to the cluster.
5. Repeat the procedures from to for each server that Path Manager will be installed to.
6. After Path Manager is installed to each server, connect all the needed cables, and complete to set up a redundant configuration..
   - If needed, change the load balancing policies and the current paths by spscmd.
   - If needed, get the moved resource groups back to the original servers.

Upgrading Path Manager to WSFC environment.

1. Make sure that the cluster status is normal.
2. Launch 'Failover Clustering Management'.

3. Choose one of the servers to be installed Path Manager (called 'target server'). Move all services and applications on the target server to another server by using ‘Failover Clustering Management’.
4. Right click the target server on ‘Failover Clustering Management’, choose ‘More Actions’ and ‘Stop Cluster Service’.
5. Confirm that cluster service has been stopped on the target server by using ‘Failover Clustering Management’.
6. Disconnect the cables connected between the target server and the storage unit.
7. Confirm that all disks on the storage units disappeared by using ‘Disk Management’ or ‘Device Manager’. ID530 Event logs are recorded to system event log. ignore them.

Upgrade

1. Upgrade Path Manager to the target server following the descriptions of this manual.
2. Connect the cables in the 6th procedure when you reboot the target server after installation. At this time, don't set up a redundant configuration yet.
3. If you will use Path Manager for Windows E1-10 for the cluster, make Path Manager’s cluster mode ‘Enable’ by using spscmd on the target server.
4. Check ‘Failover Clustering Management’ to confirm that the target server has been returned to the cluster.
5. Repeat the procedures from to for each server that Path Manager will be installed to.
6. After Path Manager is installed to each server, connect all the needed cables, and complete to set up a redundant configuration..
   - If needed, change the load balancing policies and the current paths by spscmd.
   - If needed, get the moved resource groups back to the original servers.

HAS Volume Monitoring Service

This section shows how to stop “HAS Volume Monitoring Service”.

1. Open the Start menu and run “Administrative Tools” -> “Services.”
2. Select “HAS Volume Monitoring Service” and open its “Properties.”
3. The properties window will be displayed, click the “Stop” button in the “General” tag.
4. Confirm the Service status is “Stopped”, and click “OK.”
5. Close “Services”, and then close all applications.

HBA Registration

This section shows how to setup “HBA Registration”.

1. Run Registration.exe in [(Path Managerfolder)\bin]
2. A dialog box will be displayed.select only HBAs that will be connected to Path Manager for Windows and click “Next.”

NOTE: Do not select the HBAs shown as "Stratus". You only have to select HBA(s) you use to connect to the Path Manager for Windows.

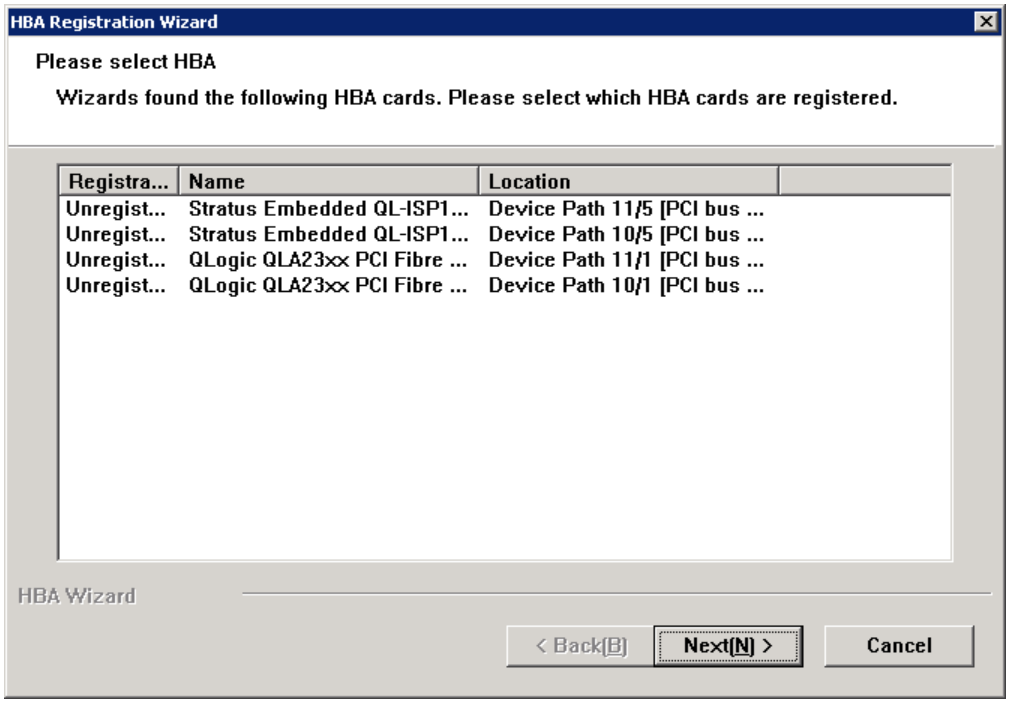

Figure 3-52: HBA Cards Registration

How to select HBAs

How to select HBAs shown in the "HBA Registration Wizard" dialog box will be described below.

- You can select the HBA by clicking “Unregistered” in the dialog box list.
- You can select two or more HBAs by pressing the Ctrl key and clicking the listings.

In the following example, two HBAs are selected.

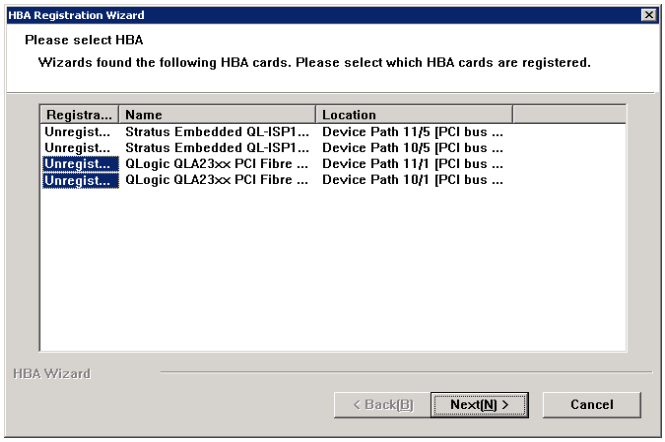

Figure 3-53: Two HBAs Selected

3. Select the HBAs you would like to register into Path Manager and click “Next.”

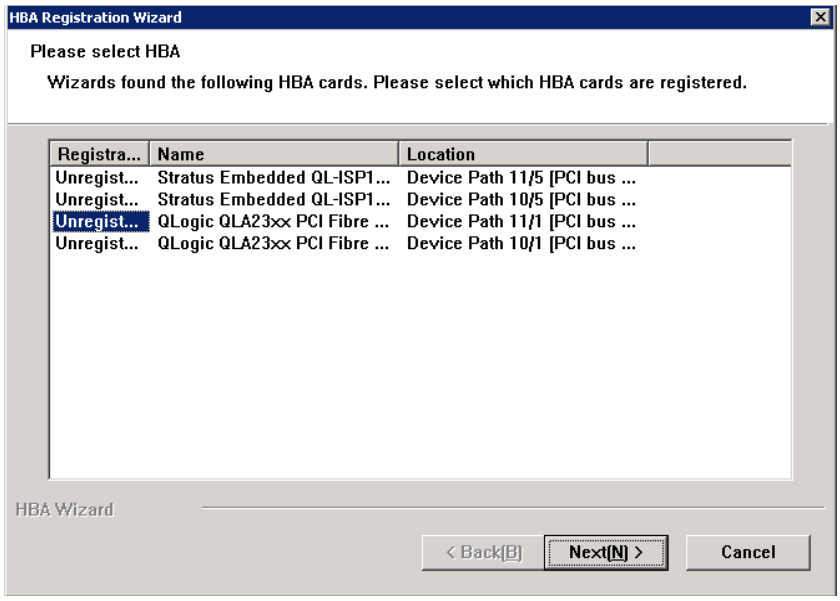

Figure 3-54: HBA Registration Confirmation

4. Reboot the server.

Chapter 4

Requirements

This section will describe the requirements before you start to use Path Manager.

Package Contents

The Path Manager package includes the Path Manager Software CD (Setup CD) and this installation guide.

License Requirements

If you setup Path Manager, confirm that the system meets the following requirements.

NOTE: If you use Path Manager, it is a license violation to use one license on two or more operating systems (OS) or with the storage unit that does not correspond to the license. If you use Path Manager Attended Edition, you can install Path Manager on two or more operation systems. But, it is a license violation to use with the storage unit that does not correspond to the license. For details, see LICENSE AGREEMENT.

Paths and Servers

The table shows the maximum number of paths to each logical disk (LD).

Logical Disks (LD)	Number of Paths
Path Manager for Windows and SnapSAN S3000/S5000 (FC)	32
Path Manager for Windows and SnapSAN S3000/S5000 (iSCSI)	8
Path Manager for Windows	4

The table shows the maximum number of paths to each server.

Servers	Number of Paths
Path Manager for Windows and SnapSAN S3000/S5000 (FC)	4096

Servers	Number of Paths
Path Manager for Windows and SnapSAN S3000/S5000 (iSCSI)	1020
Path Manager for Windows	1020
Path Manager supports Server Core Environment on Windows Server 2008 and Windows Server 2008	R2

System Requirements

The table lists the system requirements for Path Manager for Windows and Path Manager for Windows Bundle Edition.

