



VTRAK S3000
PerfectPath
User Manual

Version 1.0

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Chapter 1: Introduction

- The Role of PerfectPath (page 1)
 - How PerfectPath Works (page 1)
 - Hardware Preparation (page 1)
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The Role of PerfectPath

PerfectPath is a load balancing/path redundancy application that ensures constant data availability and peak performance across the SAN by performing Fibre Channel HBA load-balancing, transparent failover, and fail-back services. PerfectPath creates parallel active storage paths that transparently reroute server traffic without interruption in the event of a storage network problem. Peak performance of the SAN is ensured by automatically distributing server traffic among the server's storage paths (load balancing).

PerfectPath offers a new level of data accessibility and improved performance for storage systems by eliminating the point of failure represented by a single input/output (I/O) path between servers and storage systems and permits I/O to be distributed across multiple paths.

Failover/Failback Data Paths

By providing alternate I/O paths from the server to the storage system, PerfectPath provides uninterrupted access to mission-critical data. This substantially insulates server applications from I/O path failures.

In the event of a failed HBA, interface cable, or channel I/O card within the PROMISE storage system, PerfectPath automatically reroutes I/O traffic to an alternate data path. Path failover is essentially transparent, ensuring continuous access to data stored on the storage system. When configured in the recommended failback mode, PerfectPath automatically restores the primary data path and system redundancy once the defective component is replaced.

I/O Load Balancing

PerfectPath supports up to 16 data paths per device. Using an algorithm that chooses the path with the least outstanding I/O counts, load balancing can improve I/O performance.

Benefits

The following is a summary of PerfectPath benefits:

- Increases throughput by directing I/O requests through multiple HBAs and storage system channels. Logical drives can be assigned to HBAs, manually balancing the I/O load across paths.
- Provides continuous access to mission-critical data by insulating server applications from I/O path failures.
- Installs easily and is transparent to server applications.

How PerfectPath Works

PerfectPath's filter driver resides between the file system drivers and the disk device drivers. I/O requests are passed from the file system through PerfectPath, the disk driver, and ultimately to the hardware.

PerfectPath monitors the execution of I/O requests through the layered driver architecture. When it detects a failure along an I/O path, it automatically reroutes the request to an alternate path. Failover to the redundant I/O path is transparent to server applications and permits continuous access to the information stored on the disk arrays. To applications, there is only a slight delay in normal I/O operations during path failover. Existing drive numbers and device access functions continue to work as expected.

Hardware Preparation

Although PerfectPath claims and manages qualified devices accessible from the client by only a single I/O path, one of its primary purposes is the management of multiple I/O paths to storage system devices. This eliminates the data path as a potential single point of failure in the storage system.

To be properly configured for this purpose, every I/O-path element in the system must be redundant. A given client must be equipped with at least two HBAs, connected, in turn, by at least two cables to the storage system. Dual-port Fibre Channel RAID devices require at least two Fibre Channel hubs for full I/O path redundancy in a failover configuration.



Important

If you are adding a new device with multiple paths, install PerfectPath first before formatting the new device.

Chapter 2: PerfectPath for Windows 2003

- Hardware and Software Requirements (page 3)
 - Path Failover Behavior (page 3)
 - Installing PerfectPath (page 3)
 - Customizing Windows MPIO Parameters (page 4)
 - HBA Failover Settings for FC Client Connectivity (page 4)
 - Detecting New Devices After Installation (page 5)
 - Configuring PerfectPath (page 5)
 - Uninstalling PerfectPath (page 6)
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Hardware and Software Requirements

PerfectPath requirements are:

- Windows 2003, 32-bit and 64-bit AMD Intel and Itanium.
- Boot the operating system from the computer's local drive.
- PerfectPath supported HBA. For a complete list, see the Certification Matrix on the www.promise.com website.

Path Failover Behavior

HBA Settings

It is recommended that you use the default HBA settings. In cases where the path failure time is critical, the link down timeout value on the HBA can be lowered to allow faster switch from the failed path to the active path. The minimum time that PerfectPath requires to switch between paths is approximately 5 seconds plus the additional time that HBA requires.

HBA BIOS Setting: **Target Reset** must be enabled.

PerfectPath and Microsoft Clusters

If both initiators are unplugged on the node that is the cluster owner, Microsoft Cluster will not fail over to another node until PerfectPath times out. It takes about five minutes.

