Infortrend®

User's Manual

EonPath™ Multipathing Packages

for

Windows®, Solaris®, and Linux® OS

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Table of Contents

About This Manual

This manual:

- Introduces the multipath I/O driver package.
- Provides details about the EonPath package installation process.
- Describes the EonPath configuration commands.

This manual does not:

- Contain detailed information on RAID configurations
- Give a detailed description of the hardware devices and their connections.

Who should read this manual?

This document is intended for system administrators who want to install the EonPath packages for building a multipathing solution in a storage network, using Infortrend's EonStor® series RAID subsystems or EonRAID® series RAID controller head.

Related Documentation

- Generic Operation Manual (Version 1.69 or later revisions)
- RAIDWatch® User's Manual (Version 2.2 or later revisions)
- Installation and Hardware Reference Manual.

These documents are located in the product CD included with each subsystem package.

Limitations

- One logical configuration, e.g., a logical drive, can be associated with up to 32 I/O paths.

Section One
Overview

This document covers general configuration concerns, options, and work theories for using the EonPath multipathing drivers. The document covers the EonPath drivers for three major groups of operating systems, including Solaris, Windows, and Linux.

The major functionalities of the EonPath is to direct I/Os to an alternate data path in the event of HBA or cabling failure, mending the weakest point of storage configuration by far. The EonPath also comes with load-balancing algorithms which help accelerate the throughput across host-storage data links.

Unlike complicated volume management software by 3rd-party vendors, the EonPath is simple and features an end-to-end association between storage devices and HBAs across a storage network. This reduces the risk of conflicting device identifiers often occurred with 3rd-party software. A storage device, e.g., a logical drive, appears to the EonPath through Infortrend's proprietary identifying methods and thus the configuration is effortless.

Design Purposes and Benefits:

- Path redundancy, with automatic failover/failback.
- Reduces the dependability on FC switches through fault-tolerant links.
- Load-balance compliant with TPGS (Target Port Group Service) or previously known as ALUA (Asymmetric Logical Unit Access) for making maximum use of host link bandwidth

TPGS Implementation:

The TPGS methodology obtains I/O traffic statistics from EonPath drivers and let the drivers determine if I/Os should be balanced between data paths. I/Os can be selectively distributed through more than one I/O path and thus making maximum use of the processing power of both RAID controllers and data path bandwidth. With firmware release 3.48, a logical drive can be associated with IDs managed by different RAID controllers. The methodology dynamically balances I/Os on the data path partners, through the backplane, and to the hard drives.

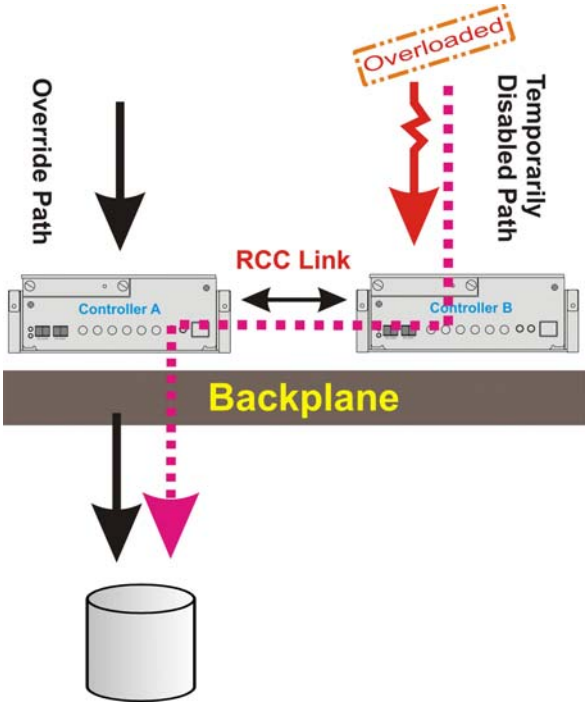


Figure 1: Selecting an Optimal Path

- **Symmetric/Asymmetric I/O Load Balancing** - In addition to failover support, the Multipathing software can use any active paths to a RAID volume to send and receive I/Os. With I/Os routed through multiple host connections, bandwidth can be increased by the addition of host controllers. The Multipathing software uses a round-robin, mini-Queue, or failover algorithms, by which individual I/O requests are routed to active host controllers in a series, one after the other, or using an adaptive least-I/O-queue method.
- **Mini-Queue Load Balancing** – Breaking the limits of finite resources set for traditional SCSI host LUNs, the EonPath has effectively managed queue depths which help boost data path performance.

Section Two
Storage-side Configuration

Design Concerns

1. We assume that EonPath drivers are implemented for an environment running mission-critical applications, and that the Infortrend storage subsystems applied in such environment should also come with high availability, i.e., dual-redundant RAID controllers. On the host side, a redundant pair of single-ported HBA is necessary.

2. Carefully configure your RAID arrays and select the appropriate array settings such as stripe size and write policy. Reconfiguration takes time and may require you to move your data.

3. Perform the similar tasks if your RAID arrays come with a more complicated mapping scheme, e.g., volumes divided into many partitions, multiple array volumes, etc.

4. Create at least two logical drives (LD0 and LD1) and associate (map) them equally with Controller A IDs (AID) and Controller B IDs (BID). Doing so you get the maximum work power from the dual-redundant RAID controllers. For more details on creating AIDs/BIDs and LUN mapping processes, please refer to Infortrend's Generic Operation manual.

5. Logical arrays are assigned to Controller A by default. Logical arrays should be manually associated with Controller B IDs.

6. Disable some configuration options for they might cause data inconsistency if module failures should occur. For example, disabling the use of buffers on individual disk drives may let you lose some performance, yet it is relatively safer for drive buffers may hold cached writes during a power outage and cause data inconsistency. The configuration option can be found in firmware's embedded utility through **Main Menu** -> **View and Edit Configuration Parameters** -> **Drive-side Parameters** -> **Drive Delayed Write**.

7. There are similar concerns with the mirrored cache operated between the RAID controllers. Make sure compensatory measures are applied, e.g., use of battery backup modules or UPS devices.

Pros and Cons of Various Configurations

Configuration		Pros and Cons
1	**Simple DAS**	DAS at its simplest form using a single-controller subsystem.
2	**Simple DAS w/o Hub**	Applies to single logical drive over flexible cabling.
3	**DAS to Dual-ported HBAs**	Dedicated data paths and high performance to a single server.
4	**DAS w/ Hubbed Ports**	Saves costs on FC switches; total host-side bandwidth can be halved.
5	**SAN w/ FC Switches**	Applies to multi-server SAN; requires external FC switches.
6	**SAN w/ FW 3.48 Mapping Method**	Arrays can be associated with Controller A or Controller B IDs. In the event of host link failure, data access travels through the alternate path to the alternate RAID controller.

1. Simple DAS (Single-controller Subsystem)

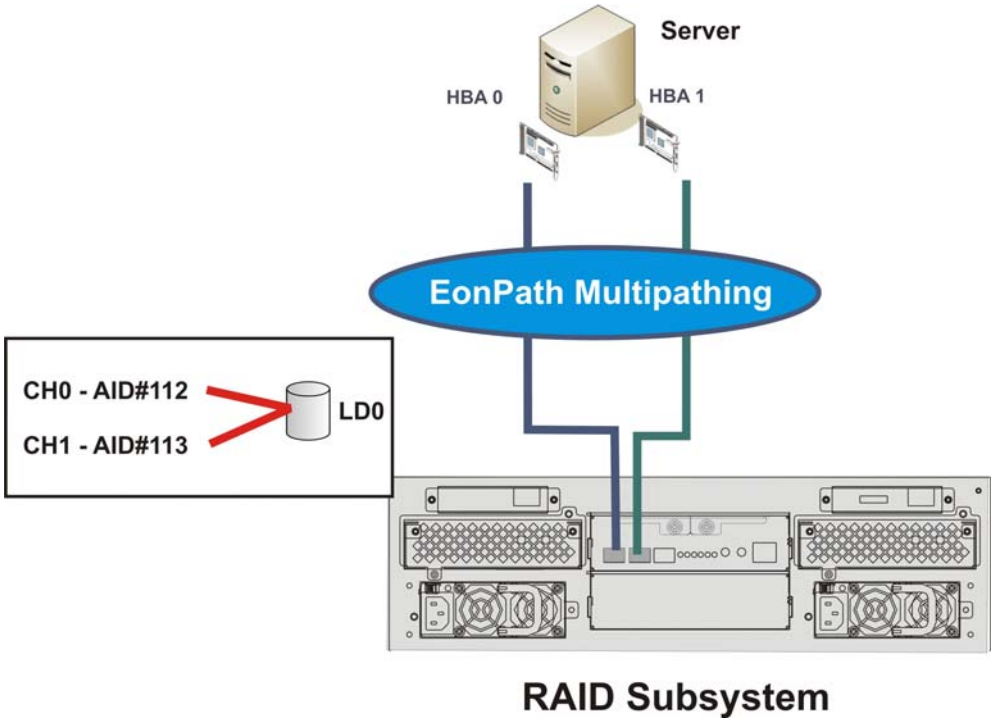


Figure 2: Simple DAS

Configuration Tasks

Tasks	Logical Drive	LUNs	Channel	AID	BID
Map LD0 to an AID on channel #0.	LD0	0	0	112	N/A
Map LD0 to an AID on channel #1 for redundant-path access.		0	1	113	N/A

This configuration applies to a single-controller subsystem which is directly attached to a host computer without intermediate networking devices. A logical drive is associated with host channel IDs on different host channels.

NOTE:

- You may use different channel IDs than are shown here in the sample topologies, IDs used in the sample configurations are mostly default numbers in firmware. As long as the IDs are carefully selected according to the configuration rules, there is no limitation on selecting different host channel IDs.
- AID and BID apply to firmware release 3.48 or later. Before firmware release version 3.48, PID (Primary ID) and SID (Secondary ID) are used instead.

