



Dell PowerVault™ TL4000/TL2000 Failover Guide

Dell PowerVault™ TL4000/TL2000 Failover Configuration Guide

This document describes the failover feature, outlines the supported failover configurations for the Dell PowerVault™ TL4000 and TL2000 products and provides instructions for configuring the library, drives, and host server for failover.

Please note the supported configurations are closely related to the LTO drive generation and form factor installed in the tape library. Please refer Dell PowerVault™ supported Failover configuration matrix table 1 and 2

Contents

What is Failover?.....	2
Dell PowerVault™ TL2000/TL4000 Configuration Support matrix	2
Basic Environment Configuration Requirements.....	3
Failover Support Configuration Details.....	4
Configuration Samples.....	4
LT05 Specific Requirements For Failover Support	11
Heterogeneous validated configurations	13
Configuring your Environment to Support Failover.....	15
Dell PowerVault™ TL2000/TL4000 Library Failover Setup.....	16
Take the Library Offline.....	16
Upgrade Library and Drive Firmware to the Latest Version	16
Backup Host Control Path Failover Setup	18
Backup Application Setup and Support	18
Failover Configuration Verification	20
Failover Test Procedure	20
Failover Performance considerations	21
Appendix A - Recovering from a failover event	22



Dell PowerVault™ TL4000/TL2000 Failover Guide

What is Failover?

Failover is an optional feature available for the Dell PowerVault™ TL4000 and TL2000 Tape libraries. Failover is designed to provide automatic path failover to a preconfigured redundant path in the event that a host adapter or control path drive is lost without aborting the current job in process. Failover provides error recovery on an alternate path when a permanent error occurs on the primary path. The failover event is enabled by the tape library and handled by the device driver making it transparent to the running Backup Application.

There are two types of Path Failover, Data Path Failover (DPF) and Control Path Failover (CPF). They are closely related however the difference is that DPF is an automatic failover support for the transfer of data, which provides error recovery for systems connected to tape drives while CPF is an automatic failover support for the transfer of commands to move tape cartridges. Please refer to the Failover supported configuration sections of this document for examples of different configurations that can be constructed.

Dell PowerVault™ TL2000/TL4000 Configuration Support matrix

The configuration matrix section provides a quick reference to drive configurations that support failover in a Dell PowerVault™ TL2000 or TL4000 library.

Important Note: Failover is not supported for any configuration containing LT03 drives

Drive Configuration	LT03 Drives		LT04 Drives		LT05 Drives	
	Supported Drive	Failover Support	Supported Drive	Failover Support	Supported Drive	Failover Support
SCSI Full Height	Yes	No				
FC Full Height	Yes	No	Yes	No		
FC Half Height					Yes	Yes *
SAS Full Height	Yes	No	Yes	No		
SAS Half Height			Yes	No	Yes	Yes *

Table 1: Dell PowerVault™ TL2000 Supported Failover Configuration Matrix

*Requires a Dell PowerVault™ TL2000 library configured with two LT05 Half Height drives



Dell PowerVault™ TL4000/TL2000 Failover Guide

Drive Configuration	LT03 Drives		LT04 Drives		LT05 Drives	
	Supported Drive	Failover Support	Supported Drive	Failover Support	Supported Drive	Failover Support
SCSI Full Height	Yes	No				
FC Full Height	Yes	No	Yes	Yes *		
FC Half Height					Yes	Yes *
SAS Full Height	Yes	No	Yes	Yes**		
SAS Half Height			Yes	No	Yes	Yes *

Table 2: Dell Power Vault™ TL4000 Supported Failover Configuration Matrix

*Requires a Dell PowerVault™ TL4000 library configured with at least two LT05 Half Height drives; two homogeneous LTO4 drives are needed in the same partition to support full path failover.