Installing PerfectPath

To install PerfectPath:

1. Set up your system hardware as described in "Hardware and Software Requirements" above.
2. Log in as Administrator.
3. If a previous version of PerfectPath is installed on your system, remove it before continuing with this installation.
4. Assign devices from the storage server to the PerfectPath client.
5. Verify that the client is able to see and access all storage devices through all available paths. For example, If you have two paths to your storage system, each logical drive should be displayed twice.
If you cannot see all available storage devices through every path, verify that you have the latest Fibre Channel HBA drivers loaded on your system.
6. Launch the PerfectPath setup.exe program.
7. Follow the step-by-step instructions during the installation process.
8. Reboot the computer.
9. Go to **Start > Control Panel > Device Manager** and expand **Disk Drives**.
Verify that your storage server disks are configured properly. One device displays for each assigned LUN. The path displayed is from the properties of the device.

Customizing Windows MPIO Parameters

An MPIO Parameters key is created during the PerfectPath installation and the following values are added under this key:

- **PDORemovePeriod** – If all paths fail, the amount of time in seconds that PerfectPath should check the paths before failover occurs. Regardless of whether this is a failover or standalone environment, PerfectPath will check the path status before it gives up (timeout and lost connections). The default setting is 300 seconds.
- **RetryCount** – The number of times a failed I/O operation is retried on the primary path after it has tried unsuccessfully to use its alternate paths and returned again to the primary. When the specified number of retries has failed, the I/O fails. The default and highest value allowed is 100.
- **RetryInterval** – The time interval, in milliseconds, between the retry attempts described in the preceding parameter. The default value is 3000 ms (3 seconds). The highest value is 100,000 ms (100 seconds).

Customizing Registry Settings

To change registry settings without requiring a system reboot:

1. Go to the **C:\Windows\system32\wbem** directory, double-click **wbemtest.exe**, and click the **Connect** button.
2. Change Namespace to **root\wmi** and click the **Connect** button again.
3. Under **IWbemServices**, click the **Open Class** button.
4. Enter **MPIO_TIMERS_COUNTERS** in the field provided and click the **OK** button.
5. From the Object editor screen, click the **Instances** button.
You should see a single instance.
6. Double-click the instance from this window.
7. Under **Properties** find the required items.
They are normally the last three.
8. Double-click each property, edit its value, and click the **Save Property** button.
9. Once all properties have been changed, click the **Save Object** button.
A Query Result window opens.
10. Click the **Close** button.
Properties are now dynamically activated.

HBA Failover Settings for FC Client Connectivity

The following table lists the settings for each type of HBA. Refer to the the Certification Matrix on the www.promise.com website for additional support information.

HBA Card Type	With PerfectPath
QLogic	Login Retry Count = 8 Port Down Retry Count = 8 Link Down Count = 30 Enable Target Reset = True Frame Size = 2048 Disk Timeout Value = 60 Execution Throttle = 32 LUNS per target = 256 Tape mode = Disable

Detecting New Devices After Installation

After PerfectPath has been installed, if you assign new devices to the client, you can rescan the device and the driver will be installed automatically.

To rescan:

1. Right-click **My computer** and select **Manage** from the popup menu.
2. In the Computer Management window, select **Device Manager**.
3. Right-click **Disk drives**, select **Scan for hardware changes**.

You should see one multi-path disk device for each storage device, and one SCSI disk device for each path to the storage device.

Configuring PerfectPath

PerfectPath is automatically configured when you install it. By default, both path failover and load balancing are enabled. You can change the configuration using the **perfectcfg** utility.

To see the utility's options, at the command prompt, type **perfectcfg** and press Enter.

Option	Description
-l	List all groups and displays several options.
-s spd_id	Display status for a specific path.
-e a c s l	Filter what will be displayed with the -s command by excluding this path. Does not affect functionality.
-i a c s l	Filter what will be displayed with the -s command by including this path, if it was previously excluded. Does not affect functionality.
-u spd_id retrydelay retrycount loadbalance	Enables or disables load balancing. <ul style="list-style-type: none"> • retrydelay – in milliseconds • retrycount – 0 to 1,000,000 • loadbalance – 1 for enable or 0 to disable.
-d, -m, -t	Technical support use only.
-x	Get and print the latest kernel dbg messages.



Caution

Using the **perfectcfg** utility to change retrydelay and retrycount values is NOT recommended.

To examples are shown below.

Displaying a List All Groups

At the command prompt, type **perfectcfg -l** and press Enter.