2. Simple DAS, Onboard Hub Disabled (FW3.48 Mapping Method)

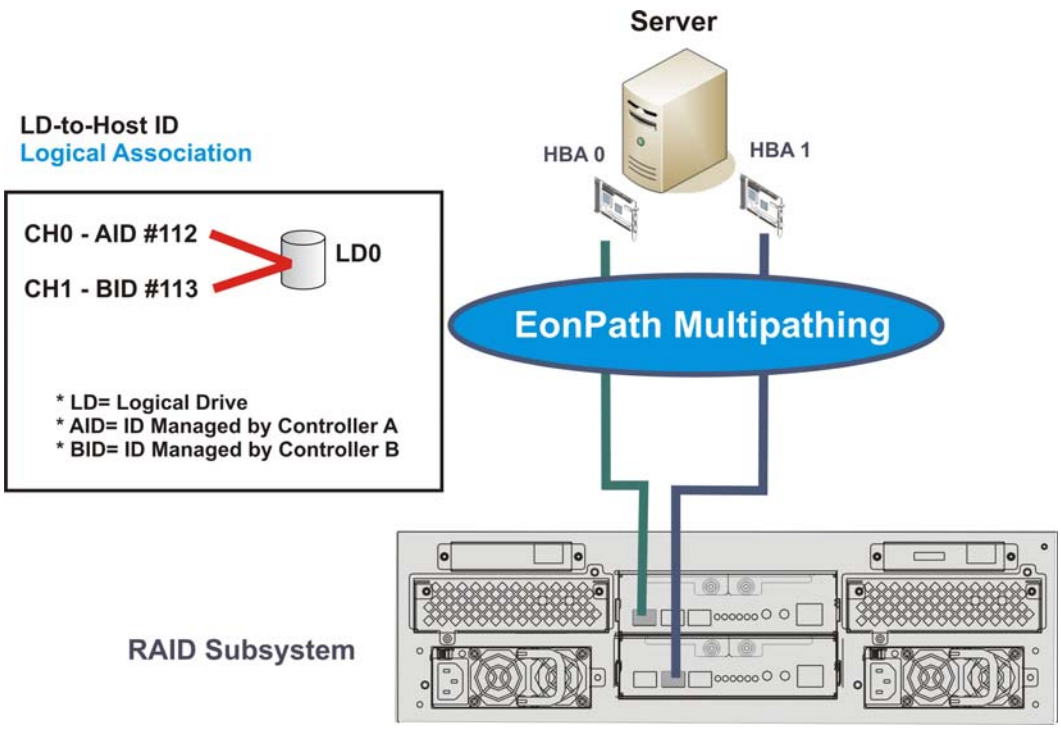


Figure 3: Simple DAS with Disabled Hub

Configuration Tasks

Tasks	Logical Drive	LUNs	Channel	AID	BID
Map LD0 to an AID on channel #0.	LD0	0	0	112	N/A
Map LD0 to a BID on channel #1 for redundant-path access.		0	1	N/A	113

This configuration applies to a redundant-controller subsystem which is directly attached to a host computer without intermediate networking devices. A logical drive is associated with different Controller IDs (Controller A and Controller B) on separate host channels of different RAID controllers.

NOTE:

- You may use different channel IDs than are shown here in the sample topologies, IDs used in the sample configurations are mostly default numbers in firmware. As long as the IDs are carefully selected according to the configuration rules, there is no limitation on selecting different host channel IDs.

3. DAS to Dual-ported HBAs (Onboard Hub Disabled)

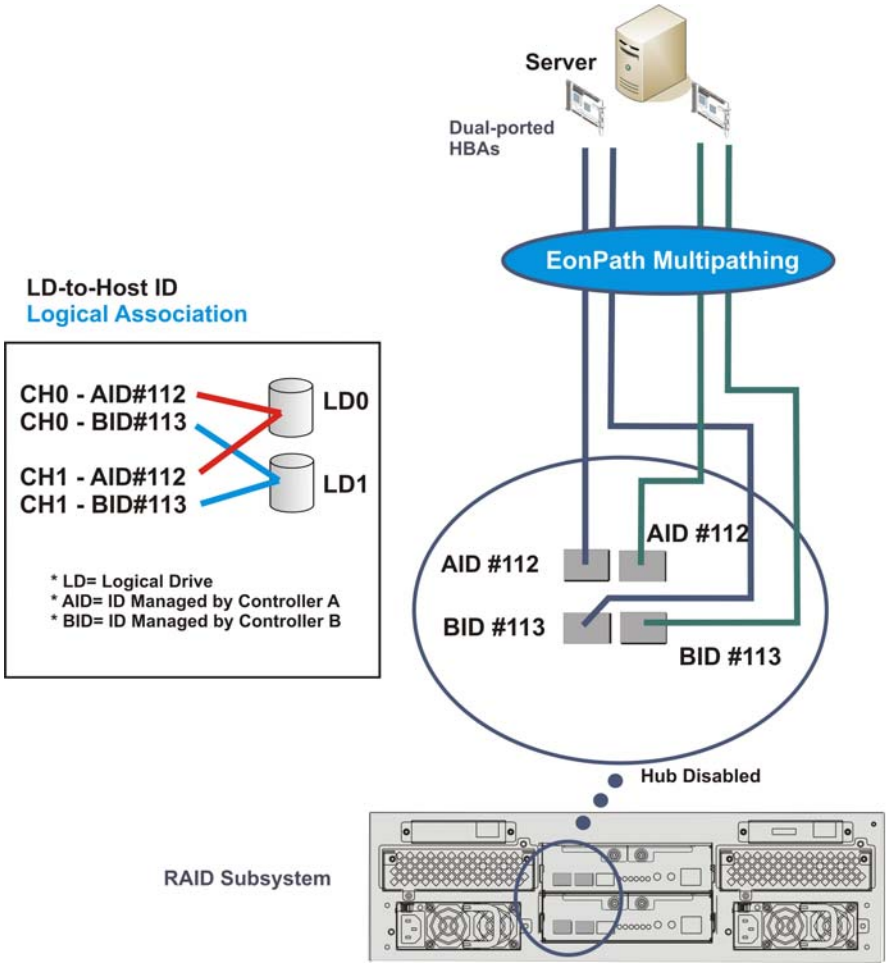


Figure 4: DAS to Dual-ported HBAs and Traditional Mapping Method

Configuration Tasks

Tasks	Logical Drive	LUNs	Channel	AID	BID
Map LD0 to an AID on channel #0.	LD0	0	0	112	N/A
Map LD0 to an AID on channel #1 for redundant-path access.		0	1	112	N/A
Map LD1 to a BID on channel #0.	LD1	0	0	N/A	113
Map LD1 to a BID on channel #1 for redundant-path access.		0	1	N/A	113

NOTE:

- The mapping information here is following the traditional mapping method which allows a logical drive to be associated with IDs managed by a single RAID controller, e.g., either

Controller A IDs or Controller B ID.

- The new mapping method (available since firmware 3.48) allows a logical drive to be managed by both counterpart controllers, i.e., a logical drive associated with both Controller A and Controller B ID.

This configuration applies to a redundant-controller subsystem which is attached to a host computer equipped with two dual-ported host adapters.

Multipathing is achieved through the following:

1. Logical drives are separately associated with Controller A IDs or Controller B IDs on separate host channels.

2. In the event of a cabling or single controller failure, a surviving controller or a controller holding a valid data link can access the array through an alternate host ID that was originally managed by the counterpart controller.

3. Cable/controller failure can be managed by EonPath by re-routing host I/Os to a valid link.

4. Host IDs managed by a failed controller are automatically passed down to a surviving RAID controller; for instance, Controller A IDs passed down to Controller B, in the event of controller failure.

In this configuration, the subsystem's onboard hub functionality is disabled.

4. DAS with Hubbed Ports (Onboard Hub Enabled)

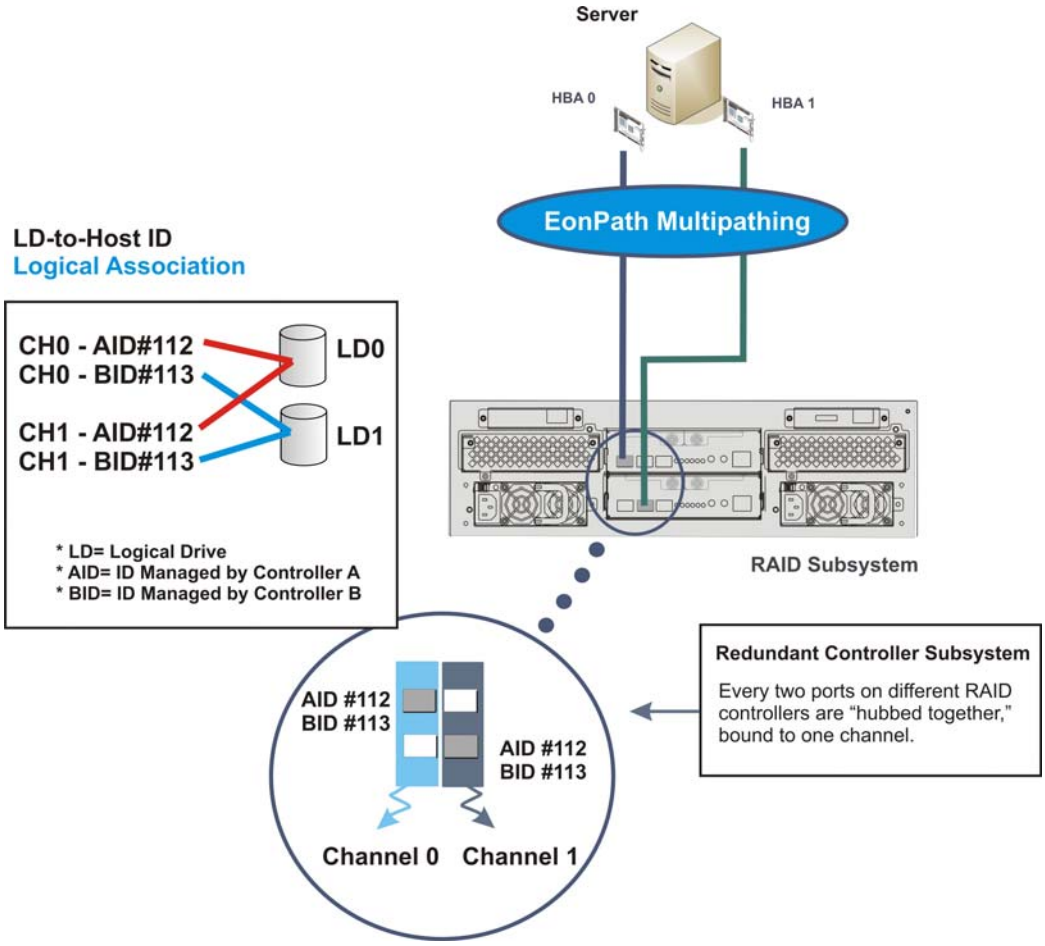


Figure 5: DAS with Hubbed Ports

Configuration Tasks

Tasks	Logical Drive	LUN	Channel	AID	BID
Map LD0 to an AID on channel #0.	LD0	0	0	112	N/A
Map LD0 to an AID on channel #1 for redundant-path access.		0	1	112	N/A
Map LD1 to a BID on channel #0.	LD1	0	0	N/A	113
Map LD1 to a BID on channel #1 for redundant-path access.		0	1	N/A	113

1. This configuration applies to a redundant-controller subsystem which is attached to a host computer with or without intermediate FC switch devices.