**If only one LTO4 SAS drive is installed in the library or in the partition, data path failover only is supported.

Basic Environment Configuration Requirements

There are some basic configuration environments that are required in order to support the failover feature available in the Dell PowerVault™ TL2000/TL4000 library. Refer to table below for full details

Important Notes:

Mixed drive generations are not recommended; however, if a library contains mixed generation drives in a single partition, and failover is a desired configuration, you must follow the LT05 environment configuration requirements and the library must contain only LTO4 media for backups.

Failover is supported with a single LTO4 SAS drive installed in the TL4000 library or in a single library partition; however, only data path failover can be configured.

Two homogeneous LTO4 drives are required in the same library partition to support full path failover.



Dell PowerVault™ TL4000/TL2000 Failover Guide

LT04 Configurations	LT05 Configurations
<ul style="list-style-type: none">• Two homogeneous (Fibre Channel or SAS) LTO4 full height drives in a single library partition• Control path enabled on all drives in the partition• Microsoft Windows 2003, Windows 2008 or Windows 2008 R2 installed in the host server• Dell PowerVault™ TL4000 library device driver running on host server• CommVault Galaxy 6.1 SP4 or later or Commvault Simpana 7.0 SP4 or later installed in the host system• Failover activated via license key on the Dell PowerVault™ TL4000 library• Shared Storage license applied to the CommVault backup application	<ul style="list-style-type: none">• Two or more homogeneous (Fibre Channel or SAS) LTO5 drives in a single library partition• Control path enabled on all drives in the partition• Microsoft Windows 2003, Windows 2008, or Windows 2008 R2 installed on the host server• Dell PowerVault™ TL4000\TL2000 library device driver running on host server• CommVault Galaxy 7.0 SP4 or later installed in the host system• Failover activated via license key on the Dell PowerVault™ TL4000 or TL2000 library• Shared Storage license applied to the CommVault backup application

Table 3: Failover Configuration Requirements

Failover Support Configuration Details

This section details the configuration requirements that must be met in order to support failover using the Dell PowerVault™ TL2000 or TL4000 library.

Important Note: Failover support is limited to the Dell PowerVault™ TL4000 when configured with LT04 drives.

Configuration Samples

Please refer to the following diagrams for cabling the supported failover configurations. The drive shown as the failover path does not need to be on standby (i.e. not in use) for failover to occur.

Failover Reference Configuration 1:

One host, one Fibre Channel switch and one Dell PowerVault™ library with two Fibre Channel drives

In this configuration, failover occurs if one of the drives in the library fails (hardware failure or drive is disconnected from the Fibre Channel switch). The physical connection of this configuration is shown in Figure 1.

Important Note: The Fibre Channel Drive Generation can be LT04 or LT05



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover configuration

(one host, one switch, two FC drives)



Figure 1: Reference Configuration 1

Failover Reference Configuration 2:

One Host with one dual port Fibre Channel HBA, two Fibre Channel switches and one Dell PowerVault™ with two Fibre Channel drives

In this configuration, failover occurs if one of the following occurs:

- One of the drives in the library fails (hardware failure or drive is disconnected from the Fibre Channel switch)
- One of the switches fails
- One of the HBA ports fails

The physical connection of this configuration is shown in Figure 2.

Important Note: Dell Recommends Fibre Channel drives to be same generation. For Heterogonous configurations refer to section: Heterogonous Validated Configurations



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover configuration (one host, two HBAs, two switches, two FC drives)

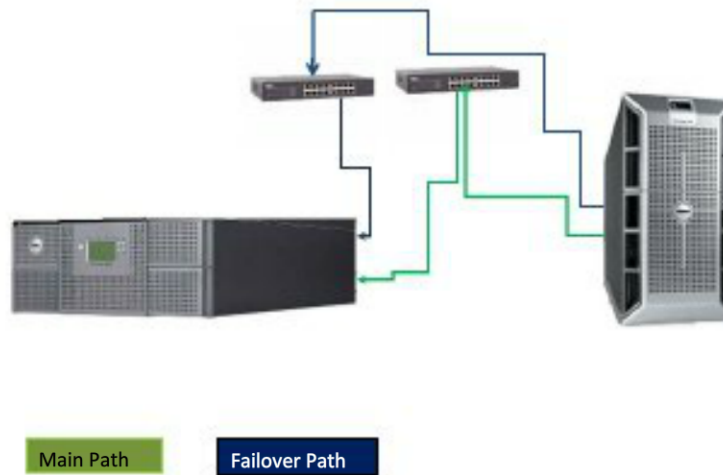


Figure 2: Reference Configuration 2

Failover Reference Configuration 3:

One host with dual port SAS HBAs and one Dell PowerVault™ with two SAS drives

In this configuration, failover occurs if one of the following occurs:

- One of the drives fails (hardware failure or is drive disconnected from the HBA port)
- One of the HBA ports fails
- One of the ports in a drive fails

This configuration takes full advantage of path failover; it is protected via data and control path.

The physical connection of this configuration is shown in Figure 3.

Important Note: Dell Recommends Fibre Channel drives to be same generation. For Heterogonous configurations refer to section: Heterogonous Validated Configurations



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover configuration (one host with two HBAs, and two SAS drives)

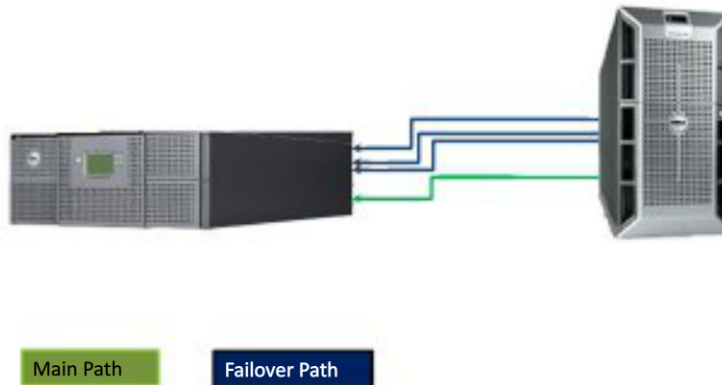


Figure 3: Reference Configuration 3

Failover Reference Configuration 4:

One Host with dual Fibre Channel HBAs, two Fibre Channel switches and a Dell PowerVault™ with two Fibre Channel drives

In this configuration, failover occurs if one or more of the following occurs:

- One of the drives fails (hardware failure or is drive disconnected from the HBA port)
- One of the HBA controllers fails
- One of the switches fails

The physical connection of this configuration is shown in Figure 4.

Important Note: Dell Recommends Fibre Channel drives to be same generation. For Heterogonous configurations refer to section: Heterogonous Validated Configurations



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover configuration

(Host with dual port HBAs, two FC switches, and two FC drives)

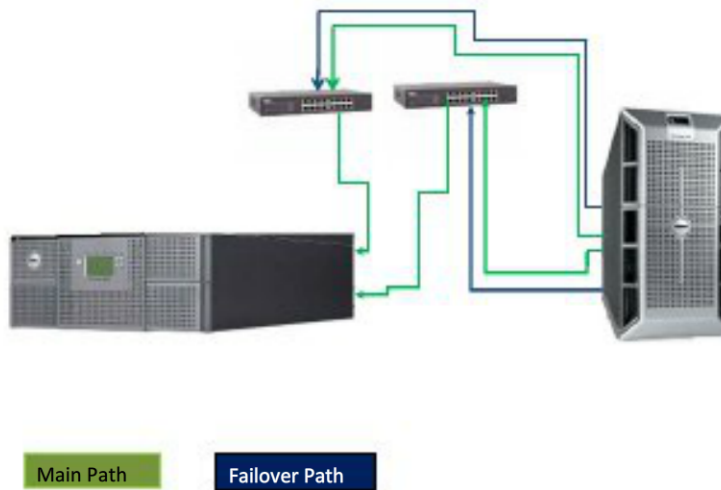


Figure 4: Reference Configuration 4

Failover Reference Configuration 5:

Two hosts with dual Fibre Channel HBAs, two Fibre Channel switches and one Dell PowerVault™ with two Fibre Channel drives

In this configuration, failover occurs if one or more of the following occurs:

- One of the drives fails (hardware failure or is drive disconnected from the HBA port)
- One of the HBA controllers fails
- One of the switches fails

The physical connection of this configuration is shown in Figure 5.