You see output similar to this:

```
Successfully opened \\.\dpsd
Successfully created event
Send SPD_GETALLID
Debug_Level is set to 0
PnP Delay is set to 1 second
Use Page 80 is set to 0
There are 3 groups
-----
    spd_id: 1
    spd_id: 2
    spd_id: 3
```

From this example, you can see that:

- There are three groups.
- Debugging is turned off (1=on, 0=off).
- PnP Delay is 1 second.
- The system is using Page 80.

Displaying Path Status

At the command prompt, type **perfectcfg -s 1** and press Enter.

You see output similar to this:

```
Successfully opened \\.\dpsd
Successfully created event
spd_id is 1
Send SPD_GETPATHSTATE
Group: 1
-----
      npath: 4
      balance: 1
      retrydelay: 3000
      retrycount: 10000
      failback: 0
      exclude: 0
      primarygroup: 0
      type: 0
      StrID: 600D7790084A57CAFABFDA6D8FD2
      Path Status:
-----
      Path00:      State: PATH_GOOD
      Path00:      OnController: Primary
      Path00:      Commands Read: 0
      Path00:      Commands Write: 0
      Path00:      Bytes Read: 0
      Path00:      Bytes Write: 0
      Path01:      State: PATH_GOOD
      Path01:      OnController: Primary
      Path01:      Commands Read: 3
      Path01:      Commands Write: 0
      Path01:      Bytes Read: 1536
      Path01:      Bytes Write: 0
```

In this example, you can see that load balancing is enabled (1=enabled, 0=disabled). In addition, you can see that the status for each path is good (state: PATH_GOOD).

Enabling Load Balancing

To enable load balancing, type the **perfectcfg -u spd_id retrydelay retrycount loadbalance** command, where the last value in the string is a 1 (one).

For example, at the command prompt, type **perfectcfg -u 2 3000 100 1** and press Enter.

Disabling Load Balancing

To disable load balancing, type the **perfectcfg -u spd_id retrydelay retrycount loadbalance** command, where the last value in the string is a 0 (zero).

For example, at the command prompt, type **perfectcfg -u 2 3000 100 0** and press Enter.

Uninstalling PerfectPath

To uninstall PerfectPath:

1. In the Management Console, unassign all devices managed by PerfectPath.
2. On the computer where PerfectPath is installed, go to **Start > Control Panel > Add/Remove Programs** and uninstall PerfectPath.
3. Reboot the computer.

Chapter 3: PerfectPath for Windows 2008

- Hardware and Software Requirements (page 7)
 - Path Failover Behavior (page 7)
 - Installing PerfectPath (page 7)
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 - Configuring HBA Failover Settings for FC Client Connectivity (page 10)
 - Uninstalling PerfectPath (page 11)
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Hardware and Software Requirements

PerfectPath requirements are:

- PerfectPath runs on Windows Server 2008, 32-bit and 64-bit AMD and Intel
- Boot the operating system from the computer's local drive.
- PerfectPath supported HBA. For a complete list, see the Certification Matrix on the www.promise.com website.

The MPIO feature must be enabled prior to installing PerfectPath.

If you have not added the MPIO feature:

1. Go to **Server Manager > Features > Add Features > Multipath I/O**.
2. Reboot the computer.

Path Failover Behavior

HBA Settings

It is recommended that you use the default HBA settings. In cases where the path failure time is critical, the link down timeout value on the HBA can be lowered to allow faster switch from the failed path to the active path. The minimum time that PerfectPath requires to switch between paths is approximately 5 seconds plus the additional time that HBA requires.

HBA BIOS Setting: **Target Reset** must be enabled.