2. For simplicity of the diagram, only two host links are shown here. All host ports can be used and therefore the subsystem can connect up to two application servers with fault-tolerant links.

3. Two logical drives are separately associated with either Controller A or Controller B IDs on separate host channels. Hubbed ports are the same host ports on different controllers combined into a shared host loop and provide path redundancy without FC switches.

5. SAN with FC Switches (Onboard Hub Disabled)

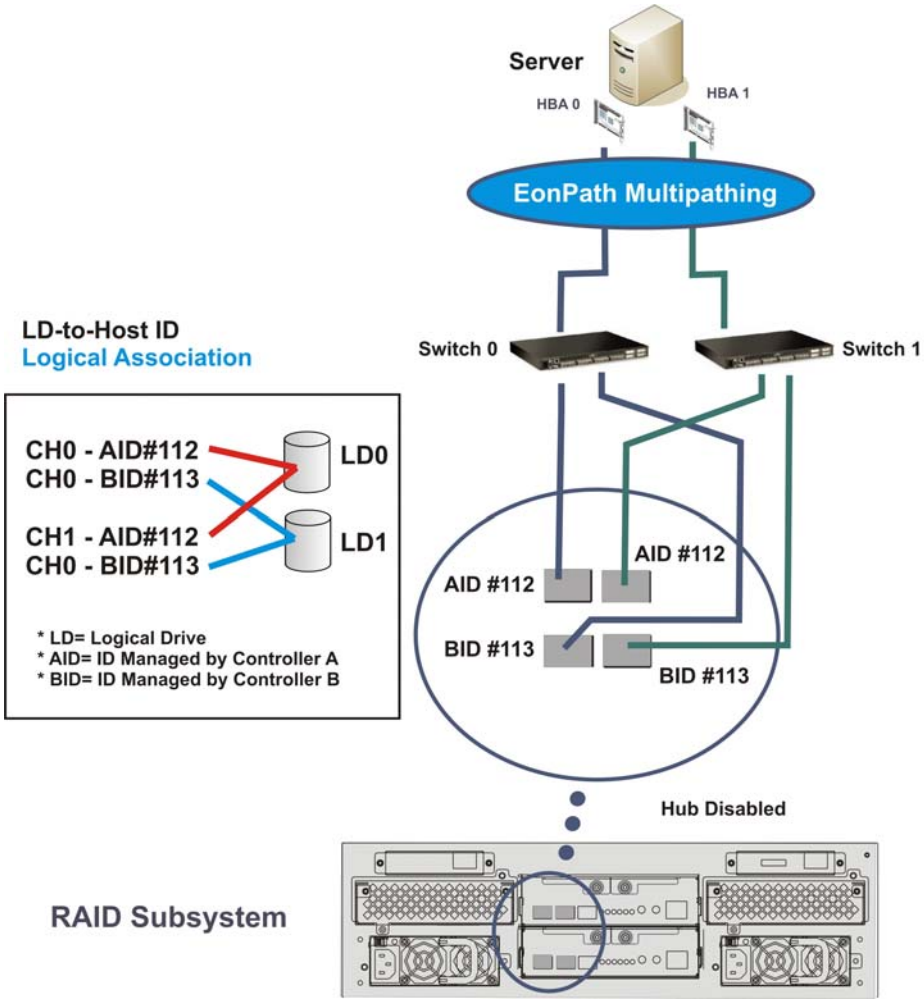


Figure 6: SAN with FC Switches

Shown above is a configuration using FC switches to facilitate the connections with multiple SAN servers. For simplicity, only one server is displayed. Many can be attached to the FC switches.

Configuration Tasks

Tasks	Logical Drive	LUNs	Channel	AID	BID
Map LD0 to an AID on channel #0.	LD0	0	0	112	N/A
Map LD0 to an AID on channel #1 for redundant-path access.		0	1	112	N/A
Map LD1 to a BID on channel #0.	LD1	0	0	N/A	113
Map LD1 to a BID on channel #1 for redundant-path access.		0	1	N/A	113

This configuration applies to a redundant-controller subsystem attached to host computer(s) using intermediate FC switch devices.

Fault Tolerance is achieved through the following:

1. Logical drives are separately associated with Controller A IDs or Controller B IDs on separate host channels.

2. In the event of a cabling or single controller failure, a surviving controller or a controller holding a valid data link can access the array through an alternate host ID.

3. Through the intermediate FC switches or a FC switch with segregated zoning, cable/controller failure can be managed by re-routing host I/Os through a valid link.

4. Host IDs managed by a failed controller are automatically passed down a surviving RAID controller; for instance, Controller A IDs passed down to Controller B, in the event of controller failure.

5. When using FC switches, the subsystem's onboard hub functionality should be disabled.

6. SAN with FC Switches (FW3.48 Mapping Method; Onboard Hub Disabled)

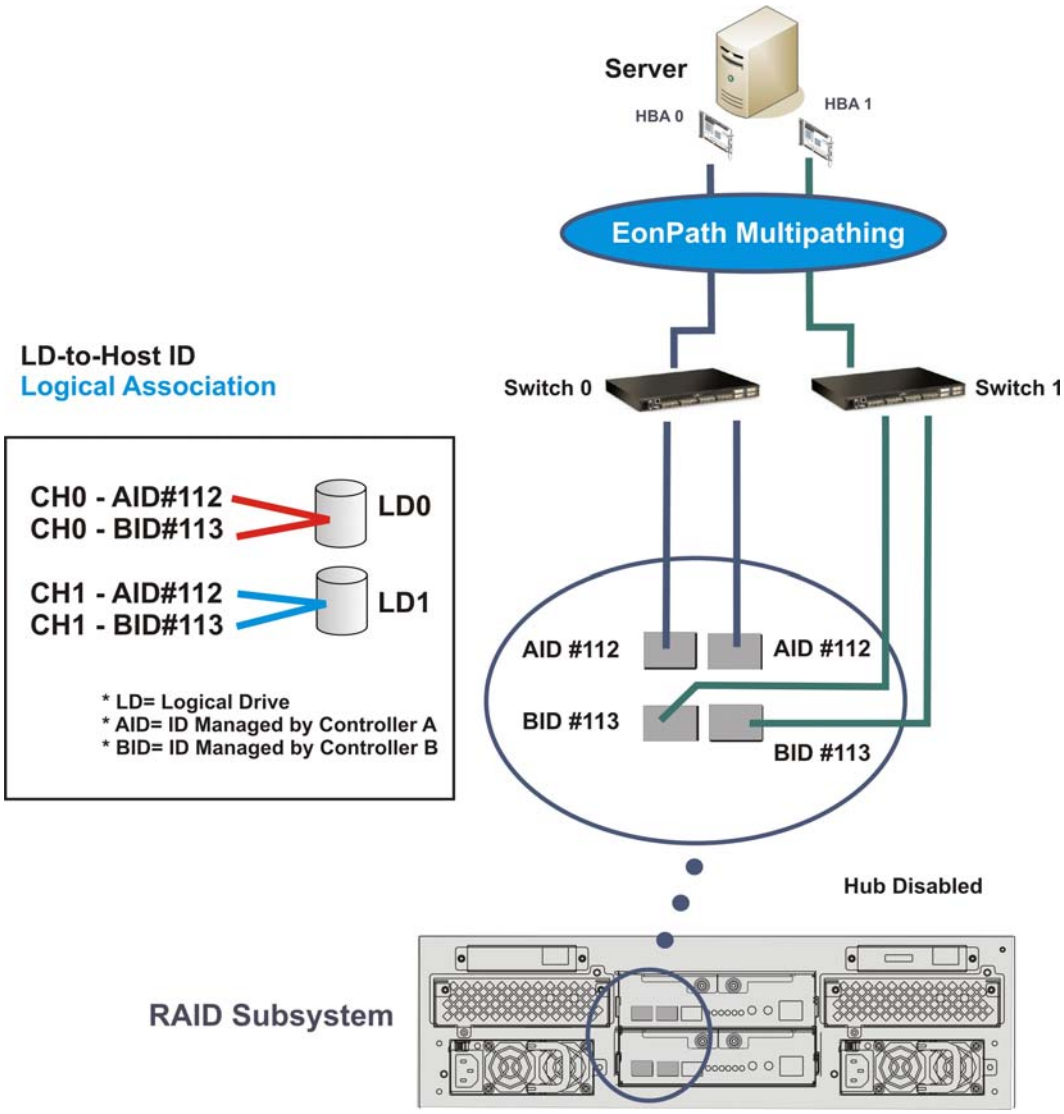


Figure 7: SAN with FC Switches & FW3.48 Mapping Method

Configuration Tasks

Tasks	Logical Drive	LUNs	Channel	AID	BID
Map LD0 to an AID on channel #0.	LD0	0	0	112	N/A
Map LD0 to a BID on channel #0 for redundant-path access.		0	0	N/A	113
Map LD1 to an AID on channel #1.	LD1	0	1	112	N/A
Map LD1 to a BID on channel #1 for redundant-path access.		0	1	N/A	113

This configuration applies to a redundant-controller subsystem which is attached to a host computer with intermediate FC switch devices. The new mapping method requires firmware revision 3.48 or later.

Fault Tolerance is achieved through the following:

1. The new mapping method allows a logical drive to be associated with IDs assigned to different RAID controllers. Associated with both Controller A and Controller B IDs, firmware can dynamically re-arrange I/O load on different I/O paths when a specific I/O path is congested with heavy load. This works with TPGS methodology which obtains I/O load statistics from Infortrend's multipathing drivers running on the host side.
2. Logical drives are separately associated with a Controller A ID and a Controller B ID on the same host channel.
3. In the event of a cabling or single controller failure, a surviving controller or a controller holding a valid data link can access the array through the inherited host IDs.
4. Through the intermediate FC switches or a FC switch with segregated zoning, cable/controller failure can be managed by re-routing host I/Os to a valid link.
5. Host IDs managed by a failed controller are automatically passed down a surviving RAID controller; for instance, Controller A IDs passed down to Controller B, in the event of controller failure.

Shown above is a configuration using FC switches to facilitate the connections with multiple SAN servers. For the reason with the diagram's simplicity, only one server is displayed here. When using FC switches, the subsystem's onboard hub functionality should be disabled.