Configuration	Description
Operating System	Windows Server 2003 Standard Edition (with SP2) Windows Server 2003 Enterprise Edition (with SP2) Windows Server 2003 Standard x64 Edition (with SP2) Windows Server 2003 Enterprise x64 Edition (with SP2) Windows Server 2003 R2, Standard Edition (with SP2) Windows Server 2003 R2, Enterprise Edition (with SP2) Windows Server 2003 R2, Standard x64 Edition (with SP2) Windows Server 2003 R2, Enterprise x64 Edition (with SP2) Windows Server 2008 Standard (without SP, with SP2) Windows Server 2008 Enterprise (without SP, with SP2) Windows Server 2008 R2 Standard (without SP, with SP1) Windows Server 2008 R2 Enterprise (without SP, with SP1) Windows Server 2008 Datacenter (SP2) (*1) Windows Server 2008 R2 Datacenter (without SP, with SP1) (*1) Windows Storage Server 2003 (*2) Windows Storage Server 2008 (*2) (*1) Windows Server 2008 Datacenter and Windows Server 2008 R2 Datacenter can be used with scalable HA Server only. (*2) Windows Storage Server 2003 and Windows Storage Server 2008 can be used with NS series only. (*3) ft series with Windows Server 2003 x86 edition can not be used SnapSAN S3000/S5000. (*4) Not supported MSCS environment.
Server	100 series Scalable HA Server NS Series ft series(*3)
Memory	Memory required by OS + 10 MB
Disk capacity	Total capacity of programs :13MB Capacity required to use Path Manager: 43 MB or more
HBA/ initiator	FC-HBAs supported by the server and Path Managerr NICs (Network Interface Cards) supported by the server
Path Manager	SnapSAN S3000/S5000

NOTE: When using by a model before 320Fb of a ft server, it's different from the other environment in the specification of the SPS command and indication. About the part partial with the other environment in a model before 320Fb (that "old ft server" and transcription) by that and this note, the, every time, it's explained.

Functions

Display Functions

This section describes Path Manager functions including:

- Path state display

  This function displays information regarding state of paths.
- Load balancing

  This function distributes I/O loads to multiple paths.
- Handling with path failures

  This function disables failed paths and failovers to alternative paths when a path failure occurs, and failbacks at the time of recovery from a failure.
- Path patrol

  This function monitors the state of paths. It also detects failures and recovery from failures as they occur.
- Cluster liaison

  This function enables the program to operate in a cluster environment (such as application servers, MSCS and WSFC).
- Log extraction

  This function outputs operation information and failure information to system log files and dedicated log files as operation histories. This function also issues notifications to operators as performance or failure information is outputted.

Path State Display

This section will describe the path state display function of Path Manager. This function is the most basic function of Path Manager. For each logical unit, this function lists the state of the paths that are managed by Path Manager. To use this function, execute spsadmin with /lun option. There are roughly four types of path state:

- Active

  This is a path that is used for I/O now.
- Standby

  This is a path that is ready for use, but not using. If active paths become faulty, the standby path is used instaed of theses faulty paths.
- Error

  This is the path that is unavailable due to failures.
- Unavailable

  This is a path that is forbidden to use by a storage unit.

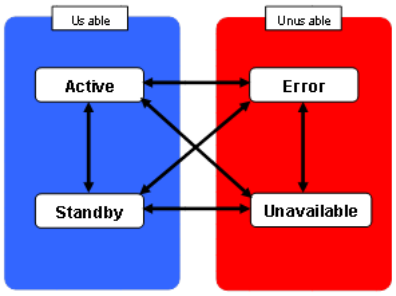

Figure 5-1: State Transition

Path List Display

Use the /lun option of the spsadmin to check the state of all paths that are managed by Path Manager. This will allow you to check which path is currently being used in each logical unit, which path is experiencing failures, and the settings for load balancing. Use the command prompt to execute the spsadmin. An example of command execution will be shown below.

```
C:\> spsadmin /lun
+++ LogicalUnit #0 [Normal] +++
   SerialNumber="0000000995000003", LDNumber=0x00004
   LoadBalance=Least Size
   0: ScsiAddress=2:0:0:6, Priority=2, Status=Active
   1: ScsiAddress=3:0:0:6, Priority=3, Status=Active

  +++ LogicalUnit #1 [Normal] +++
   SerialNumber="0000000995000003", LDNumber=0x00005
   LoadBalance=Round Robin <Unoptimized>
   0: ScsiAddress=2:0:0:7, Priority=2, Status=Active
   1: ScsiAddress=3:0:0:7, Priority=3, Status=Active

  +++ LogicalUnit #2 [Normal] +++
   SerialNumber="SL7E1074300006   ",
LunWWN=12345678901234556778231245673412
   LoadBalance=Failover Only
   0: ScsiAddress=2:0:1:0, Priority=1, Status=Standby
```

A list of recognized paths is displayed for each logical unit. The image above shows that there are three logical units and two paths are recognized for each of the logical units.

- Logical unit number

  This shows the logical unit number, the presence of a failed paths and the redundant. configuration

Normal	All paths are alive and this logical unit is redundant.
Normal <Non-Redundant>	All paths are alive but this logical unit is not redundant.
Degraded	Some paths are degraded but this logical unit is still redundant.
Degraded <Non-Redundant>	Some path are degraded and this logical unit is not redundant.
Dead	All paths are degraded.

- Serial Number

  Serial number of Storage unit.
- Identifier of logical disk
- Identifier for each logical disk in a storage unit.
  - On Storage D or SnapSAN S3000/S5000, logical disk number displayed as "LDNumber."
  - On Storage identifier for logical disk displayed as "LunWWN."
- Load balancing policy

  Load balancing algorosm of a logical unit.

  If the path configuration is not optimized for the I/O performance for some reasons, <unoptimized> is displayed.
- Path number

  A sequencial path number in a logical unit.
- SCSI address

  SCSI address of each path. Parameters indicate from left, PortNumber, PathID, TargetID and LogicalUnitNumber. All of these are internal values of Windows, therefore they may be changed after rebooting a server.

Item	Description
PortNumber	Number to identify a Host Bus Adapter(HBA). If iSCSI, paths of different Network Interface Cards may have the same PathNumber
PathID	Number to identify a channel on a HBA. But, different PathNumber may be assigned for channels on the same HBA
TargetID	Number to identify a logical unit on the same device.
Logical Unit Number	Number to identify a device on the same port/channel.

- Path priority

  The larger this value of a path, the higher the priority for the selection of an alternative path when a failure occurs. Although, the preferred path designated by a storage unit is used prior to this value, the path with the highest priority may not always selected. Priority has a value between 1 and 255. The larger the value is, the higher the priority becomes.

- Path state

This displays path state.

Active	This path is acti\ve.
Standby	This path is standby.
Error	This path has some faults.
Unavailable	This path could not be used.

You can also use /v or /a suboption to display more detail information.

- Display detail information

  Spsadmin can display detail path information by using /v or /a suboption with /lun option.

  /v and /a display almost same information except /a option displays lost paths that OS does not recognize.

  Displaying contexts are different between Storage D/SnapSAN S3000/S5000 .

An example is shown below. This exsample indicates that LocigalUnit #0 is Strorage D/SnapSAN S3000/S5000 and LogicalUnit #1 is Stroage,

```
C:\> spsadmin /lun /a
+++ LogicalUnit #0 [Normal] +++
   Vendor        : "       "
   ProductID     : "DISK ARRAY
        "
   SerialNumber: "0000000995000003"
   LDNumber      : 0x00005
   LoadBalance : Least Size
   0: Priority=2, Status=Active, Detail=None
       PortNumber=2, PathID=0, TargetID=0, Lun=7
       BusNumber=0x00000010, SlotNumber=0x00000000
       WWPN=2200000995000003, HD=00, Port=01
       Protocol=FC
   1: Priority=2, Status=Standby, Detail=None
       PortNumber=3, PathID=0, TargetID=0, Lun=7
       BusNumber=0x00000030, SlotNumber=0x00000000
       WWPN=2a00000995000003, HD=01, Port=01
       Protocol=FC

+++ LogicalUnit #1 [Normal] +++
   Vendor        : "DGC       "
   ProductID     : "RAID 10            "
   SerialNumber: "SL7E1074300006   "
   LunWWN        : 0x12345678901234556778231245673412
   LoadBalance : Failover Only
   0: Priority=2, Status=Active, Detail=None
       PortNumber=2, PathID=0, TargetID=1, Lun=1
       BusNumber=0x00000010, SlotNumber=0x00000000
       SP=A, Port=01
       Protocol=FC
   1: Priority=2, Status=Standby, Detail=None
       PortNumber=3, PathID=0, TargetID=1, Lun=1
       BusNumber=0x00000030, SlotNumber=0x00000000
       SP=B, Port=01
      Protocol=FC
```

The meanings of items in an example is as follows:

- Logical unit number
  This shows logical unit numbers.
- Vendor
  Vendor ID of logical disk.
- ProductID
  Product ID of logical disk.
- SerialNumber
  Serial number of Storage unit.
- LDNumber/LunWWN
  Identifier for each logical disk in a storage units.
  - On Storage D or SnapSAN S3000/S5000, logical disk number displayed as "LDNumber."

    - On Storage identifier for logical disk displayed as "LunWWN."
- LoadBalance

  Load balancing algorosm of a logical unit.
- Priority

  A priority of a path.
- State

  A path state.
- Detail

  A detail state of path. Detail explanation about this item is described later.
- PortNumber

  Port Number belonging to SCSI address of a path.
- PathID

  PathID belonging to SCSI address of a path.
- TargetID

  TargetID belonging to SCSI address of a path.
- Lun

  Logical unit number belonging to SCSI address of a path.
- BusNumber

  PCI bus number of HBA(hexadecimal number). This item is available on only FC connection. If iSCSI, this value displays dummy.
- SlotNumber

  PCI slot number of HBA(hexadecimal number). This item is available on only FC connection. If iSCSI, this value displays dummy.
- WWPN

  Uniq identifier of port belonging to a storage unit. This item is available on only FC connection. If iSCSI, this value displays dummy. If using Path Manager this item will not be displayed.
- HD (Hexadecimal Number)

  Number of host director belonging to Storage D/SnapSAN S3000/S5000 unit. This is a hexadecimal number, and is displayed only if using D/SnapSAN S3000/S5000.
- SP (Storage Processor)

  Showing storage processor belonging to Storage unit.
- Port Number

  Port number on a host director or storage processor. This is a hexadecimal number,
- Protocol

  Showing cont" protocol (FC or iSCSI.)

"Detail" indicates detail state by a combination with "State."