Important Note: Dell Recommends Fibre Channel drives to be same generation. For Heterogenous configurations refer to section: Heterogenous Validated Configurations



Dell PowerVault™ TL4000/TL2000 Failover Guide

Multiple Host Failover configuration

(two hosts, two FC switches, and 2 FC drives)

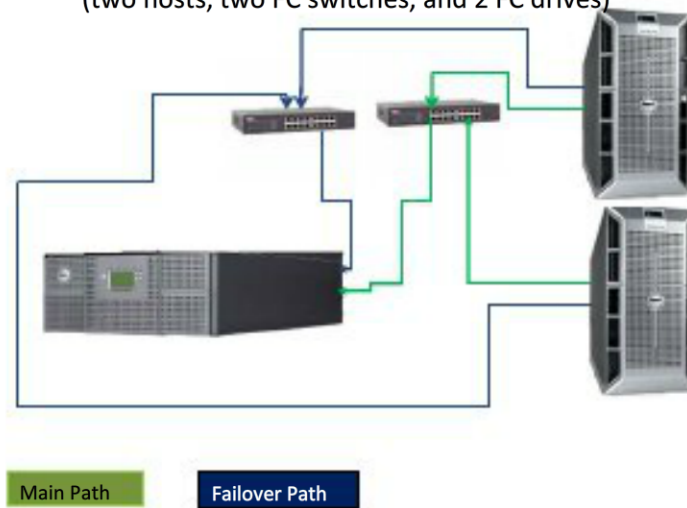


Figure 5: Reference Configuration 5

Note that a SAN environment is susceptible to backup performance issues due to the sharing of resources across multiple hosts. A failover event in the system can potentially complicate the performance issues. Failover is a means to maintain the data storage flow in the event of a failure along the communication path between the host and the drive or library, but the environment manager must monitor the state of the system to ensure all the paths are active.

Failover Reference Configuration 6:

One host with dual port SAS HBA and one Dell PowerVault™ with a single SAS drive

In this configuration, failover occurs only if one of the HBAs fails. This configuration only supports data path failover as there is no second drive to failover the control path. The physical connection of this configuration is shown in Figure 6.



Dell PowerVault™ TL4000/TL2000 Failover Guide

Single SAS Drive Failover Configuration (one host with two HBAs, and One SAS drive)

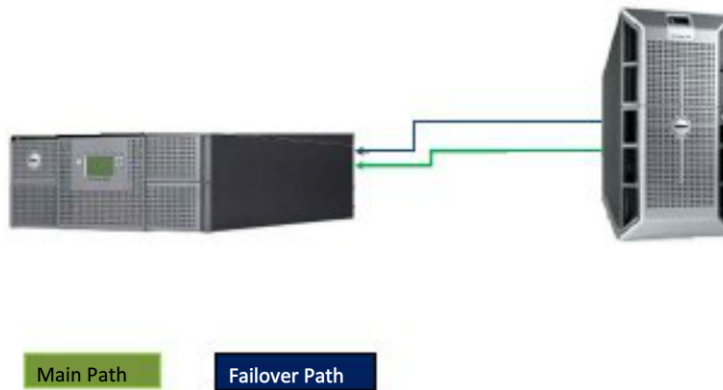


Figure 6: Reference Configuration 6

Failover Reference Configuration 7:

One host with two Fibre Channel HBAs, one Fibre Channel switch and one Dell PowerVault™ with a Single Fibre Channel drive

In this configuration, failover occurs only if one of the HBAs fails. This configuration only supports data path failover as there is no second drive to failover the control path. The physical connection of this configuration is shown in Figure 7.