Section Three
EonPath MPIO for Windows

Windows MPIO Overview

Infortrend participated in Microsoft's Multi-path I/O (MPIO) program and developed a set of self-developed drivers to facilitate multipathing solutions under a native Windows architecture. Infortrend's MPIO implementations aim to provide failover capabilities through the use of redundant physical path components, to redistribute the Read/Write load among multiple paths, and to avoid the interoperability issues with storage devices from different vendors.

With a single host bus connection, any of the physical path components between host and storage (host bus adapters, cables, and switches) can become a single point of failure and a potential performance bottleneck. Cabling failures can easily occur due to poor contact, dirty interface media, or overstressed fibers. Redundant hardware, advanced RAID technology, and failover capabilities are used to enhance fault tolerance in environments where mission-critical data needs to be continuously available.

Supported Hardware

The MPIO driver program is designed for use with subsystems built around the ASIC266 or ASIC400 platforms. These supported subsystems include the EonStor series Fibre-to-Fibre, Fibre-to-SATA, and iSCSI-to-SATA RAID subsystem series, or Fibre-to-Fibre controller heads.

Supported OS

Windows Server 2000/ Server 2003, x86 or x64 versions.

Installation Prerequisites

Environmental Prerequisites

- The host computer(s) must be connected to Infortrend's RAID storage using fault-tolerant cabling devices, either end-to-end or via routing devices such as Fibre Channel switches or GbE Ethernet switches. The driver-level MPIO then manages the fault-tolerant connections.

- In a Fibre Channel SAN environment, the same level of intelligent path management mechanisms should be implemented to handle

problems such as misaddressing a device after a disruption of an FC Arbitrated Loop.

- If you are using the EonStor series Fibre-host RAID subsystems, the Fibre HBA cards and its associated driver should be installed to the host computer(s) prior to the MPIO program installation.

- If you are using the EonStor iSCSI series subsystems, either iSCSI initiator cards along with its drivers or Ethernet cards with iSCSI initiator software should be installed to the application servers(s) prior to the EonPath installation.

  - When using software initiator, the associated software configuration should be completed before EonPath installation.

  - In an IP SAN built on Ethernet cards, appropriate configuration of Microsoft iSCSI initiator (or software by other vendors) should be completed before applying EonPath's MPIO capabilities.

- Firmware version 3.47x or above must be running on your RAID subsystem/controller.

Hardware Prerequisites

- The MPIO program aims to eliminate every single point-of-failure for high-availability environments. Therefore, it is preferred your storage subsystems also come with fully redundant and hot-swappable modules.

- To create path redundancy in a Fibre Channel storage network or applications using other host-side links, apply at least two (2) single-ported HBA cards or two (2) dual-ported Fibre Channel or iSCSI initiator HBA cards (for models featuring more than dual host ports) on the host computer(s).

- Before installing and using the MPIO program, RAID volumes must be created and properly associated with host ID/LUNs for using the MPIO functions.

NOTE:

For logical drive creation, LUN mapping and Firmware configuration, please refer to the **RAIDWatch User's Manual** or firmware **Operation Manual** that came with your RAID subsystem.

The EonPath MPIO Program Package

The MPIO program package comes as a zip file and is available through Infortrend's e-support websites.

Download the zip file and extract its contents. The following file folders for different Windows platforms should be available:

1. Windows x86 edition
2. Windows X64 edition

Select one of the installer programs from a folder that is appropriate for your OS and host computer(s).

MPIO Driver Installation

Before you install the MPIO driver program, make sure your computer system meets the requirements previously listed. It is recommended that you close all running applications before running the installer program.

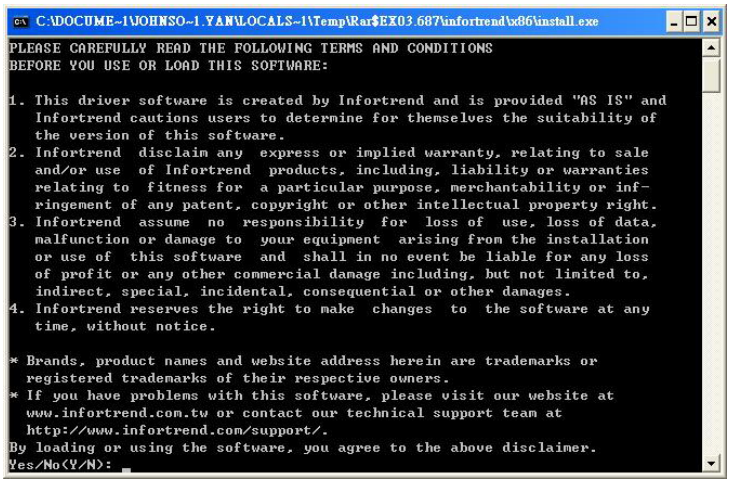
CAUTION!

If you have a previously installed MPIO program on the host computer(s), we strongly recommend that you remove the MPIO program and restart the computer before performing the Infortrend MPIO driver program installation. Install the MPIO program without uninstalling the previous version may cause unexpected system faults.

To install EonPath MPIO, follow these steps:

Step 1. Double-click on the installer file, **install.exe,** to start the installation process.

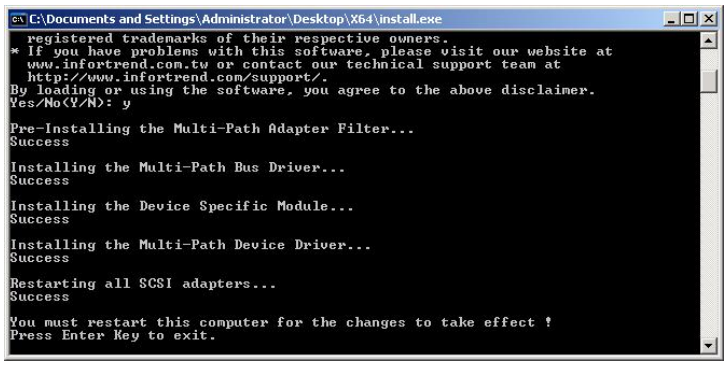
Step 2. A **Licenses Announcement** window will appear. Read the announcement carefully.



Step 3. If you agree the terms and conditions listed, type **Y** and then click **Enter** on the keyboard to install the program onto your host computer.

NOTE:

A DOS screen will appear during the installation process. The DOS screen will automatically close once the installation is completed. It will take approximately a few seconds.



Shown above is a DOS screen displayed during MPIO driver installation process.

Step 4. Restart computer. The MPIO driver installation will be completed after a system reboot.

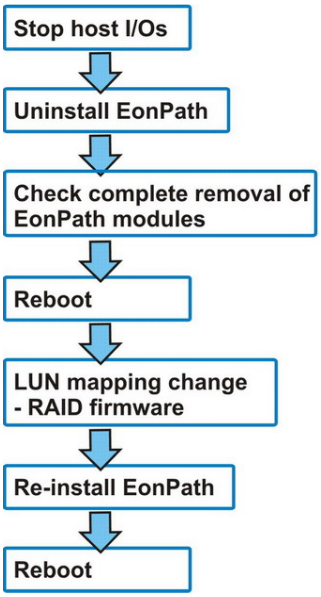
NOTE:

If you should need to remove the MPIO driver program in the future, the uninstallation will also take effect after a system reboot.

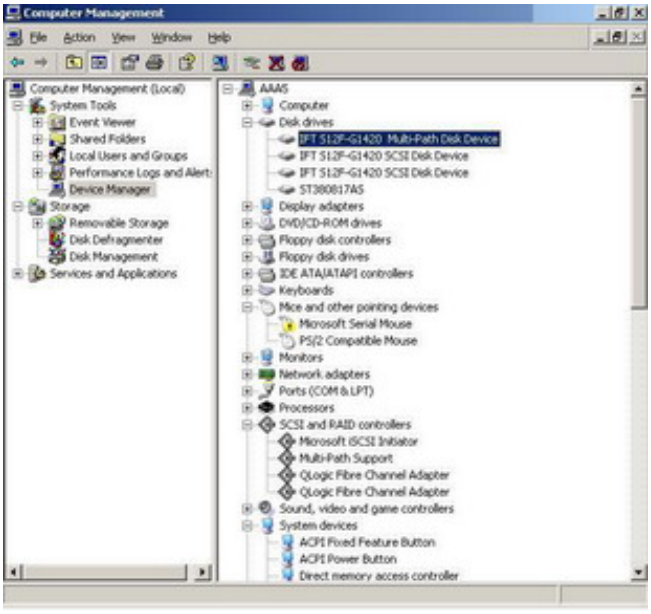
Step 5. The MPIO driver program is successfully installed onto your host computer. Your storage system is now protected by the multi-path load balance and failover functionalities.

Known Issues

1. If RAID configurations have been deleted and created, you need to uninstall and reinstall the EonPath software. The EonPath software recognizes RAID configurations by a random device ID generated by firmware. A re-configured array will appear with a different ID and hence the software needs to be re-installed.
2. If the need arises to change host LUN mapping, i.e., associate a logical drive with different host ID/LUNs, you need to stop host application I/Os, uninstall the EonPath program, reboot the host computer, configure RAID array LUN mapping, and then re-install the EonPath program for the new configuration to take effect.

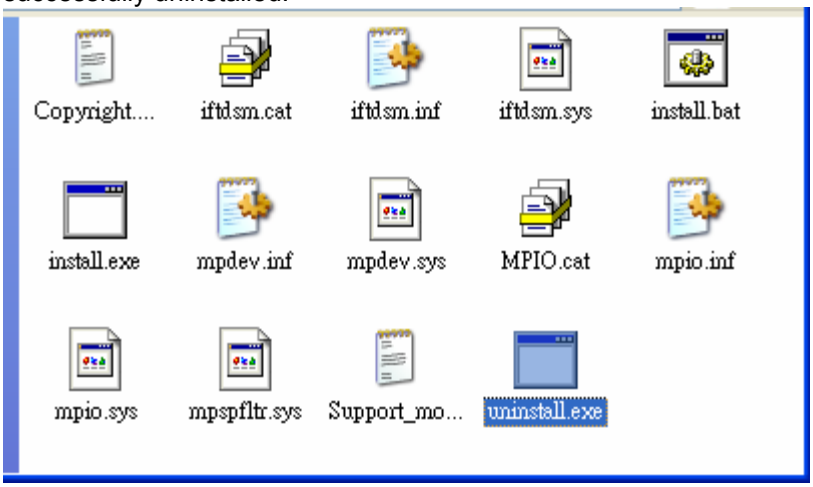


3. Make sure the EonPath is completely removed if you want to make changes to LUN mapping. In Windows, you can check Computer Management, Device Manager, check Disk drives and the SCSI and RAID controller items. Make sure items such as "Multi-path device" have been removed.