State	Detail	Explanation
Active	None	This path is active state.
	.Monitoring	This path is active state, but in the intermittent failure monitoring
Standby	.None	This path is standby state
Error	Degenerated	This path is fault. This path can be recovered automatically.
	Manual failback only	This path is fault. This path can not be recovered automatically. Requires manual recovery by spsadmin.
	Lost	This path is fault. Operating system does not recognize this path(The path what has this state is displayed only with /a suboption.)
Unavailable	None	This path is not usable.

Load Balancing Policies

This section will describe the load balancing function of Path Manager. This function distributes I/O loads to available paths managed by Path Manager.

Seven load balancing policies are available.

- Failover Only

  Uses only one path for every I/O request on one logical unit.

  If plural logical units use this policy, the paths of each logical units are activated as dispersed as possible.

- Round Robin

  Using all recognized path at all times. For each I/O request, a path is selected in order of a priority. The highest priority path is selected again after the lowest priority path is used.

  If some logical units are set to Round Robin, all paths on the logical units are activated and failback mode becomes "active."

  If some paths belonging to Round Robin logical unit is set to standby or failback mode becomes "standby", load balancing policy shifts to "Round Robin with Subset" automatically.

NOTE: Round Robin policy uses all paths including the paths that can not give the best performance because of storage unit structure. Therefore, this policy is not advantageous on the various cases. Using this policy is not recommended without a certain intention.

- Round Robin with Subset

  Selects only active paths selected in order of a priority.

- Least I/O

  Selects an active path that has the fewest number of I/O requests during operation.

- Least Size

  Selects an active path that has the fewest total size of I/O requests during operation.

- Weighted Path

  Selects an active path to become total I/O request size ratio indicated by priority. For example, if two active paths whose priorities are 3 and 2 exist, this policy select path to make total I/O request size ratio three-two.

- LBA Region

  Selects an active path by I/O request's logical block address of a logical unit.

Suppose uses of each load balancing policy are explained below (ordered by faster path selection.

Load Balance	Description
Failover Only	Good for environment on whom I/O stress of many logical units are equal. If using Path Manager E series, only this policy can be used.
Round RoRound Robin with Subsetbin	Good for a logical unit who has very heavy stress constantly. But, Round Robin is not recommended to use because it can not show the bset I/O performance depending on storage unit.
LBA Region	Good for a logical unit being accessed on the whole area evenly, and whose I/O requests' sizes are equal. This policy supposes database use.
Least I/O	Good for a logical unit whose I/O requests' sizes are equal. This policy supposes database use
Least Size	Good for a logical unit whose I/O requests' size are various one. Shows better performance on various environments.
Wighted Path	Good if you want to control I/O size of each path.

Load Balancing Setting

You can set load balancing by using /loadbalance option of spsadmin. An example is shown below.

```
C:\>spsadmin /loadbalance lio 2:0:0:5
Result of changing current path.
  "0000000995000003":0x0000b Success
```

First argument of /load balance option indicates load balancing policy. In this example, indicates Least I/O.

Second argument indicates logical unit to change load balancing. In this example, indicates a path on the logical unit by SCSI address.

NOTE: You can also indicate target by physical path address or logical disk indicator. See Appendix.A for detail.

The second line of the result indicates Path Manager's serial number , identifier of logical unit and result of changing load balancing.

Correspondence of the first option of /loadbalance and load balancing policy is shown below.

Table 5-1: Load Balance Setup

Load	Description
fo or 0	Failover Only
rr or 1	Round Robin
rrs or 2	Round Robin with Subset
lio or 3	Least I/O
wp or 4	Weighted Path
ls or 5	Least Size
lba or 6	LBA Region
ps or 7	Selects better policy from "Failover Only" or "Least Size" according to the storage unit

NOTE: If a logical unit is used by MSCS, only "Failover Only" is usable. The other load balancing policies are unusable.

Path Priority

Path priority is used to specify the order of paths to be used. Path priority is assigned to each path in each logical unit, and expressed as an integer between 1 and 255. As this number becomes higher, priority becomes higher. And the priority number is uniquely determined in each logical unit. Path priority is valid on only some load balancing policies, and its meaning is changed on each policy.On the "Failover Only", path priority is used to determine which path is to be used as an alternative in case of failures in the path currently being used. Therefore, the path with the highest priority will be first used. However, when failures occur in this path, then the path with the second highest priority will be used.

NOTE: On Path Manager or SnapSAN S3000/S5000, paths indicated by Path Manager take precedence over the value of the priority. Therefore, paths are not always selected by priority order. And, if also using Path Manager with cluster mode, highest priority path may not be used.

On the "Round Robin", priorities are order of use. Paths are selected in order from highest path to lowest one. After that, highest priority path is selected again.

On the "Weighted Path", priorities indicate ratio of path use. For example, if two paths whose priorities are 1 and 2 exist, Path Manager uses these paths on one-two ratio.

On the other load balancing policies, priorities are meaningless.

Setting Priority

How to set priority will be described here. Use spsadmin to set the priority. When the priority settings are changed, this will affect the paths used for I/O immediately.

CAUTION: Usually, please don't change priorities if load balancing policy is "Failover Only." Otherwise I/O throughput may be degraded.

Use /priority option of spsadmin to change priorities. An example is shown below.

```
C:\>spsadmin /lun

 +++ LogicalUnit #1 [Normal] +++
  SerialNumber="0000000995000003", LDNumber=0x00005
  LoadBalance=Failover Only
  0: ScsiAddress=2:0:0:7, Priority=2, Status=Standby
  1: ScsiAddress=3:0:0:7, Priority=2, Status=Active

C:\>spsadmin /priority 3 2:0:0:7
Result of changing priority.
  2:0:0:7 Success

C:\>spsadmin /lun

 +++ LogicalUnit #1 [Normal] +++
  SerialNumber="0000000995000003", LDNumber=0x00005
  LoadBalance=Failover Only
  0: ScsiAddress=2:0:0:7, Priority=3, Status=Standby
  1: ScsiAddress=3:0:0:7, Priority=2, Status=Active
```

Priority values can be between 1 and 255. It is possible to take the same value in plural paths.

Active and Standby

Each usable path can take two status "Active" and "Standby." Active path is currently using for I/O requests, and standby path is not currently using. Active status and standby status can be shifted by spsadmin for each other.

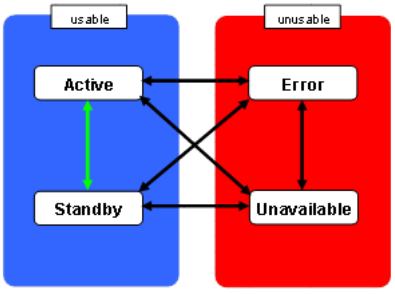

Figure 5-2: Active and Standby

Setting Active Standby

Active option of spsadmin turns path's status to active.

```
C:\>spsadmin /lun
 +++ LogicalUnit #0 [Normal] +++
  SerialNumber="0000000995000003", LDNumber=0x00004
  LoadBalance=Least Size
  0: ScsiAddress=2:0:1:6, Priority=1, Status=Standby
  1: ScsiAddress=3:0:1:6, Priority=3, Status=Active

C:\>spsadmin /active 2:0:1:6
  2:0:1:6 Success

C:\>spsadmin /lun
 +++ LogicalUnit #0 [Normal] +++
  SerialNumber="0000000995000003", LDNumber=0x00004
  LoadBalance=Least Size <Unoptimized>
  0: ScsiAddress=2:0:1:6, Priority=1, Status=Active
  1: ScsiAddress=3:0:1:6, Priority=3, Status=Active
```

NOTE: If paths that are inferior I/O performance because of storage structure are turned to active status, I/O performance may be degraded on whole logical unit. On such condition, shows "<Unoptimized>" with load balancing policy in result of "spsadmin /lun."
To correct such condition, use spsadmin with /rollback option. Path Manager turns only paths that show superior I/O performance to active status. As the result, logical units can show best I/O performance.On "Failover Only" load balancing policy, only one path is active. Therefore, if you turn one standby path to active, the former active path is turned to standby status automatically.

As an opposite, use /standby option to turn active path to standby state.

```
C:\>spsadmin /lun
 +++ LogicalUnit #0 [Normal] +++
  SerialNumber="0000000995000003", LDNumber=0x00004
  LoadBalance=Least Size <Unoptimized>
  0: ScsiAddress=2:0:1:6, Priority=1, Status=Active
  1: ScsiAddress=3:0:1:6, Priority=3, Status=Active

C:\>spsadmin /standby 2:0:1:6
  2:0:1:6 Success

C:\>spsadmin /lun
 +++ LogicalUnit #0 [Normal] +++
  SerialNumber="0000000995000003", LDNumber=0x00004
  LoadBalance=Least Size
  0: ScsiAddress=2:0:1:6, Priority=1, Status=Standby
  1: ScsiAddress=3:0:1:6, Priority=3, Status=Active
```

You cannot specify the paths so that all paths on a logical unit will become standby status.

If you want to know whether /standby is able to execute with one path indicator or not, add /v suboption to /standby.

With /v option, status is never changed.

```
C:\>spsadmin /standby /v 2:::
   There will be no active paths on logical disks as
follows:
   Serial="0000000995000003", LDN=0x00004
```

Change Current Path

On logical units using "Failover Only" load balancing policy, using path can be changed by /path option of spsadmin.

- /path Option

An example of /path option is shown below.

```
C:\>spsadmin /lun
 +++ LogicalUnit #0 [Normal] +++
   SerialNumber="0000000941990071", LDNumber=0x00015
   LoadBalance=Failover Only
   0: ScsiAddress=3:0:0:5, Priority=2, Status=Active
   1: ScsiAddress=4:0:0:5, Priority=3, Status=Standby

C:\>spsadmin /path 4:0:0:5
Results of changing current path.
   4:0:0:5 Success

C:\>spsadmin /lun
 +++ LogicalUnit #0 [Normal] +++
   SerialNumber="0000000941990071", LDNumber=0x00015
   LoadBalance=Failover Only
   0: ScsiAddress=3:0:0:5, Priority=2, Status=Standby
   1: ScsiAddress=4:0:0:5, Priority=3, Status=Active
```

NOTE: If plural paths on the same logical unit are indicated by wildcard, the last path that is hit with wildcard becomes current path.