Dell PowerVault™ TL4000/TL2000 Failover Guide

Single FC Drive Failover configuration

(Two HBA adapters, One FC switch, and one FC drive)



Figure 7: Reference Configuration 7

LT05 Specific Requirements For Failover Support

The introduction of LT05 drive support in the Dell PowerVault™ TL2000 and TL4000 allowed additional failover configurations. These configurations are unique to the Dell PowerVault™ TL2000 and TL4000 configured with LT05 devices and do not extend to LT04 configurations.

Important Note: Failover is only supported on Dell PowerVault™ TL2000 when configured with LT05 drives

Failover Reference Configuration 8:

One host with two Fibre Channel ports, one Fibre Channel switch, and a Dell PowerVault™ configured with three Fibre Channel drives

In this configuration, failover occurs if one or more of the following occurs:

- One of the drives fails (hardware failure or is drive disconnected from the HBA port)
- One of the Fibre Channel ports in the HBA fails



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover configuration

(one host, two FC HBAs, One FC switch, three FC drives)



Figure 8: Reference Configuration 8

Important Note: This configuration can be extended to up to four LT05 drives

Failover Reference Configuration 9:

One host with three dual port SAS HBAs and a Dell PowerVault™ configured with three SAS drives

In this configuration, failover occurs if one or more of the following occurs:

- One of the drives fails (hardware failure or is drive disconnected from the HBA port)
- One of the HBA controller ports fails
- One port in a SAS drive fails



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover configuration

(one host with three dual port HBAs, and three SAS drives)

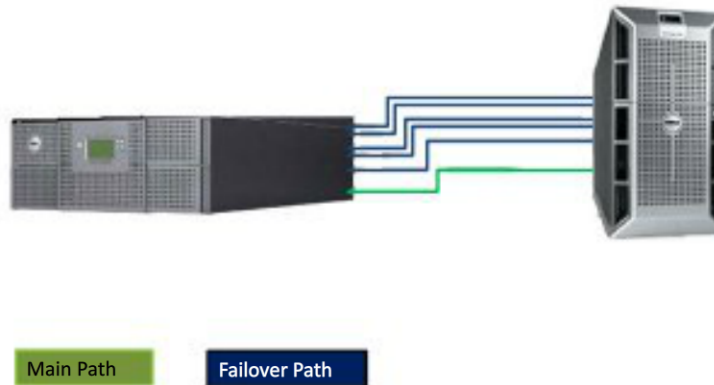


Figure 9: Reference Configuration 9

Important Note: This configuration can be extended up to four drives provided the host system can support four dual SAs HBAs.

Heterogeneous validated configurations

Heterogeneous configurations have some limitations, if the configuration contains LT04 and LT05 drives, the Library must contain only LT04 media for proper operations.

Important Note: Heterogeneous configurations containing LT03 drives are not supported

Failover Reference Configuration 10:

One host, one Fibre Channel switch and one PowerVault™ library configured with one LT04 Fibre Channel and one LT05 Fibre Channel drive

In this configuration, failover occurs if one of the drives in the library fails (hardware failure or drive is disconnected from the Fibre Channel switch). The physical connection of this configuration is shown in figure 10



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover configuration

(one host, one switch, two FC drives)



Figure 10: Reference Configuration 10

Failover Reference Configuration 11:

One host with two dual port SAS HBAs and one PowerVault™ with one LT04 SAS and LT05 SAS drive

In this configuration, failover occurs if one of the drives in the library fails (hardware failure or drive is disconnected from the HBA).

In the event a single port in the SAS drive fails, failover will take effect and data will be streamed onto the same drive using the second SAS connection.