Uninstalling MPIO Program

To remove the MPIO program from Windows, you can locate and execute an execution file "uninstall.exe" under the sub-folder Windows\X64 or Windows\X86 of the product CD that came with your subsystem. Select the file in the correct sub-folder according to your Windows OS. Restart your system after the MPIO program is successfully uninstalled.

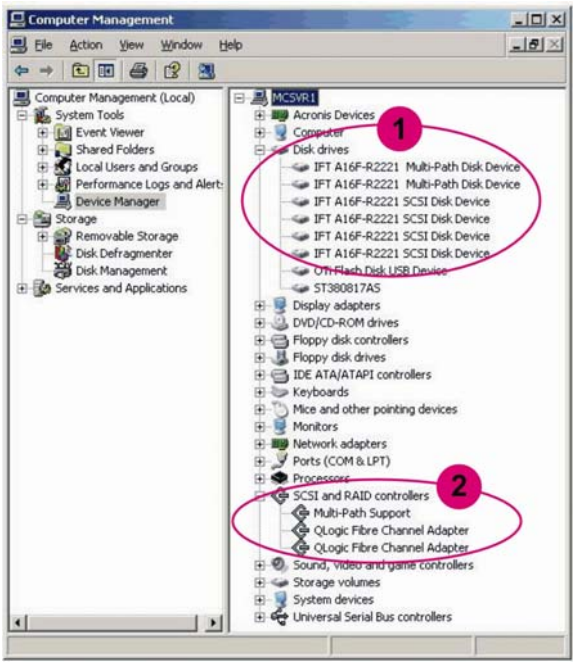


Methods to Check if the MPIO Program Is Installed Correctly

To have the multipathing protection running on your Fibre or iSCSI storage network, please make sure the MPIO program is installed successfully. You can check if the MPIO program is installed for the Fibre RAID subsystems in the **Computer Management** window.

Installation

To verify if the MPIO program is installed successfully, first open the **Computer Management** window from **Settings** -> **Control Panel** -> **System** -> **Hardware** (tabbed window) -> **Device Manager**. Click to select **Device Manager** from the category tree on the left.



Check the following items:

1. Click the **Disk drives** type icon to display one or more **multi-path disk device**(s) and mapped LUNs. The LUNs available through separate host links and the Multi-path Disk Devices will be displayed together. That is because an individual RAID volume can be associated with two different ID/LUNs on two different host data paths (channels).

   The example here uses a single host computer to connect the EonStor A16F-R2221 RAID subsystem. The connection with an iSCSI subsystem will be similar to this regardless of the interconnecting networking devices. Two (2) RAID volumes (two logical drives) were created and associated with four (4) channel ID/LUNs on the two (2) data paths connecting the host computer. Each configured RAID volume (logical drive) is designated by a unique serial identifier (randomly and automatically generated by the RAID controller). No matter the RAID volume is associated with how many host ID/LUNs on how many data paths, MPIO recognizes this identifier and considers the RAID volume as a Multipath Disk Device.

   I/Os can be directed through different host ID/LUNs associated with a Multipath Disk Device.

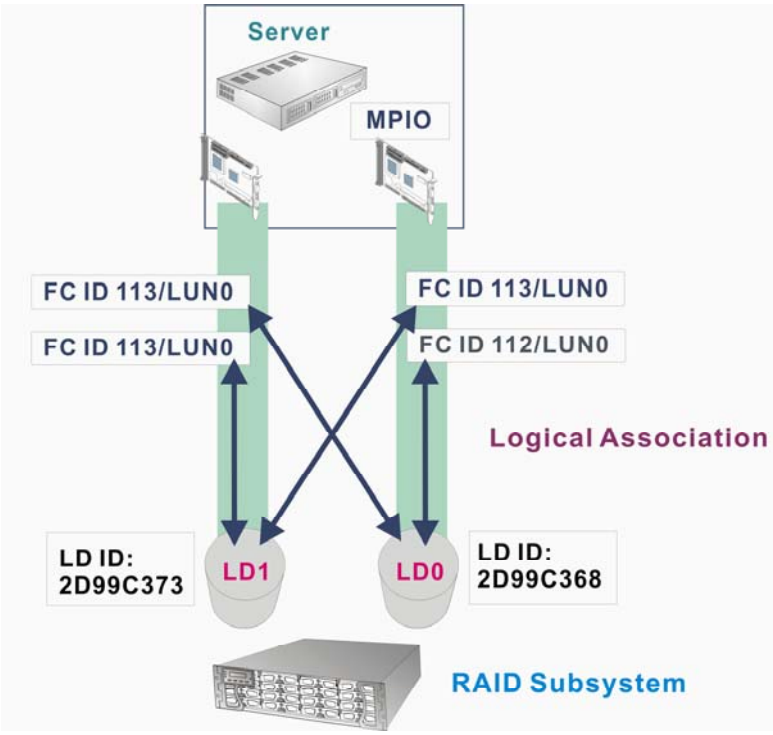


Figure 2-1: Multipath Disk Device Logical Association

2. The physical data path devices can be found under the **SCSI and RAID Controllers** category, under which a **Multi-Path Support** simulated device and the two installed **HBA Adapters** should be found.

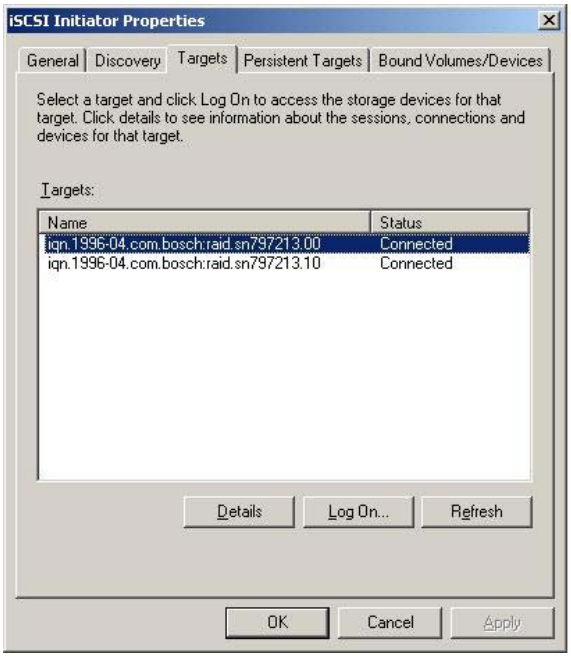
3. For the configuration using iSCSI RAID, the physical data path devices can be found under the **Network Adapters** category. Physical network devices such as Ethernet NICs or iSCSI adapters can be found here.

   If your iSCSI network is operated through **Microsoft iSCSI Initiator**, both the Microsoft iSCSI initiator and Multi-path Support (simulated devices) should be found under the **SCSI and RAID Controllers** category.

iSCSI Component Check Approach

4. If your iSCSI operation is managed by Microsoft iSCSI software initiator, you can verify the installed components by accessing the properties screen of the initiator program.

   Click on the **Targets** or **Persistent Targets** tab to check the status of the connected storage device. If the multipathing program has been successfully initiated, the target status will change from **Inactive** to **Connected**. When dealing with newly-installed components, you need to manually "**Add**" the iSCSI ports through the **Discovery** tabbed window. Note that the Target portals here refer to the iSCSI ports on your iSCSI RAID subsystem.



Microsoft iSCSI Initiator

5. Microsoft iSCSI Initiator Installation

The following paragraphs introduce the Microsoft iSCSI Initiator software and its installation process. Depending on the iSCSI HBA cards used in an iSCSI network, the iSCSI initiator software installation maybe required. Please consult your HBA card vendor or refer to the documentation that came with your HBAs. Microsoft iSCSI Initiator software also facilitates the use of standard Ethernet cards to build up an iSCSI networked storage. In installations without dedicated iSCSI HBA cards, it is important to install the iSCSI initiator software.

Microsoft iSCSI Initiator Download

The Microsoft iSCSI Initiator program version 2.0 can be downloaded from Microsoft's official website. The link is shown below:

http://www.microsoft.com/downloads/filelist

Three Initiator program files are available for Windows running on different platforms. Choose the program that is most appropriate for you.

The example shown in the following sections is based on "**iSCSI-2.0-x86fre.exe.**"

Installing the iSCSI Initiator

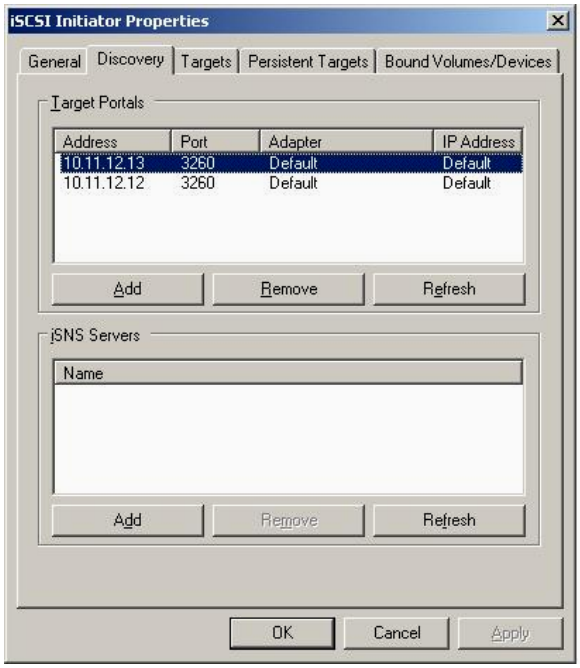
Double click on the "**iSCSI-2.0-x86fre.exe**" and then follow the on-screen instructions by its install shield wizard. Installation completes within a few minutes.

iSCSI Initiator Configuration

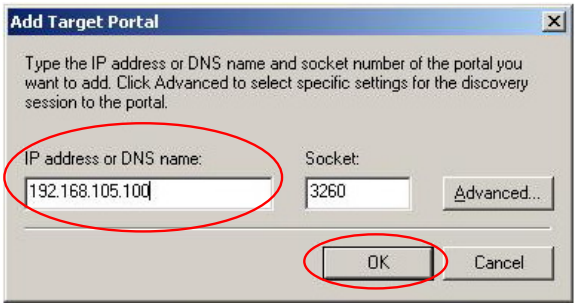
Once successfully installed, you may access the Microsoft iSCSI Initiator program by double-clicking the associated desktop icon or the same icon through the Start menu. In iSCSI applications using standard Ethernet cards, the associated iSCSI parameters must be correctly configured before the MPIO software is installed.