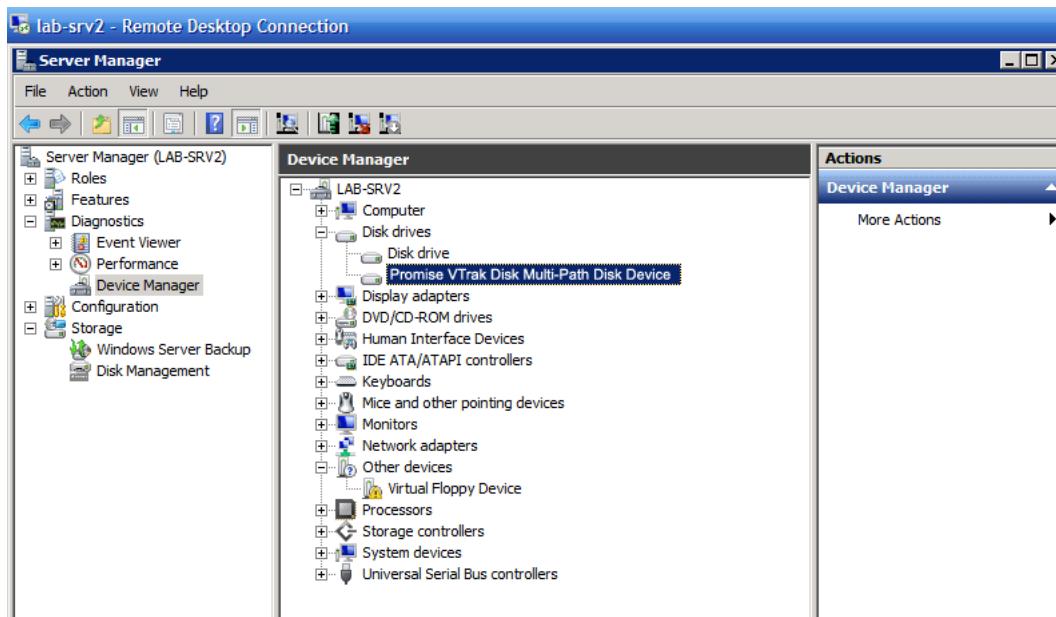
PerfectPath and Microsoft Clusters

If both initiators are unplugged on the node that is the cluster owner, Microsoft Cluster will not fail over to another node until PerfectPath times out. It takes about five minutes.

Installing PerfectPath

To install PerfectPath:

1. Set up your system hardware as described in "Hardware and Software Requirements" above.
 2. Log in as Administrator.
 3. If a previous version of PerfectPath is installed on your system, remove it before installing this version of PerfectPath.
 4. Assign devices from the storage server to the PerfectPath client.
 5. Verify that the client is able to see and access all storage devices through all available paths. For example, If you have two paths to your storage system, each logical drive should be displayed twice.
If you cannot see all available storage devices through every path, verify that you have the latest Fibre Channel HBA drivers loaded on your system.
 6. Launch the PerfectPath setup.exe program.
 7. Follow the step-by-step instructions during the installation process.
 8. Reboot the computer.
 9. Go to **Start > Control Panel > Device Manager** and expand **Disk Drives**.
Verify that your storage server disks are configured properly. One device displays for each assigned LUN. The path displayed is from the properties of the device.
-

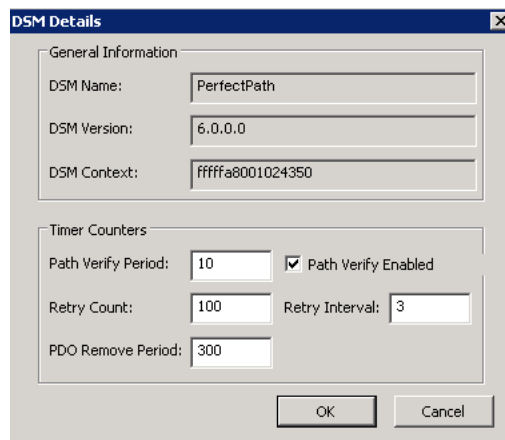


Configuring PerfectPath

The load balancing policy defaults to Round Robin for each device.

To configure the load balancing policy and other PerfectPath settings:

1. Go to **Start > Control Panel > Device Manager** and expand the **Disk Drives**.
2. Right click a device, select **Properties** from the popup menu, and click the **MPIO** tab.
3. Click **Details** to configure the Timer Counters for PerfectPath.
4. Verify the parameters are set properly and click the OK button.



If the parameters are not correct, set the parameters to match those displayed in the screen below. All settings on this screen are carried over to the other disks.

- **RetryCount** – The number of times a failed I/O operation is retried on the primary path after it has tried unsuccessfully to use its alternate paths and returned again to the primary. When the specified number of retries has failed, the I/O fails. The default and highest value allowed is 100.
- **RetryInterval** – The time interval, in milliseconds, between the retry attempts described in the preceding parameter. The default value is 3000 ms (3 seconds). The highest value is 100,000 ms (100 seconds).
- **PDORemovePeriod** – If all paths fail, the amount of time in seconds that PerfectPath should check the paths before failover occurs. Regardless of whether this is a failover or standalone environment, PerfectPath will check the path status before it gives up (timeout and lost connections). The default setting is 300 seconds.

Configuring Clusters for PerfectPath

PerfectPath version 6.0 and later supports cluster configuration on Windows Server 2008.