Failovers

This section will describe the functions to handles with path failures by Path Manager. These functions will be used when a path failure or a path recovery has occurred.

- Failover

  When failures occur in the paths, Path Manager automatically switches paths to be used from failed paths to normal paths. This action is referred to as failover. The transition of the path state is shown in Figure 3- 2.

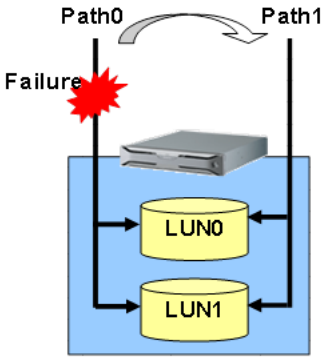

Figure 5-3: Failover

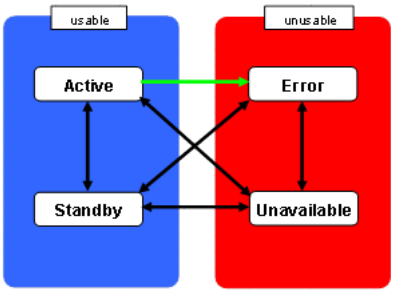

Figure 5-4: Transition of path status on failover

NOTE: Path Manager executes a failover after an error was returned from a storage unit, a HBA or a NIC. Therefore, if a failure such those devices could not respond and return any errors to Path Manager has been occurred, it may take several minutes to failover. (The required time depends on the timeout process of OS.)

- Failback

  When unusable paths due to failures recover from the failures and become available again, Path Manager automatically recognizes this event and adds these recovered paths to the group of usable paths. This action is referred to as failback. The transition of path state is shown in Figure 3- 4.

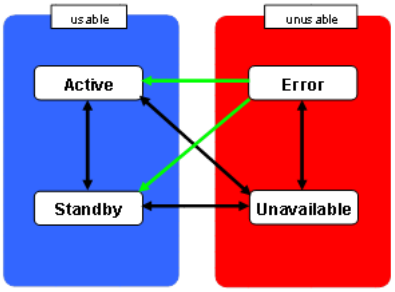

Figure 5-5: Transition of Path Status

This time, path status after failback depends on failback mode and load balancing policy.

Failback Mode Selection

In Path Manager, two types of failback mode are available: active failback and standby failback. The descriptions of each type and how to set the failback mode will be shown below.

NOTE: Failback mode is meaningful for only logical units whose load balancing policy is "Failover Only." Explanations below are on the assumption that logical units use "Failover Only."

1. Descriptions of Failback Mode

   /1/ Active failback

   When a path is recovered from failure, the state of the path becomes usually active. But, becomes standby if the path has the same or lower priority than current active path.

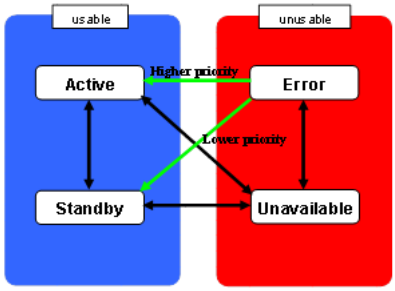

Figure 5-6: Active Failback

When a path is recovered from failure, the state of the path becomes usually active. But, becomes standby if the path has the same or lower priority than current active path.

NOTE: Active failback cannot be used if you use Path Manager with cluster mode enable.

2. Standby Failback

   When a path is recovered from failure, the status of the path becomes standby.

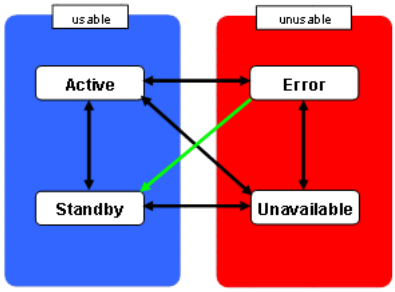

Figure 5-7: Standby Failback

If you want to avoid changing active path when failback occurs, use standby failback.

3. Setting and confirming a Failback Mode

   Use the /failbackmode option of the spsadmin to select the type of failback

a. Setting to active failback

Specify "active" or simply "a" as an argument.

b. Setting to standby failback

Specify "standby" or simply "s" as an argument

c. Confirming a failback mode

No arguments.

Examples of /failbackmode is shown below. In the examples, sets to active failback.

```
C:\>spsadmin /failbackmode
   FailbackMode        : Standby

C:\>spsadmin /failbackmode active
Failback mode was changed.
   FailbackMode        : Active
```

NOTE: If Path Manger and SnapSAN S3000/S5000 series are used concurrently, make sure to change the failback mode with at least 1 logical unit for each logical unit recognized.

- Manual Failback

Failback will not be executed even though failed paths have recovered from the failures. In such a case, use the /failback option of the spsadmin to execute forced failback.

```
C:\>spsadmin /lun
 +++ LogicalUnit #0 [Degraded<No-Redundant>] +++
   SerialNumber="0000000941990071", LDNumber=0x00015
   LoadBalance=Failover Only
   0: ScsiAddress=3:0:0:5, Priority=2, Status=Error
   1: ScsiAddress=4:0:0:5, Priority=3, Status=Active

C:\>spsadmin /failback 3:0:0:5
   3:0:0:5 Success

C:\>spsadmin /lun
 +++ LogicalUnit #0 [Normal] +++
   SerialNumber="0000000941990071", LDNumber=0x00015
   LoadBalance=Failover Only
   0: ScsiAddress=3:0:0:5, Priority=2, Status=Standby
   1: ScsiAddress=4:0:0:5, Priority=3, Status=Active
```

NOTE: Manual failback cannot failback the paths which have not been recovered from failures. Even if you execute the /failback option to such paths, failback operations will be unsuccessful. If after-mentioned recovery check function is enabled, failed paths will failback automatically at the time paths are recovered from failure.

- Monitoring Intermittent Failure

Usually, Path Manager changes access path by failover if path failure occurs, and never uses the failure path until it is recovered.

However, in the case that path failure is not continuous but intermittent, Path Manager may continue to use failed path because doesn't come to failover or continues to repeat failover and failback. As the result, I/O throughput may be degraded seriously.

Monitoring intermittent failure function prevent degrading of throughput in such case.

To set or confirm monitoring, use /monitormode option of spsadmin.

a. Setting monitoring to enable

Specify "enable" or simply "e" as an argument.

b. Setting monitoring to disable

Specify "disable" or simply "d" as an argument

c. Confirming a monitoring

No arguments.

Examples are shown below. This function is set "Disable" by default.

```
C:\>spsadmin /monitormode
  MonitorMode          : Disable

C:\>spsadmin /monitormode enable
Monitor mode was changed.
  MonitorMode          : Enable
```

NOTE: If you try a non-disruptive update of storage control software for SnapSAN S3000/S5000, make monitormode disable.

If this function is enable, Path Manager protect I/O throughput from degrading by two different methods as follows:

1. Monitoring errors on static state

   When Monitoring function is "enable", Path Manager always observes errors on all paths. Target errors are three types as follows:

   I/O request errors

   Health check errors(see "3.6.1 Health Check")

   Link downs

   If Path Manager detects these errors three times in 10 minutes on a path, the paths are closed and shift to "Failure" state. After that, this pas is not used for I/O request.

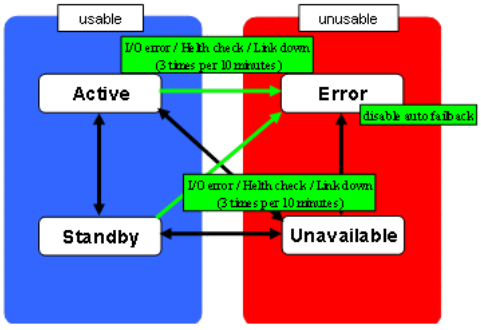

Figure 5-8: Monitoring Errors on Static State

The paths closed by Path Manager cannot be recovered by recovery check automatically(see "3.6.2 Recovery Check").

To recover the paths, please maintain hardware and use manual failback by spsadmin.

You can know paths on whom automatic failback were disabled by monitoring. Execute spsadmin with /lun option and /v or /a suboption. If paths can not be recovered automatically, spsadmin displays "Manual Failback Only" on "Detail".

```
C:\> spsadmin /lun /a
+++ LogicalUnit #0 [Degraded<No-Redundant>] +++
   Vendor        : "Overland Storage      "
   ProductID     : "DISK ARRAY        "
   SerialNumber: "0000000995000003"
   LDNumber      : 0x00005
   LoadBalance  : Least Size
   0: Priority=2, Status=Active, Detail=None
       PortNumber=2, PathID=0, TargetID=0, Lun=7
       BusNumber=0x00000010, SlotNumber=0x00000000
       WWPN=2200000995000003, HD=00, Port=01
       Protocol=FC
   1: Priority=2, Status=Error, Detail=Manual Failback
Only
       PortNumber=3, PathID=0, TargetID=0, Lun=7
       BusNumber=0x00000030, SlotNumber=0x00000000
       WWPN=2a00000995000003, HD=01, Port=01
       Protocol=FC
```

2. Monitoring errors just after recovering from failure

   When monitoring function is "enable" and failback mode is "Active", paths recovered from failure become "Active" with "Monitoring" sub status.

   After five minutes past from recovering, observation is finished and the paths become "Active."

   Monitoring just after recovering is not worked if the path status transitions from error to standby.

   While monitoring just after recovering, the path status transitions to error and automatic failback is disabled if one of conditions shown below is met.

   "A case that I/O error, link down or health check error occur three times while monitoring.

   "A case that it is repeated three times to failover and failback in five minutes after the first failback.