Step 1. Double-click on the icon to open the initiator program window.

Step 2. When opened, click on the **Discovery** tab and then click on the ***Add*** button to add new target portals.



Step 3. When the **Add Target Portal** window prompts, enter the IP or host name of the iSCSI host port of your RAID subsystem. Click ***OK*** to proceed.



NOTE:

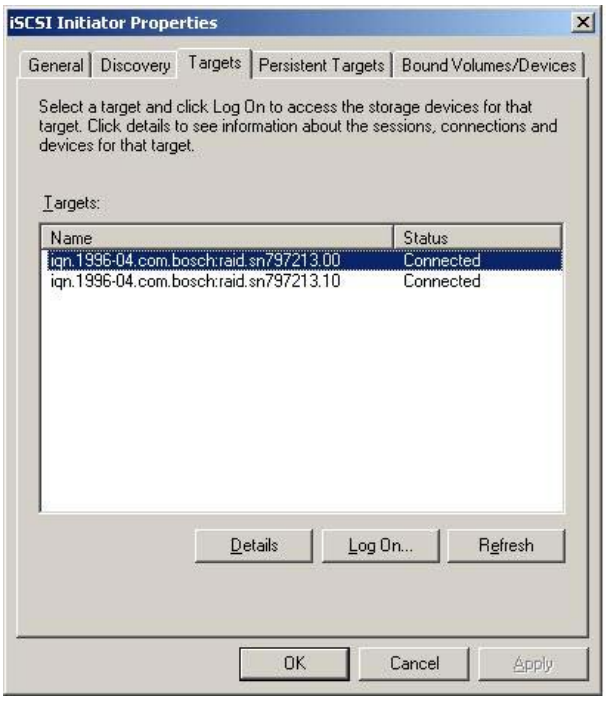
You can check your iSCSI ports' IP addresses using the RS-232 terminal connection or the RAIDWatch® Manager software. Please refer to the firmware **Operation Manual** or **RAIDWatch User's Manual** that came with your subsystem for more information.

NOTE:

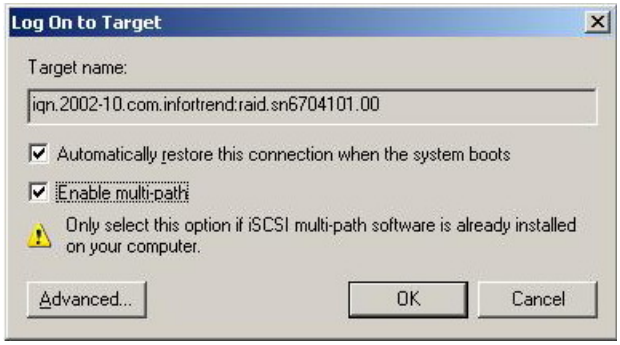
Windows will automatically generate a socket number that is shown on the right of the IP address input box. It is recommended you keep the socket number without changing it.

Step 4. To create path redundancy, repeat ***Step 3*** above to add one or more target portals.

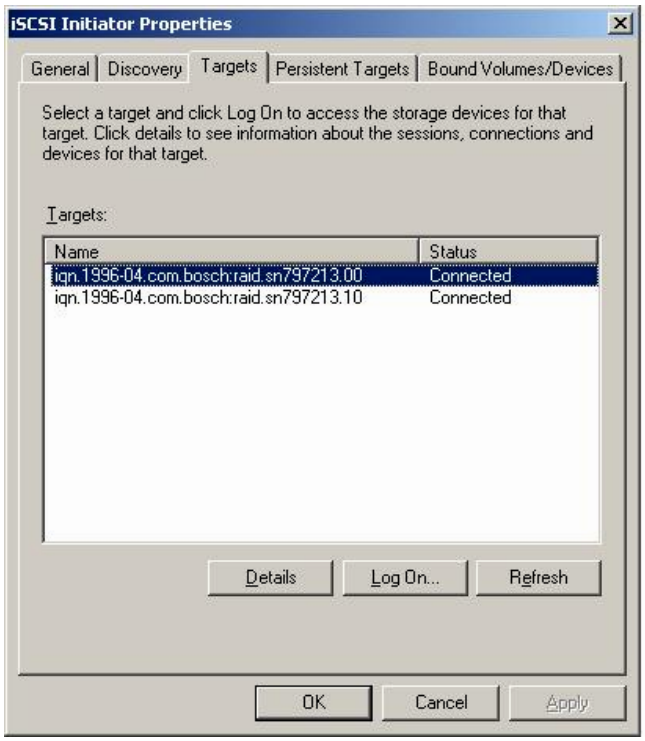
Step 5. Click on the **Targets** tab on the iSCSI Initiator program window, and then click on the ***Log On*** button.



Step 6. The **Log On to Target** window should prompt. Click on both check boxes to enable the connections to be restored automatically when the system reboots and the support for multi-path connection. Click ***OK*** to exit this window.

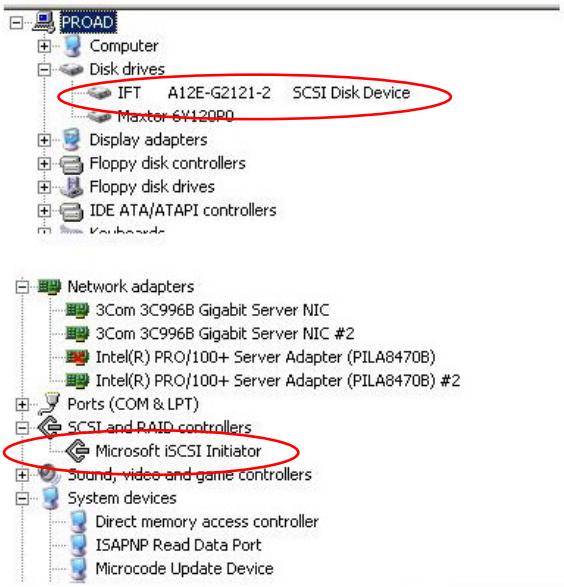


Step 7. Return to the **iSCSI Initiator Properties** window. Click ***OK*** to exit the program.



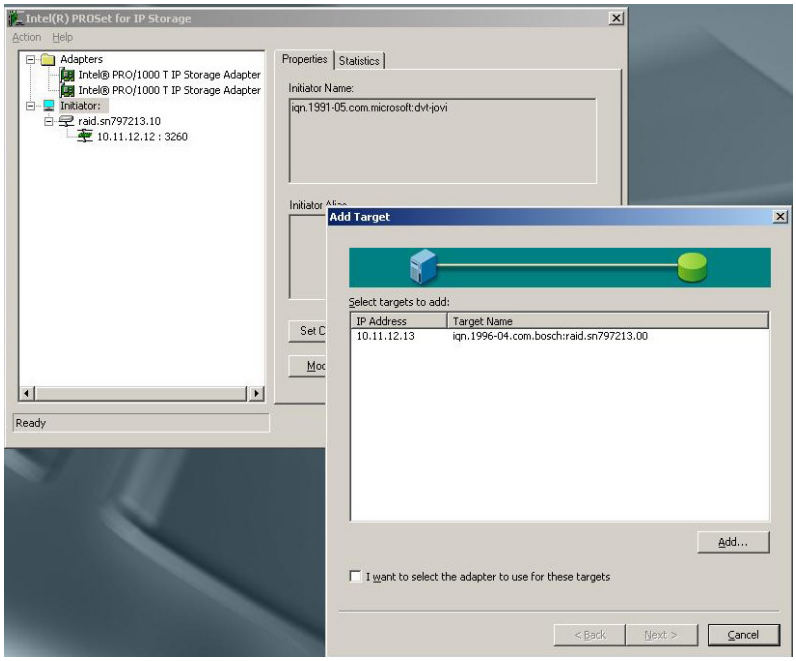
Step 8. On the Windows desktop, right-click on the **My Computer** icon and then select the **Manage** option. A **Computer Management** window will be opened.

Step 9. Click on the **Device Manager** on the tree table located on the left-side of the **Computer Management** window. The EonStor RAID volumes should be present and the Microsoft iSCSI Initiator program should be listed.



NOTE:

Some HBA cards may provide a configuration utility and require configuring the corresponding iSCSI ports as well. The configuration screen of an iSCSI HBA powered by IntelPRO/1000 IP Storage chipsets is shown below.



Section Four

EonPath Multipathing Package for Solaris

EonPath Solaris Package Overview

The EonPath package consists of Block Device Drivers and configuration commands that facilitate the configuration of multipathing storage solutions built around Solaris-based servers. The major functionalities are:

1. The Block Device Driver that acts as the device manager between Solaris OS and Infortrend's RAID storage. (Native, without conflicting with other 3rd party device drivers).
2. The commands to configure Path Redundancy.
3. The means to monitor I/O flow (specific to Infortrend's RAID storage).
4. The commands for configuring multi-path load-balancing redistribution.

The EonPath package aims to help you achieve the following:

1. End-to-end Path Failover

   With redundant physical path components (HBAs, cables, and switches) between the server and storage, failover algorithms, and the OS-based device-aware drivers, the weakest point of today's storage configuration can be mended.

2. Transparent Recovery of a broken path

   Third-party failover software often causes configuration difficulties and compatibility issues among multi-vendor components in a storage configuration. The Block Device Driver in this package insulates and manages hardware components on behalf of the operating system. The configuration efforts and the chance of encountering interoperability problems can be reduced.

3. Native support for I/O load-balancing in tiered, multi-vendor storage configurations.

   This package provides a means for Infortrend's load-balancing algorithms to operate at its best. The firmware algorithms appear as the device module containing non-generic and vendor-specific characteristics supported by Solaris and Linux operating systems.

Supported Hardware

The EonPath driver program is designed to use with ASIC266- or ASIC400-based, EonStor Fibre-to-Fibre, Fibre-to-SATA, and SAS series RAID subsystems or Fibre-to-Fibre controller heads.

Supported OS

Solaris comes with various OS revisions, please refer to the readme file that came with your EonPath package for details about the supported versions.

Installation Prerequisites

Environmental Prerequisites

- The host computers must have at least two (2) connections to the network, and EonPath software installed to create and manage the connections in a manner consistent with the operating system.
- If installed in a Fibre Channel SAN environment, it is preferred to route the FC links through redundant, high-bandwidth FC network switches with the same intelligent failover mechanisms to eliminate single point-of-failure.
- If you are using the EonStor series RAID subsystems that come with Fibre Channel host ports, or the EonRAID 2510FS controller heads, the Fibre HBA cards and its driver should be installed to the host computer(s) prior to EonPath program installation.
- Firmware version 3.47x or above must be running on your RAID subsystem.