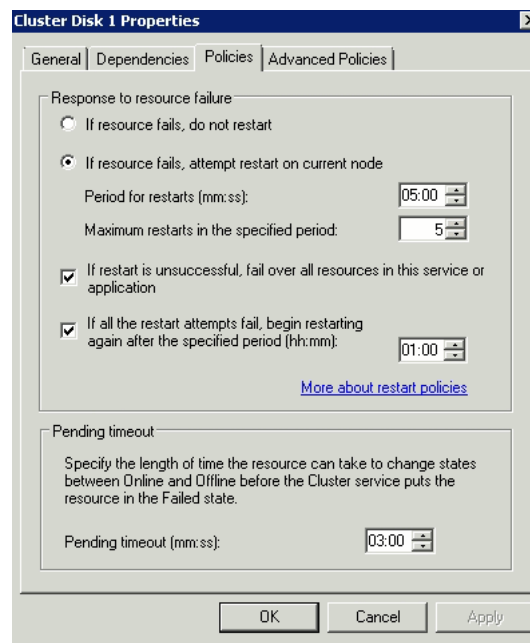
When a storage server failover occurs, Windows cluster detects the resource failure and attempts to restart the failed resource according to cluster policy *Response to resource failure*. If the cluster cannot start the failed resource, you must bring the resource online manually.

In order to have the cluster resources constantly available during storage server failover events, you can configure cluster policy settings to increase the retry count and lengthen the interval.

To configure cluster policy settings:

1. Right-click a disk in Failover Cluster Management and select **Properties** from the popup menu.
2. Click the **Policies** tab.
3. Set the recommended values to:
 - Period for restarts, 05:00 (five minutes)
 - Maximum restarts in the specified period, 5

The recommended settings are shown on the screen below.



Important

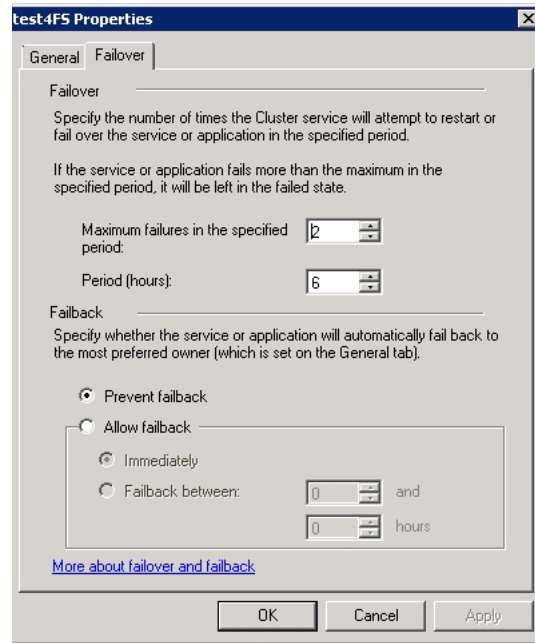
You must set these parameters for all available devices.

To ensure service continuity during VTrak appliance failover events, carefully consider failover properties of your Windows cluster services and applications. If the cluster fails to start the service or application, you must bring it online manually.

To view application failover properties:

1. Right-click a configured service or application in the Failover Cluster Management and select **Properties** from the popup menu.
2. Click the **Failover** tab.
3. The recommended settings are
 - Maximum failures in the specified period, 2
 - Period (hours), 6
 - Prevent failback, enabled

The recommended settings are shown on the screen below.



Configuring HBA Failover Settings for FC Client Connectivity

The following table lists the settings for each type of HBA. Refer to the the Certification Matrix on the www.promise.com website for additional support information.

HBA Card Type	With PerfectPath
QLogic	Login Retry Count = 8 Port Down Retry Count = 8 Link Down Count = 30 Enable Target Reset = True Frame Size = 2048 Disk Timeout Value = 60 Execution Throttle = 32 LUNS per target = 256 Tape mode = Disable

Uninstalling PerfectPath

To uninstall PerfectPath:

1. In the Management Console, unassign all devices managed by PerfectPath.
2. On the Windows computer, go to **Start > Control Panel > Programs and Features**.
3. Click the **Uninstall** button.
PerfectPath uninstalls.
4. Reboot the system.

After PerfectPath has been installed, your disk may no longer be managed by MPIO.

To reset MPIO Management on the Windows machine:

1. Go to **Start > Control Panel > MPIO Properties**.
2. Click the **Discover Multi-Paths** tab.
3. Add the disks again.

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