   You can know paths who is monitoring just after recovered. Execute spsadmin with /lun option and /v or /a suboption. If paths can not be recovered automatically, spsadmin displays "Monitoring" on "Detail".

```
C:\> spsadmin /lun /v
+++ LogicalUnit #0 [Normal] +++
   Vendor        : "Overland Storage      "
   ProductID     : "DISK ARRAY        "
   SerialNumber: "0000000995000003"
   LDNumber      : 0x00005
   LoadBalance  : Least Size
   0: Priority=2, Status=Active, Detail=Monitoring
       PortNumber=2, PathID=0, TargetID=0, Lun=7
       BusNumber=0x00000010, SlotNumber=0x00000000
       WWPN=2200000995000003, HD=00, Port=01
       Protocol=FC
   1: Priority=2, Status=Standby, Detail=None
       PortNumber=3, PathID=0, TargetID=0, Lun=7
       BusNumber=0x00000030, SlotNumber=0x00000000
       WWPN=2a00000995000003, HD=01, Port=01
       Protocol=FC
```

- Path Configurations Monitoring

  This function monitors connections between server and storage.

  By this function, errors shown below can be detected.

  "Path failure that was occurred while system is not running.

  "Wrong connections of FC/LAN cables.

  Path Configuration Monitoring is executed on booting server, and after every 24 hours.

Path Patrol

This section will describe the path patrol function in Path Manager. This function periodically monitors the state of all paths that are available or unavailable for use. Path Manager has a health check function and a recovery check function. The Path Manager driver allows execution of these functions. The overview of these is as follows:

- Health check

  Paths that are available for use are monitored, and an alert message is recoded to the event log in case of failures.

- Recovery check

  Paths that are not used due to failures are monitored, and the failback function is automatically activated at the time of failure recovery.

  In path patrol function, I/O for a path monitoring is issued every specified period of time. When the I/O is successfully complete, the path is regarded as being available for use. If the I/O results in an error or if it is not complete before time-out, the paths is regarded as maybe unavailable for use.

- Health Check

  This function detects failed paths and makes them fail over by periodically issuing monitoring I/O to available paths that have not been used for a certain period of time. This function is used mainly for two purposes.

- Monitoring failures in alternative paths in environments except for using dynamic load balancing.
- Monitoring intermitting failure (see "3.5.5 Monitoring Intermittent Failure").

NOTE: If the function of monitoring intermittent failure is "disable", failover does not occur by health check error. In this case, Path Manager only reports errors to the system event log.

- Recovery Check

  This function detects paths that recovered from failures and makes them fail back automatically by periodically issuing monitoring I/O to failed paths. This function is used for archiving active failback or standby failback.

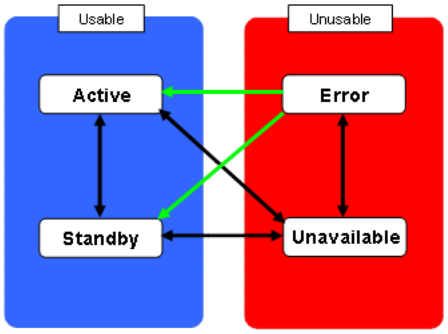

Figure 5-9: Failback By Recovery Check

- Settings for Path Patrol

  To change or confirm path patrol settings, use spsadmin with /patrol option.

  You can confirm current path patrol settings by executing /patrol option without arguments.

```
C:\>spsadmin /patrol
   Patrol    : Enable
   Interval  : 60
```

  "Patrol" shows if path patrol is working or not. If "Enable", path patrol is working, and if "Disable", is not.

  "Interval" shows interval of path patrol by seconds.

To change path patrol settings, use patrol option with arguments. Indicate "enable" or "disable" as /patrol option to change path patrol work.

In the example shown below, path patrol is turned disable.

```
C:\>spsadmin /patrol
   Patrol    : Enable
   Interval  : 60

C:\>spsadmin /patrol Disable
Path patrol setting was changed.
   Patrol    : Disable
   Interval  : 60
```

It is also possible to change interval by using /i suboption. In the example shown below, interval is changed to 90 sec.

```
C:\>spsadmin /patrol e
Path patrol setting was changed.
   Patrol    : Enable
   Interval  : 60

C:\>spsadmin /patrol /i 90
Path patrol setting was changed.
   Patrol    : Enable
   Interval  : 90
```

It is also possible to change enable/disable and interval at the same time.

```
C:\>spsadmin /patrol
   Patrol    : Disable
   Interval  : 60

C:\>spsadmin /patrol enable /i 90
Path patrol setting was changed.
   Patrol    : Enable
   Interval  : 90
```

NOTE: Too short interval value of path patrol may become a cause of much needless error detection especially when failure that I/O is not responded is occurred. We recommend you use by default value.It is impossible to set health check and recovery check separately. Path patrol settings always work for both health check and recovery check Cluster Liaison

The cluster liaison function enables the use of Path Manager in a cluster environment. When abnormalities occur in I/O, Path Manager first attempts to switch paths. If this does not work, then the cluster control program will switch nodes. Path Manager can be used in application servers, MSCS (Microsoft Cluster Service) or WSFC (Microsoft Failover Cluster) environments.

- Application Servers Liaison

  This function allows Path Manager to work in liaison with application servers.

  When you use Path Manager with application servers, you must set the cluster mode of Path Manager enabled.

Use the spsadmin with /clustermode option to check the current setting of cluster mode and set it.

The example of the /clustermode option is shown below.

```
C:\>spsadmin /clustermode
   ClusterMode          : Disable

C:\>spsadmin /clustermode e
Cluster mode was changed.
   ClusterMode          : Enable
```

NOTE: If storage D and SanSNAP S3000/S5000 series used concurrently, make sure to change the cluster mode with at least 1 logical unit for each logical unit recognized.It is not necessary to enable cluster mode if you don't use Path Manager.

- MSCS Liaison

  On Windows Server 2003, this function allows Path Manager to be used in an MSCS environment. No special setting is needed for MSCS Liaison.

NOTE: Only "Failover Only" load balancing policy can be used on the logical unit used by MSCS. If alogical units used by MSCS has the other policies, Path Manager change the policy to "Failover Only" automatically.

You can't use the MSCS if Path Manager is used.

- WSFC Liaison

  On Windows Server 2008, this function allows Path Manager to be used in an WSFC environment. No particular settings are necessary to use this function.

You must set the cluster mode enabled using /clustermode option of spsadmin.exe if disk array is used. The cluster mode is disabled by default. Please refer to the section 3.7.1 about cluster mode. You don't have to set the cluster mode enabled if disk array isn't used.

Log Extraction

This section will describe the functions about logs output when failures are detected by Path Manager and alerts work with the logs.

Path Manager internally holds log information (SPS logs). From the log information, the log service outputs important information to the event log (system).

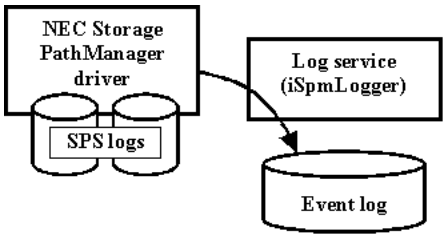

Figure 5-10: Collect Logs

SPS Logs

SPS logs refer to log information internally held by Path Manager, and information regarding operation of Path Manager and failed I/O are recorded in the SPS logs. SPS logs are stored in a log storage folder (installation directory \Log).

NOTE: SPS Logs are used for analysis by engineers. The descriptions of logs are not open to users. For example, even if a string "Error" is recorded in these logs, this does not always indicate troubles of Path Manager.

Errors which users have to pay attention are reported to the system event log.

The explanations about generation control of SPS logs are shown below. SPS logs consist of currently used log and previous generation log.

Initial State

At the time of program installation, only the currently used log files exist.The currently used log files stored logs up to the size of 5 MB, which is the maximum size of each file.

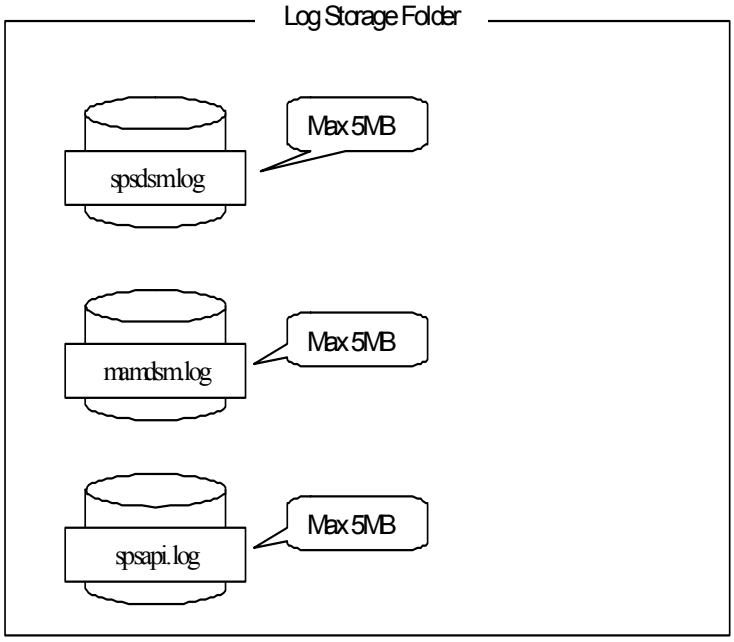

Figure 5-11: Storing SPS Logs

NOTE: SPS logs consists of spsdsm.log, mamdsm.log and spsapi.log.

Log Rotation at the First Time

When the currently used general log file becomes full, the file name changes to "spsdsm.log.old." This will be kept as the log file of the previous generation. Then a new "currently used log file" named "spsdsm.log" is created, and logs will be stored in this file.

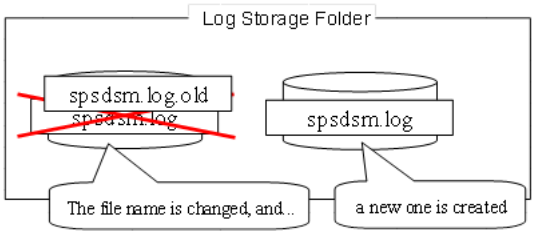

Figure 5-12: Storing SPS LOGS - 2

The behavior is same for each SPS log file.