Hardware Prerequisites

- The EonPath program aims to eliminate every single point-of-failure for high-availability environments. Therefore, it is preferred your storage subsystems also come with fully redundant and hot-swappable modules, e.g., EonStor models that come with dual-redundant RAID controllers.
- To create path redundancy in a Fibre Channel storage network or applications using other host-side links, apply at least two (2) single-ported HBA cards or two (2) dual-ported HBA cards (for models featuring more than dual host ports) on the host computer(s).
- Before installing and using the EonPath program, RAID volumes must be created and properly associated with host ID/LUNs for using the multipathing functions.

NOTE:

For logical drive creation, LUN mapping and Firmware configuration, please refer to the **RAIDWatch User's Manual** or firmware **Operation Manual** that came with your RAID subsystem.

Installation

Step 1. Right-click on a Sun CDE desktop to display the Workspace and then the Tools menu.

Step 2. Open a terminal and use the [pkgadd] command to begin installing EONPATH package.

Step 3. The shell screen should look like this:

```
Bash-22.05b# pkgadd –d EonPath-1.0.1.3-sparc.pkg

The following packages are available:

1. EonPath        EonPath – Infortrend multipath package (sparcv9)
                  1.0.1.3

Select package(s) you wish to process (or 'all' to process all packages).
(default: all) [?,??,q]: all

Processing package instance <EonPath> from </test/ EonPath-1.0.1.3-
sparc.pkg>

EonPath - Infortrend Technology, Inc.

(C) 2006 Infortrend Technology, Inc.
Using </> as the package base directory.
# # Processing package information.
# # Processing system information.
 5 package pathnames space requirements.
# # Verifying disk space requirements
# # Checking for conflicts with packages already installed.
# # Checking for setuid / setgid programs.
```

Step 4. When prompted by a confirmation message, press "y" to proceed.

```
This package contains scripts which will be executed with super-user
permission during the process of installing this package.

Do you want to continue with the installation of <EonPath> [y,n,?] y
```

Step 5. The messages displayed during installation should look like this:

```
Installing EonPath – Infortrend multipath package as <EonPath>
# # Installing part 1 of 1.
```

```
/kernel/drv/iftmd.conf
/kernel/drv/sparcv9/iftmd
/usr/bin/EonPath
[Verifying class]
# # Executing postinstall script.

Installation of <EonPath> successful.
```

Step 6. The default location of an installed package is shown below. You may then execute the package.

```
bash-2.05b#  cd /usr/bin/
bash-2.05b#  ./ EonPath
```

NOTE:

- Solaris 9 requires you to execute the following command to manually mount the UFS file-system:

Mount -o logging /dev/dsk/<cxtxdxsx> /<mountpoint>

Similar file system will be automatically mounted in Solaris 10.

Step 7. Type "help" to display all configuration commands. You should then proceed with configuring multipathing devices.

```
EonPath>>help

list lun       ----- for listing current IFT LUNs
list md        ----- for listing current multipath devices
detail md      ----- for displaying details of multipath devices
make md        ----- for configuring multipath devices
del md         ----- for deleting multipath devices
add path       ----- for adding a path on the specified device
remove path    ----- for removing a path on the specified device
set disk       ----- for setting I/O path state
set lb         ----- for setting device load-balancing policy
stat           ----- for gathering I/O statistics
version        ----- for displaying EonPath driver version
help           ----- for displaying all EonPath commands
quit/exit      ----- for exiting configuration
```

Configuration Commands

list lun:

This command displays all currently mapped LUNs - RAID storage volumes associated with host ID/LUNs - that appear on the host links to an application server.

Example:

Idx	Device	Device S/N	Size
#0	/dev/dsk/c4t112d0p4	0x0888882238B47500	4400(MB)

list md:

This command displays configured Multipath devices, i.e., RAID volumes configured through the multipathing configuration.

detail md:

This command brings out detailed information of a selected Multipath device, a RAID volume as the multipathing configuration target.

Example:

EonPath: detail md

Idx	Device	Device S/N	Paths	Size
#0	/dev/dsk/c179t179dls0	0x0888882238B47500	1	400(MB)

Select Multipath Device Index [Input '-1' for Cancel]: [0] 0

Multipath Device: /dev/dsk/c179t179dls0
LoadBalance Mode: Mini-Queue
Paths List:

Idx	Device	Device S/N	State
#0	/dev/dsk/c4t112d0s0	0x0888882238B47500	ok

make md:

This command selects a specific RAID volume into Multipath device configuration.

Example:

```
EonPath: make md
Idx          Device                    Device S/N              Paths
--------------------------------------------------------------------------
#0           N/A                       0x0888882238B47500      1
Select Multipath Device Index [Input '-1' for Cancel]: [0] 0
EonPath: Device /dev/dsk/c179t179dls0 create success.
```

del md:

Disassociate a RAID volume from the multipathing configuration scheme.

add path:

Combines an additional I/O path with an existing RAID volume, making it the alternate I/O route for data path redundancy.

remove path:

Disassociate a configured I/O path from an existing RAID volume.

set disk:

Specifies I/O paths as Active or Passive I/O route.

Example:

```
bash-3.00# EonPath
EonPath>>set disk
Idx   Device               Device S/N                        Paths   Size
----------------------------------------------------------------------
#0    /dev/dsk/c188t188d1s0    0x00012354EB30B600        2      4096(MB)

Select Multipath Device Index [Input '-1' for Cancel]:[0]

Multipath Device: /dev/dsk/c188t188d1s0
LoadBalance Mode: Mini-Queue
Paths List:
Idx   Device                     Device S/N              State
--------------------------------------------------------------------
#0    /dev/dsk/c6t115d0s0     0x00012354EB30B600         Ok
#1    /dev/dsk/c5t115d0s0     0x00012354EB30B600         Ok

Select Path Index [Input '-1' for Cancel]:[0]
Set Path State to: (0):Active (1)Passive (2)Ok [Input '-1' for Cancel]:[0] 0
EonPath: Set device state success for /dev/dsk/c6t115d0s0.
```

set lb:

Specifies a load-balancing policy for your multipathing configuration. The configurable options are:

0: Fail_Over	(two I/O paths are combined as fault-tolerant partners).
1: Mini_Queue	(I/O requests equally shared by detecting and directing I/Os to a path carrying lower traffic).
2: Round_Robin	(I/Os are dynamically assigned to I/O paths in turn according to the I/O load).
3: Vendor_Spec	(Factory reserved)

Example:

```
bash-3.00# EonPath
EonPath>>set lb
Idx   Device                Device S/N                  Paths        Size
-------------------------------------------------------------------------------------
#0    /dev/dsk/c188t188d1s0    0x00012354EB30B600     2       4096(MB)

Select Multipath Device Index [Input '-1' for Cancel]:[0]

Select Load Balance Mode

    0: Fail_Over
    1: Mini_Queue
    2: Round_Robin
    3: Vendor_Spec

[Input '-1' for Cancel]:[1] 0
EonPath: Set device load balance policy success for /dev/dsk/c6t115d0s0.
```

stat:

This allows you to monitor the on-going I/Os traveling through the existing I/O paths.

Example:

```
EonPath>>stat
Device                    Total-Read(KB/s)   Total-Write(KB/s)
================================================================
              ==============
/dev/dsk/c179t179d1s0          3540              11342
#0  /dev/dsk/c4t112d0s0        1756              6242

Device                    Total-Read(KB/s)   Total-Write(KB/s)
================================================================
              ==============
/dev/dsk/c179t179d1s0          5266              12650
#0  /dev/dsk/c4t112d0s0        2316              6216

Device                    Total-Read(KB/s)   Total-Write(KB/s)
================================================================
              ==============
/dev/dsk/c179t179d1s0          5564              16534
#0  /dev/dsk/c4t112d0s0        2510              7425

Device                    Total-Read(KB/s)   Total-Write(KB/s)
================================================================
              ==============
/dev/dsk/c179t179d1s0          7651              12210
#0  /dev/dsk/c4t112d0s0        1724              6424

[Press "Enter" to Stop]
```

Version:

Displays the revision number of the EonPath driver.

```
EonPath>>version
Version: EonPath Disk Driver 1.0.5
EonPath>>
```

help:

Displays all available functions.

quit/exit

Exits the current configuration console.

Configuration Change Concerns

If the need arises for a configuration change (connecting different host ports, etc.), reboot the system, and use EonPath commands such as "make md" and "add path" to activate the new connection.

Uninstalling EonPath Packages

1. Stop host application I/Os to the RAID subsystem.
2. Use the "pkgrm" command to uninstall the EonPath package.

   The uninstallation process should look like the following:

```
bash-3.00# pkgrm EonPath

The following package is currently installed:
  EonPath          EonPath - infortrend multipath package
             (sparcv9) 1.0.1.20

Do you want to remove this package? [y,n,?,q] y

## Removing installed package instance <EonPath>

This package contains scripts which will be executed with super-user
permission during the process of removing this package.

Do you want to continue with the removal of this package [y,n,?,q] y
## Verifying package dependencies.
## Processing package information.
## Executing preremove script.
## Removing pathnames in class <application>
## Removing pathnames in class <none>
/usr/bin/EonPath
/usr/bin <shared pathname not removed>
/usr <shared pathname not removed>
/kernel/drv/sparcv9/mpio_path
/kernel/drv/sparcv9 <shared pathname not removed>
/kernel/drv/mpio_path.conf
/kernel/drv <shared pathname not removed>
/kernel <shared pathname not removed>
/etc/.EonPath.conf
/etc <shared pathname not removed>
## Updating system information.

Removal of <EonPath> was successful.
```

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Section Five

EonPath Multipathing Package for Linux

EonPath Linux Package Overview

The EonPath package consists of device drivers and configuration commands that facilitate the configuration of multipathing storage solutions built around Linux-based servers. The major functionalities are:

1. The device driver that acts as the device manager between Linux operating system and Infortrend's RAID storage. (Native, without conflicting with other 3rd party device drivers).
2. The commands to configure Path Redundancy.
3. The means to monitor I/O flow (specific to Infortrend's RAID storage).
4. The commands for configuring multi-path load-balancing redistribution.

The EonPath package aims to help you achieve the following:

1. End-to-end Path Failover

   With redundant physical path components (HBAs, cables, and switches) between the server and storage, failover algorithms, and the OS-based device-aware drivers, the weakest point of today's storage configuration can be mended.

2. Transparent Recovery of a broken path

   Third-party failover software often causes configuration difficulties and compatibility issues among multi-vendor components in a storage configuration. The device driver in this package insulates and manages hardware components on behalf of the operating system. The configuration efforts and the chance of encountering interoperability problems can be reduced.

3. Native support for I/O load-balancing in tiered, multi-vendor storage configurations.

   This package provides a means for Infortrend's load-balancing algorithms to operate at its best. The firmware algorithms appear as the device module containing non-generic and vendor-specific characteristics supported by Solaris and Linux operating systems.

Supported Hardware

The EonPath driver program is designed for use with ASIC266- or ASIC400-based, EonStor Fibre-to-Fibre, Fibre-to-SATA, and SAS series RAID subsystems or Fibre-to-Fibre controller heads.

Supported OS

- Please refer to the readme file that came with your EonPath package for details about supported kernels.

Installation Prerequisites

Environmental Prerequisites

- The host computers must have at least two (2) connections to the RAID storage, and EonPath software installed to create and manage the connections in a manner consistent with the operating system.
- If installed in a Fibre Channel SAN environment, it is preferred to route the FC links through redundant, high-bandwidth FC network switches with the same intelligent failover mechanisms to eliminate single point-of-failure.
- If you are using the EonStor series RAID subsystems that come with Fibre Channel host ports, the Fibre HBA cards and its driver should be installed to the host computer(s) prior to EonPath program installation.
- Firmware version 3.47x or above must be running on your RAID subsystem.

Hardware Prerequisites

- The EonPath program aims to eliminate every single point-of-failure for high-availability environments. Therefore, it is preferred your storage subsystems also come with fully redundant and hot-swappable modules, e.g., EonStor models that come with dual-redundant RAID controllers.
- To create path redundancy in a Fibre Channel storage network or applications using other host-side links, apply at least two (2) single-ported HBA cards or two (2) dual-ported HBA cards (for models featuring more than dual host ports) on the host computer(s).
- Before installing and using the program, RAID volumes must be created and properly associated with host ID/LUNs for using the multipathing functions.

NOTE:

For logical drive creation, LUN mapping and Firmware configuration, please refer to the **RAIDWatch User's Manual** or firmware **Operation Manual** that came with your RAID subsystem.

Installation

Step 1. Open a Linux Terminal.

Step 2. Locate the EonPath package files and execute the "INSTALL" file. You will need to "untar" the package to extract the driver files to a preferred location.

Step 3. The terminal screen should look like this:

```
[root@linux-as3jk EonPath]# cd EonPath
[root@linux-as3jk EonPath]# ll
total 28
drwxr-xr-x    4 root     root        4096 Jun  6 12:23 config
drwxr-xr-x    2 root     root        4096 May 25 18:47 i686
-rwxr-xr-x    1 root     root        2973 Jun  6 16:58 INSTALL
-rwxr-xr-x    1 root     root         778 May 19 14:52 mkdev_24.sh
drwxr-xr-x    2 root     root        4096 Jun 23 13:49 objs
-rw-r--r--    1 root     root         434 Jun  6 15:54 README
-rwxr-xr-x    1 root     root         951 Jun  6 14:47 UNINSTALL

[root@linux-as3jk EonPath]# ./INSTALL
```

Step 4. When prompted by a confirm message, press "y" to proceed. You will then be reminded to reboot the system for the installation to take effect.

```
Install config file: 'EonPath' to /sbin
Install EonPath Driver for Kernel  2.4.21-4.ELsmp
Wait for making nodes...
install rc.modules
call depmod

Install Completed, Please reboot system.
```

Step 5. The default location of an installed package is shown below. You may then execute the package.

```
[root@linux-as3jk EonPath]# cd /sbin/
        .
        .
        .
[root@linux-as3jk sbin]# ./EonPath
EonPath>>help
```

Step 6. Type "help" to display all configuration commands. You should then proceed with configuring multipathing devices.

```
EonPath>>help

command list:
list lun          -----  for listing current IFT LUNs
list md           -----  for listing current multipath devices
detail md         -----  for displaying details of multipath devices
make md           -----  for configuring multipath devices
del md            -----  for deleting multipath devices
add path          -----  for adding a path on the specified device
remove path       -----  for removing a path on the specified device
set disk          -----  for setting I/O path state
```

set lb	-----	for setting device load-balancing policy
statis	-----	for gathering I/O statistics
help	-----	for displaying all EonPath commands
version	-----	for displaying EonPath driver version
quit	-----	for exiting configuration

Configuration Commands

list lun:

This command displays all currently mapped LUNs - RAID storage volumes associated with host ID/LUNs - that appear on the host busses.

Example:

Idx	Device	LUN_S/N	Size
#0	/dev/sda	0x0A11145E7E8A0300	4400(MB)
#1	/dev/sdb	0x0A21145E7E8A0300	4400(MB)

list md:

This command displays the configured RAID volume(s) devices configured in the multipathing configuration.

Example:

Idx	Device	LUN_S/N	Paths	Size
#0	/dev/ift_md0a	0x0A11145E7E8A0300	2	4400(MB)

NOTE:

Due to different kernel versions in Linux OS, the multipath device names will be slightly different. For kernel 2.6 (ent 4 and fedora 5), the name is "ift_mdN". N is a number between 0 and 63. For kernel 2.4 (ent 3), the name is "ift_mdNC". N is a number between 0 and 3, while C is an alphabetic character ranging from "a" to "p".

detail md:

This command brings out detailed information of a selected Multipath device, a RAID volume as the multipathing configuration target.

Example:

EonPath>>: detail md

Idx	Device	LUN_SN	Paths	Size
#0	/dev/ift_md0a	0x0A11145E7E8A0300	2	4400(MB)

Select Multipath Device Index [Input '-1' for Cancel]: [0] 0

Multipath Device: /dev/ift_md0a Paths List:

```
LoadBalance Mode: Mini-Queue
Idx     Device          LUN_SN              HBA_ID  State
---------------------------------------------------------------------
#0      /dev/sda        0x0A11145E7E8A0300  0       Ok
#1      /dev/sdb        0x0A21145E7E8A0300  1       Ok
```

make md:

This command selects a specific RAID volume into Multipath device configuration.

Example:

```
EonPath>>: make md
Idx     Device          LUN_SN              Paths
---------------------------------------------------------------------
#0      N/A             0x0A11145E7E8A0300  2

Select Multipath Device Index [Input '-1' for Cancel]: [0] 0
EonPath: Device /dev/ift_md0a device create successful.
```

del md:

Disassociate a RAID volume from the multipathing configuration scheme.

add path:

Combines an additional I/O path with an existing RAID volume, making it the alternate I/O route for data path redundancy.

```
EonPath>>: add path
Idx     Device          LUN_SN              Paths   Size
---------------------------------------------------------------------
#0      /dev/ift_md0a   0x0A11145E7E8A0300  2       4400(MB)

Select Multipath Device Index [Input '-1' for Cancel]: [0] 0
Idx     Device          LUN_SN              HBA_ID  State
---------------------------------------------------------------------
#2      /dev/sdc        0x210100E08B2AADE1  0       Ok
Select Path Device Index [Input '-1' for Cancel]: [0] 0
EonPath: Device /dev/ift_md0a add path successful.
```

remove path:

Disassociate a configured I/O path from an existing RAID volume.

set disk:

Specifies specific I/O paths as Active or Passive I/O route.

Example:

```
EonPath>>set disk
Idx  Device          LUN_SN              Paths  Size
---------------------------------------------------------------------
#0   /dev/ift_md0a   0x0A11145E7E8A0300  2      4400(MB)
```

```
Select Multipath Device Index [Input '-1' for Cancel]:[0] 0

Multipath Device: /dev/ift_md0a Path List:

Idx  Device          LUN_SN              HBA_ID   State
---------------------------------------------------------------------
#0   /dev/sda        0x0A11145E7E8A0300  0        Ok
#1   /dev/sdb        0x0A21145E7E8A0300  1        Ok

Select Path Index [Input '-1' for Cancel]:[0] 0
Set Path State to: (0):Active (1)Standby Ok [Input '-1' for Cancel]:[0] 0
EonPath: Set device state success for /dev/ift_md0a.
```

set lb:

Specifies a load-balancing policy for your multipathing configuration. The configurable options are:

0: Fail_Over	(two I/O paths are combined as fault-tolerant partners).
1: Mini_Queue	(I/O requests equally shared by detecting and directing I/Os to a path carrying lower traffic).
2: Round_Robin	(I/Os are dynamically assigned to I/O paths in turn according to the I/O load).
3: Vendor_Spec	(Factory reserved)

Example:

```
EonPath>>set lb
Idx  Device          LUN_SN              Paths     Size
---------------------------------------------------------------------
#0   /dev/ift_md0a   0x0A11145E7E8A0300  2         4400(MB)

Select Multipath Device Index [Input '-1' for Cancel]:[0] 0

Select Queue Transfer Mode [current: 0, 0:Round_Robin, 1:Mini_Queue]:[0]
[Input '-1' for Cancel]:[1] 0
EonPath: Set device queue load balance success for /dev/ift_md0a.
```

statis:

This allows you to monitor the on-going I/Os traveling through the existing I/O paths.

Example:

```
EonPath>>statis
Device                    Total-Read(KB/s)    Total-Write(KB/s)
=======================Statistics=============================
          =====================
/dev/ift_md0a                  3540            11342
/dev/ift_md0b                  1756            6242

Device                    Total-Read(KB/s)    Total-Write(KB/s)
=======================Statistics=============================
          =====================
/dev/ift_md0a                  5266            12650
/dev/ift_md0b                  2316            6216

Device                    Total-Read(KB/s)    Total-Write(KB/s)
```

```
=======================Statistics=============================
          ====================
/dev/ift_md0a                    5564          16534
/dev/ift_md0b                    2510          7425


[Press "Enter" to Stop]
```

Version:

Displays the revision number of the EonPath driver.

```
EonPath>>version
EonPath version:1.05(x86)
EonPath driver version:1.05(RedHat Enterprise Linux AS3.0-i686)
```

help:

Displays all available functions.

quit

Exits the current configuration console.

Configuration Change Concerns

If the need arises for a configuration change (connecting different host ports, etc.), reboot the system, and use EonPath commands such as "make md" and "add path" to activate the new connection.

Uninstalling EonPath Packages

1. Stop host application I/Os.
2. Locate the "UNINSTALL" command file in folder where the package files reside to uninstall the EonPath package.

The uninstallation details should appear like the following:

```
[root@localhost mpio_1.09]# ./UNINSTALL
uninstall config 'mpio'
uninstall  /lib/modules/2.4.21-4.ELsmp/kernel/drivers/mpio
uninstall device nodes
uninstall rc.modules
```