Log Rotation at the Second Time and After

When the new "spsdsm.log" becomes full, the previous log file "spsdsm.log.old" will be deleted. Then "spsdsm.log" becomes "spsdsm.log.old." A new "spsdsm.log" is created, and logs will be stored in this file.

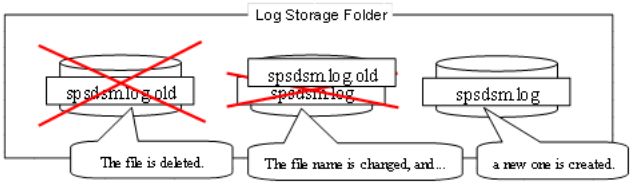

Figure 5-13: Storing SPS Logs (3)

The above actions will be repeated every time the log file becomes full. As a result, only the previous log file and the currently used log file exist.

The behavior is same about the other SPS logs.

Event Logs

Among the pieces of information stored in the SPS logs, important information such as information related to failover and failback will be outputted to the event log (system) by the log service.

The Event Log List table shows the outputted event log information.

Table 5-2: Errors Posted by spsdsm (mamdsm) to Error Log

Event #	Detected Event	LV	Output Details	Description/*Action*
261	Failback was done	Info	Failback finished successfully%. [Error info, path info] Date&Time [Timestamp]	Shows that a failed path was succeeded to recover by auto or manual. *Action*: No operation is needed.
262	Failback failed	Err	Failback failed%. [Error info, path info] Date&Time [Timestamp]	Shows that auto or manual failback of a path was failed. *Action*: Maintain hardware on the path and recover again.
263	Failback completed	Info	Failback was already completed. [Error info, path info] Date&Time [Timestamp]	Shows that a recovered path was tried to recover again. *Action*: No operation is needed.
265	Changing Priority was done	Info	Path Priority was changed successfully%. [Priority info]. [Error info, path info] Date&Time [Timestamp]	Shows that priority of a path was changed. *Action*: No operation is needed.
266	Failed to change Priority	Err	Failed to change Path Priority%. [Error info, path info] Date&Time [Timestamp]	Shows that changing priority of a path was failed. This sometimes occurs when changing priority was executed on the same time of changing path. *Action*: Execute again a little later.
268	LBMode was changed	Info	LoadBalancing Mode was changed successfully%. [LoadBalancing info]. [Error info, path info] Date&Time [Timestamp]	Shows that load balancing of a logical disk was changed. *Action*: No operation is needed.
269	Failed to change LBMode	Info	Failed to change LoadBalancing Mode%. [Error info, path info] Date&Time [Timestamp]	Shows that changing load balancing mode of a logical disk was failed. *Action*: Maintain hardware on the path and recover.
270	Path error	Info	Path error was detected%. [Error info, path info] Date&Time [Timestamp]	Shows that health check detected error. *Action*: Maintain hardware on the path and recover again.
275	Effectiveness was changed	Info	Effectiveness of Path was changed%. [Priority info]. [Error info, path info] Date&Time [Timestamp]	Shows that effectiveness of a path was changed. *Action*: No operation is needed.
276	Failed to change Effectiveness	Warn	Failed to change Effectiveness of Path%. [Error info, path info] Date&Time [Timestamp]	Shows that changing effectiveness of a path was failed. This sometimes occurs when changing effectiveness was executed on the same time of changing path. *Action*: Execute again a little later.
277	Mode changed	Info	Mode was changed successfully%. [Mode info]. [Error info, path info] Date&Time [Timestamp]	Show that mode of PathManager (cluster mode, failback mode and so on...) was changed. *Action*: No operation is needed.

Table 5-2: Errors Posted by spsdsm (mamdsm) to Error Log

Event #	Detected Event	LV	Output Details	Description/*Action*
278	Some Paths are not redundant	Warn	Some paths are not redundant	Shows that configuration check service detected no-redundant point in composition of path connections. *Action*: Confirm the composition and remove causes of non-redundancy.
279	New path was added	Info	A path was added. [Location info on a server] - [Storage port] to [Logical disk info].	Shows that PathManager recognized a new path. *Action*: No operation is needed.
280	Existing path was removed	Warn	A path is missing. [Location info on a server] - [Storage port] to [Logical disk info].	Shows that configuration check service could not find a path which must exist. *Action*: Confirm information of the event and remove causes that the path doesn't exist.
281	Existing path was added	Info	A path appeared. [Location info on a server] - [Storage port] to [Logical disk info].	Shows that PathManager recognized a lost path again. *Action*: No operation is needed.
282	Path observation was finished.	Info	Path was recovered completely. [Location info on a server] - [Storage port] to [Logical disk info].	Shows that path observation was finished because prescribed time past from path recovery. *Action*: No operation is needed.
283	Path was closed by intermittent error.	Warn	Path was closed because of intermission failure. [Intermittent error info], [Error info, Path info], Date&Time: [occurrence time]	Shows that PathManager detected intermittent errors on a path and closed the path. *Action*: Maintain hardware on the path and recover manually.
284	Auto failback was disabled.	Warn	Path cannot be failbacked automatically. There are intermission failure on the path. Confirm and correct hardware which compose the path. [Intermittent error info], [Error info, Path info], Date&Time: [occurrence time]	Shows that PathManager prohibited auto path recovery because of intermittent errors. *Action*: Maintain hardware on the path and recover manually.
285	Load balancing policy was changed because of MSCS.	Info	Loadbalancing method was changed "failover only" because MSCS was detected on logical unit [Logical disk info], Date&Time:[occurrence time]	Shows that Load balancing policy was changed to "Failover Only" because MSCS detected on the logical unit. *Action*: No operation is needed.
513	Failover started	Info	Failover started%.	Shows that auto or manual failback was succeeded. *Action*: Maintain hardware on the path and recover.

Table 5-2: Errors Posted by spsdsm (mamdsm) to Error Log

Event #	Detected Event	LV	Output Details	Description/*Action*
514	Failover was done	Warn	I/O Path was changed%. [Error info, path info] Date&Time [Timestamp]	Shows that auto or manual failback was failed. *Action*: Maintain hardware on the path and recover.
515	Failover failed	Err	Failover failed%. [Error info, path info] Date&Time [Timestamp]	Shows that recovered path was tried to recover again. *Action*: Maintain hardware on the path and recover.
530	Path was removed	Info / Warn	Path was removed%.	Shows that a path was lost because of link down and others. *Action*: Maintain hardware on the path and recover.

Here are the descriptions of the output details.

Table 5-3: Event Log Details

Output	Description
Error Info	Error status codes of the event. The format is as follows: (NTSTATUS-8 digits),(SCSI STATUS-2 digits), (SRB STATUS-2 digits), (Sense key-2 digits), (Additional sense code-2 digits), (Additional sense code qualifier-2 digits) To get the meaning of each error code, a knowledge of SCSI and OS is required. A dummy info shown below is recorded if error codes could not be obtained or are meaningless for the event. XXXXXXXX, XX, XX, XX, XX, XX

Table 5-3: Event Log Details

Output	Description
Path Info	Path location info of the event. The format is as follows: (Bus number of HBA in a server), (Slot number of HBA in a server), (Port info of Path Manager Storage), (Logical disk info), (Internal info) Internal info is a unique number assined to the path by PathManager. "Port info of Path Manager Storage" and "Logical disk info" vary depending on models of Path Manager Storage. [Port info of Path Manager Storage] Path Manager Storage, SnapSAN Manager or M series. 16-charactr WWPN with FC models (Dummy data with iSCSI models. Path Manager Storage E series Serial number and port info of the device. ex) SL7E1074800027 00000001 The first 16 digits: Serial number of the device. The last 8 digits: Port location Port location consists of two parts. The first 4 digits are ID of a storage processor (SP) in the device ("0000" and "0001" indicate SP-A and SP-B respectively), and the last 4 digits are the port number on SP. [Logical disk info] Path Manager Storage,storage processor SnapSAN Manager or M series Internal device name, serial number and Logical disk number. ex) iStorage_1000___000000093511A533&00021 The first 16 digits are an internal name, the next 16 digits are a serial number, and the last 5 digits subsequent to "&" are a logical disk number. Path Manager Storage E series RAID info and LUN- world wide name of the device. A dummy info shown below is recorded if a path location could not be obtained. XXXXXXXX, XXXXXXXX, XXXXXXXXXXXXXXX, XXXXXXXXXXXXXXX, XXXXXXXXXXXXXXX, XXXXX, XXXXXXXX
Priority Info	Values of priority before and after changing. If priority is enabled, the value increased by 65536 is shown.
LoadBalancing Info	Values of load balancing policy before and after changing. This value is used by PathManager internally, and may be different from a value specified by "spsadmin /loadbalance"
Mode Info	Values of PathManager modes before and after changing. This value is modified by changing failback mode, cluster mode and so on.
Timestamp	The date&time when the event occurred as UTC.
Location info on a server	Same as "bus number of the HBA in a server" and "slot number of the HBA in a server" of Path info.
Storage port	Same as "Port info of Path Manager Storage" of Path info.

Table 5-3: Event Log Details

Output	Description
Logical disk info	Same as "Logical disk info" of Path info.
Intermittent error info	Information about intermittent error. This is a fixed string as follows: Montiroing Error Count 3/3 Interval 600, These are internal values of PathManager

Dump data is added on event ID 500s. Dump data can be confirm by event viewer. An example is shown below.

```
0000: 00 00 44 00 01 00 be 00   ..D...¾.
0008: 00 00 00 00 01 02 06 40   .......@
0010: 00 00 00 00 00 00 00 00   ........
0018: 00 00 00 00 00 00 00 00   ........
0020: 00 00 00 00 00 00 00 00   ........
0028: 24 00 00 00 03 00 00 00   ........
0030: 20 02 00 30 13 84 18 9c    ..0.„.œ
0038: 69 53 74 6f 72 61 67 65   iStorage
0040: 20 31 30 30 30 20 20 20    1000
0048: 30 30 30 30 30 30 30 39   00000009
0050: 33 34 35 30 35 32 36 38   34505268
0058: 30 30 30 30 30 00 00 00   00000...
0060: 9d 00 00 c0 00 0a 00 00   ? ..À....
0068: ff ff ff 00               ÿÿÿ
```

Figure 5-14: Even Viewer - Dump Data

It is possible to specify the path that this event was occurred. A little difference exists if target is SnapSAN S3000/S5000.

Table 5-4: Format of Dump Data (SnapSAN S3000/S5000)

Data	Description
00h~27h	OS internal value.
28h~2Bh	PIC bus number of HBA. (Invalid if iSCSI connection)
2Ch~2Fh	PIC slot number of HBA. (Invalid if iSCSI connection)
30h~37h	WWPN of storage port. (Invalid if iSCSI connection)
38h~47h	ASCII codes of storage's internal name.
48h~57h	ASCII codes of storage's serial number.
58h~5Ch	ASCII codes of logical disk number
60h~6Ch	Error codes(Only ID513) 60h~63h NTSTATUS 64h SCSI STATUS 65h SRB STATUS 66h Sense key 67h Addtional sense code 68h Additional sense code qualifier

Figure 5-15: Data Dump SnapSAN S3000/S5000

Table 5-5: Data Dump Format

00h~27h	OS internal value.
28h~2Bh	PIC bus number of HBA. (Invalid if iSCSI connection)
2Ch~2Fh	PIC slot number of HBA. (Invalid if iSCSI connection)
30h~3Fh	ASCII code of storage's serial number.
40h~47h	Former 4 characters in 8 characters by ASCII indicate SP(SP A as 0000 and SP B as 0001), and the following 4 characters indicate port number.
48h~57h	ASCII code of storage's internal name.
58h~64h	Error codes(Only ID513) 58h~5Ah dumm 5Bh~5Eh NTSTATUS 5Fh SCSI STATUS 60h SRB STATUS 63h Sense key 64h Addtional sense code 65h Additional sense code qualifier

Figure 5-16: Data Dump (Storage ~ Series)

The principal combinations of error codes and operations needed are shown below.

Table 5-6: Causes and Operations

Combination of Errors	Causes and Operations
NTSTATUS : C000009D SRB STATUS : 0A	[Causes] Link down was occurred on the path. [Operations] Confirm that cables are certainly connected. Confirm that hardware (HBA, storage unit, switch, connector, etc) are healthy.
NTSTATUS : C00000C0	[Causes] Operating system could not recognize the path. [Operations] Confirm that cables are certainly connected. Confirm that hardware (HBA, storage unit, switch, connector, etc) are healthy.
NTSTATUS : C00000B5 SRB STATUS : 09 or 0B	There are two causes. If the error is recorded repeatedly, it may be cause 1, if not, cause 2. [cause 1] Hardware didn't respond for I/O request. [Operation 1] Confirm that hardware on the path is healthy. Storage unit are mainly doubtful. [Cause 2] Hardware could not respond for I/O request in proper time because of momentary very heavy I/O stress. [Operation 2] No operation needed until this error occurs frequently. If occurs frequently, see [Cause 1] or change load balancing policy.
NTSTATUS : C0000056	[Causes] I/O request was submitted to a logical unit while operating system detached the unit. On the environment that backup software who use snapshot function is running, this error might occur if applications request I/O to logical units during snapshot operation. [Operations] Confirm application's operations.
NTSTATUS : C0000185 SCSI STATUS : 02 SRB STATUS : 84 Sense key : 03???04	[Causes] I/O request failed because of fault of a storage unit. [Operations] Fix the storage fault.

Chapter 6

Operation

This section describes how to check the operation status and troubleshoot Path Manager. Path Manager automatically recognizes disk subsystems and paths, after installation is complete and connection is established between the server and the storage, Then operation starts.

Subsequently, Path Manager automatically starts up when the system starts up, and Path Manager automatiocally groups paths for each logical unit and conceals the paths in applications (to make only one path visible). Path Manager automatically stops when the system stops.

Use an spsadmin to check current Path Manager operation status such as path state display and path control. Refer to "section 3 Functions of Path Manager" for the spsadmin.

NOTE: After the installation of Path Manager, you may see WinMgmt ID:10(WMI ID:10 on Windows Server 2008 environment) events in the Application Event log. This is the design of Path Manager and has no influence on a system.Additionally, after the uninstalling Path Manager, WinMgmt ID:10 is recorded when a server is rebooted. This also has no influence on a system, too.

Checking Operation Status

After installing Path Manager and before starting its operation, make sure that multiple paths connect the server and storage and that Path Manager is properly functioning. The most basic methods to check operation status of Path Manager are described below.

Use the /lun option of the spsadmin. Follow the steps shown below:

1. Activate the command prompt.
2. Input "spsadmin /lun" and press the Return key.

If Path Manager recognizes the redundant paths, mutiple paths are displayed below each "Logical Unit" in the output of spsadmin /lun operation.

The example of checking operation status will be shown below. The following example indicates that there are three logical units connected with two paths. Refer to " Functions of Path Manager" for the detailed information about the display.

```
C:\> spsadmin /lun
+++ LogicalUnit #0 [Normal] +++
   SerialNumber="0000000995000003", LDNumber=0x00004
   LoadBalance=Least Size
   0: ScsiAddress=2:0:0:6, Priority=2, Status=Active
   1: ScsiAddress=3:0:0:6, Priority=3, Status=Standby

 +++ LogicalUnit #1 [Normal] +++
   SerialNumber="0000000995000003", LDNumber=0x00005
   LoadBalance=Least Size <Unoptimized>
   0: ScsiAddress=2:0:0:7, Priority=2, Status=Active
   1: ScsiAddress=3:0:0:7, Priority=3, Status=Active

 +++ LogicalUnit #2 [Normal] +++
   SerialNumber="SL7E1074300006   ",
LunWWN=12345678901234556778231245673412
   LoadBalance=Failover Only
   0: ScsiAddress=2:0:1:0, Priority=1, Status=Standby
   1: ScsiAddress=3:0:1:0, Priority=2, Status=Active

C:\>
```

NOTE: It may take some time (up to a minute) for the spsadmin to return its result if the spsadmin is used right after the server starts up. This is because the spsadmin waits for WMI to start up, and this is not a failure. Wait for the spsadmin to return the result. If only one path is displayed in the /lun option of the spsadmin, first refer to "FAQs and Troubleshooting" to see if solutions can be found before making inquiries.

Initial Settings

The default settings of each parameters in Path Manager will be shown as follows.

1. Load balancing method

   The initial setting of load balancing policy is as follows.

Storage	Default load balancing
Path Manager or SnapSAN S3000/S5000 series	Least Size
Path Manager	Failover Only

To check the setting value (mode) of the load balancing method, use the /lun option of the spsadmin

2. Priority

   Path Manager determines the initial value of the priority in the following ways.

- When a new path to a newly recognized logical unit is found, the path priority becomes enabled with a priority value of 1.
- When a new path to an already recognized is found, the path priority determines as the following manners.

If the load balancing policy is the "Failover Only", the priority of all the paths to the same logical unit is enabled and the value of priority is updated automatically.

- For an already recognized path to an already recognized logical unit, the state of priority will be kept event after the system is rebooted.
- When an already recognized path to an already recognized logical unit is recovered from path failures, the value of priority is as same as before the failure. And whether the prioirity is enabled or disabled will depend on the failback mode.

When a path is recovered from failures, and a different path with the same prioirty exists in the same logical unit, the prioirty will be determined in accordance with above.

NOTE: If the HBA driver is reinstalled, priority setting information may be lost. After installing the HBA driver, make sure to check the settings for priority and make settings again as needed.

3. Failback method

   When Path Manager is installed, the failback method is set to standby failback.

4. Cluster mode

   The cluster mode is disabled when Path Manager is installed. If Path Manager is used with the cluster software(Application Servrs or WSFC) and the disk array unit, set the cluster mode to be enabled. If the disk array unit is not used, you don't have to set the clustermode to be enabled.

5. Path patrol

   The path patrol is enabled and interval is 60 sec when Path Manager is installed.

6. Function of intermittent error monitoring

   Function of intermittent error observation is "Disable" by default.

Recommended Settings for Priority

The recommended settings of priority from the viewpoint of swithcing paths when path failures occurred will be described here.

In a system having a configuration with two paths, there will be only one available path when failures occur in the path in use. Therefore, setting priority does not have any significant meaning except for when executing load balancing.

However, in a system having a larger number of paths, attention must be paid to settings for priority in order to secure smooth switching of paths in case of failures and to secure dynamic load balancing performance.

In the figure below, the system has a configuration with four paths and two FC switches, and path priorities are set to 4, 3, 2, and 1 to respective paths from left to right. Therefore, the path having priority 4 is currently in use.

When the left FC switch fails in this system, the path having priority 4 will fail. Therefore, failover is executed so that the path with priority 3 is be used. However, since the left FC switch has failed, the path having priority 3 has also failed. As a result, failover is executed again so that the path with priority 2 will be used.

Path Manager takes the longest to recognize path failures when I/O time-out occurs. In such cases, it will take up to a minute for Path Manager to be aware of the failures. So in the above example it may take up to a minute longer for Path Manager to recognize path failures due to execution of failover. To avoid such situations, it is recommended that paths having priorities in numerical sequence do not have common resources.

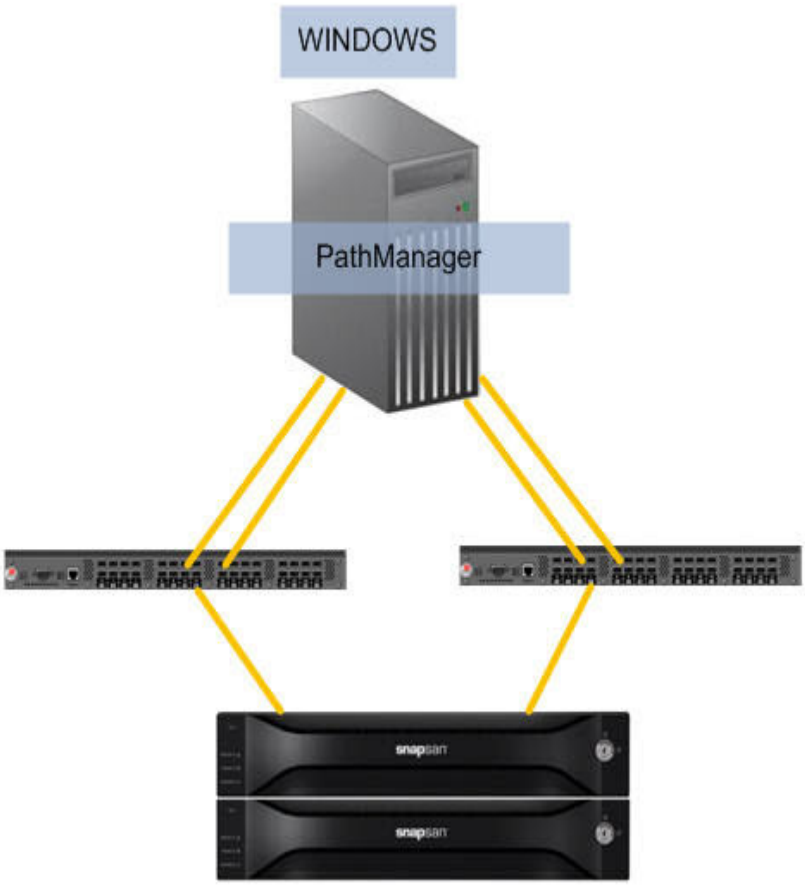

Figure 6-1: Setting Priority (1)

In the next figure, path priorities are set to 4, 2, 3, and 1 from left to right. In this case, only one execution of failover is necessary to determine which path is going to be used next in the case of failures in a FC switch or failures in the Storage controller.

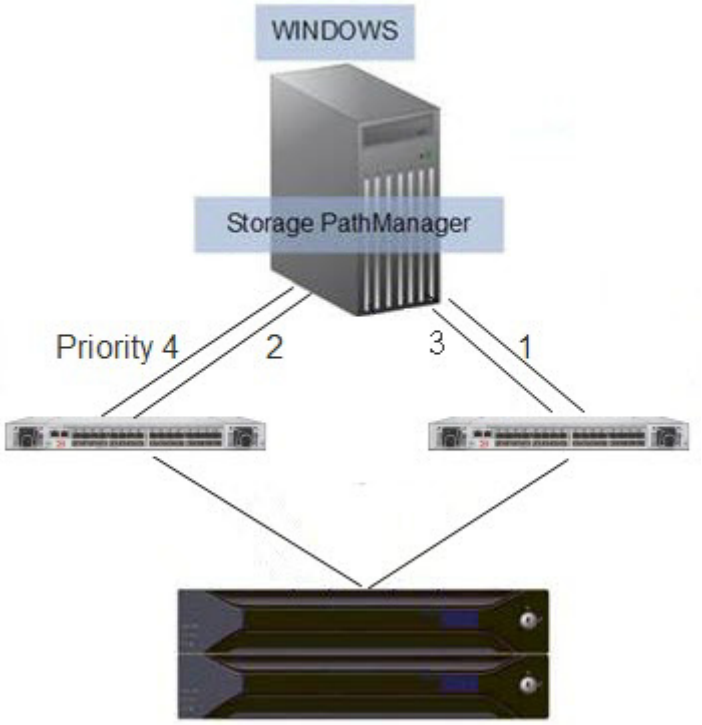

Figure 6-2: Setting Priority (2)

Load Balancing Policy

In Path Manager, various types of load balancing policies are available, and you can choose them depending on operations. About criteria for choosing them.

Backup and Restore the Settings

This section will describe how to backup and restore the settings of Path Manager.

Because there is no special backup and restore utility for the settings, you need to do manually with spsadmin.

For the detail of spsadmin, please refer to appendix.

1. Backup settings

   Keep the results of spsadmin as follows.

   Load balancing policies and priorities:

```
>spsadmin /lun -v
Settings of path patrol:
>spsadmin /patrol
Modes:
>spsadmin /mode
```

2. Restore settings

   Restore the kept settings with spsadmin as follows:

Load balancing policies:

```
>spsadmin /loadbalance mode  path_number
```

Priorities:

```
>spsadmin /path path_number
>spsadmin /priority priority path_number
>spsadmin /active path_number
>spsadmin /standby path_number
```

Settings of path patrol:

```
>spsadmin /patrol param /i Interval
```

Modes:

```
>spsadmin /failbackmode state       (Failback mode)
>spsadmin /clustermode state        (Cluster mode)
>spsadmin /eventmode state            (Event type)
>spsadmin /monitormode state       (Intermittent error
observation)
```

FAQs and Troubleshooting

This section will describe the things need to confirm when a trouble is occurred and the information need to make inquiry as a troubleshooting when Path Manager is in operation.

If only one path is displayed in the -getlun option of Path Manager, causes may be found in the table below. Refer to the descriptions in the table before making inquiries.

INSERT Table 4-1 FAQs and Troubleshooting

Inquiry (event)	Points to check	Handling
spsadmin /lun is failed. Only one path is visible. Some devices are missing at disk drives in device manager.	Is the installed HBA driver an appropriate one?	Reinstall the appropriate HBA driver.
	If you use the Path Manager that can be set the call function, is the cross call function set to Off?	Set the cross call function of Path Manager to On. Use SnapSAN Manager to change the settings.
	Is Path Manager connected with the server?	Confirm the connection betweenPath Manager and the server
	Is Path Manager turned on?	Confirm Path Manager is turned on.
	If you use the FC fabrics, are those fabrics are turned on?	Confirm those FC fabrics are turned on.
	Have you changed the connection between Path Manager and the server? Is Path Manager connected with the server?	Confirm the connection between Path Manager and the server. If you intend to change the connection, please execute “spssdmin /deletemissing” after the changes. Confirm the connection betweenPath Manager and the server.
	If you use the iSCSI connections, you must configure the iSCSI Initiator. Can you access to the Path Manager from the server?	Confirm whether the setting of iSCSI Initiator is correct. Confirm whether ping command to the IP addresses of the port of Path Manager successes.
	Is the configuration of Access Control of Path Manager correctly set?	Confirm the configuration of Access Control of Path Manager . Confirm also the server and Path Manager connected logically.
	Is the configuration of zoning of the FC switch correctly set?	Confirm the configuration of zoning of the FC switch.
Event ID 280 is generated in the System Event log	Have you changed the connection between Path Manager and the server? Is Path Manager connected with the server?	Confirm the connection between Path Manager and the server. If you intend to change the connection, please execute “spsadmin /deletemissing” after the changes. Confirm the connection between Path Manager and the server.

Information Gathering Necessary in Case of Failures

When path failures occur or when some kind of trouble occurs in Path Manager, collect the basic information such as date of failure, details of failure, and system configuration that is necessary when investigating the failure.

If information is collected only in part or if no information is collected, causes of failure may not be identified since sufficient investigation cannot be carried out.

Also collect the following information that is necessary in investigation from the viewpoint of Path Manager.

To collect the information, use the Path Manager Log Collector.

There are two ways to execute the Log Collector.

1. Execute from the Start menu (Recommended)

   Execute Log Collector with the default settings. You can use this way if you don't have to specify any options.

2. Execute from the command prompt with any options

   If you use Path Manager on the Server Core environment or want to specify any option to Log Collector, you have to use this way.

   It takes four or five minutes to execute Log Collector. (It depends on the system configuration.)

Procedures to execute from start menu

1. Log onto the system as a member of the Administrators group.
2. Select the following item from the [Start] menu.

   [All programs] - [Path Manager] - [Log Collector]

3. The dialog box which confirms to execute the Log Collector will be shown. Click [Yes].
4. When collecting logs are finished, the dialog box which indicates to finish will be shown. Click [Yes].
5. A log file is created in the following directory under the install directory of Path Manager.

   (Install directory of Path Manager)\logtool\

   As the default settings, the log file is put into the following directory:

   c:\Program Files\\SPS\logtool\

6. The format of the file name is as follows:

   spslogYYMMDDhhmmss.zip

   YY: The year when Log Collector is executed. (last two digit of the year)

   MMDD: The month and day when Log Collector is executed. (If the value is less than 10, 0 is filled at the beginning)

   hhmmss: The time when Log Collector is executed. (hour, minute and second)

   Example:

The name of archived log file collected on September 18 at 7:16:53 p.m. is:

spslog070918161653.zip

NOTE: On Windows Server 2008 and Windows Server 2008 R2 environment, only built-in administrator can execute the Log Collector from start menu. When the other user collects the information, please launch command prompt by "run as administrator" and follow "Procedures to execute from command prompt with any options" shown as below.

Procedures to execute from command prompt with any options

1. Log onto the system as a member of the Administrators group.
2. Execute the command prompt, and move the following directory Log Collector is installed:

(Install directory of Path Manager)\logtool\

As the default settings, the log file is put into the following directory:

```
c:\Program Files\\SPS\logtool\
```

3. Execute the Log Collector using one of the following commands:

```
cscript spslog.vbs [/s] [output_file_name.zip]
wscript spslog.vbs [/s] [output_file_name.zip]
```

/s: Silent mode. The dialog boxes for confirmation will no be shown.

Example:

```
cscript spslog.vbs ServerA.zip
cscript spslog.vbs /s
cscript spslog.vbs /s ServerA.zip
```

NOTE: The behaviors are the same with cscript or wscript.

4. If you do not specify the output file name, the file name is as follows:

```
spslogYYMMDDhhmmss.zip
YY: The year when Log Collector is executed. (last two
digit of the year)
MMDD: The month and day when Log Collector is executed.
(If the value is less than 10, 0 is filled at the
beginning)
hhmmss: The time when Log Collector is executed. (hour,
minute and second)
```

CAUTION: If you specify the file name that already exists, Log Collector overwrites this without any warning. On the Server Core environment, you can not specify the output file name, and the output log files are put into a "log" directory not archived as a zip file.

On Windows Server 2008 and Windows Server 2008 R2 environment and log on as no-built-in administrator user, launch command prompt by "run as administrator and execute.

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