In the event a SAS drive fails; failover will result on control path and data moved to the additional drive in the library

The physical connection of this configuration is shown in Figure 11



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover configuration (one host with two HBAs, and two SAS drives)

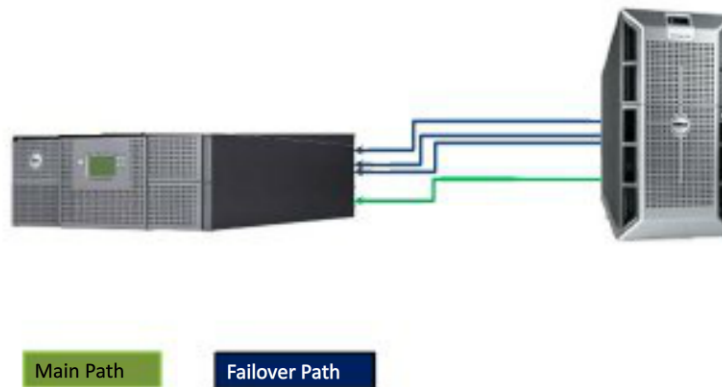


Figure 11: Reference Configuration 11

Configuring your Environment to Support Failover

Ensure you have the following for successful environment configuration:

- Dell PowerVault™ TL2000 or TL4000 configured with failover capable drives. Please refer to failover configuration support matrix.
- A network connection to your Dell PowerVault™ TL2000/TL4000 library for management purposes. Refer to the Dell PowerVault™ TL4000\TL2000 Tape Library User's Guide for more information
- A Dell PowerVault™ TL4000\TL2000 Tape Library failover license
- A host system configured with as many tape connections needed for your environment.
- Enough cables to make the necessary connections needed for your environment
- A Fibre Channel switch if utilizing a Fibre Channel configuration
- CommVault Backup Application
 - a. For Dell PowerVault™ TL4000 with LT04 drives
 - i. CommVault Galaxy 6.1 SP4 or later with SAN license enabled
 - b. For Dell PowerVault™ TL2000/TL400 with LT05 drives
 - i. CommVault Simpana 8.0 SP4 or later with SAN license enabled
 - ii. Patch to support LT05 tape applied



Dell PowerVault™ TL4000/TL2000 Failover Guide

- Dell PowerVault™ TL2000/TL4000 Microsoft Windows device driver. The driver can be downloaded from Dell support site: <http://support.dell.com>

Important Note: Please refer to Dell PowerVault™ Compatibility Matrix for latest supported OS list, Backup application and Dell PowerVault™ Tape configurations.

<http://support.dell.com/support/edocs/stor-sys/matrix/PVMatrix/index.htm>

Dell PowerVault™ TL2000/TL4000 Library Failover Setup

Take the Library Offline

Before starting the failover configuration process, it is important to ensure no backup jobs are running and library resources are not controlled by the tape backup application

Follow the instructions for taking the library offline in the Dell PowerVault™ TL2000 Tape Library and TL4000 Tape Library User's Guide. In the event you do not have a copy of this document, it can be downloaded from the Dell support site at <http://support.dell.com>.

Upgrade Library and Drive Firmware to the Latest Version

Ensure your Dell PowerVault™ TL2000/TL4000 library has the latest library and drive firmware. The latest firmware can be found at <http://support.dell.com>.

If a firmware upgrade is needed, follow the instructions included in the firmware download package located at <http://support.dell.com>.

Apply the failover license to the library

In order to support failover, a license must be entered into your library. If a license is needed, please contact your Dell technical sales representative. Follow the steps provided with your failover documentation to obtain the license for your library.

Failover can be enabled via the Remote Management Unit (RMU) or the Operator Control Panel (OCP). Select the method you prefer and follow the instructions below.

Entering Path Failover License Activation Key via the Remote Management Interface (RMU)

If you ordered failover at point of sale, the envelope containing the failover authorization code is located in the accessory box that came with your unit. If you ordered failover after point of sale, an envelope containing your failover authorization



Dell PowerVault™ TL4000/TL2000 Failover Guide

code was sent to you. Please follow the instructions on the failover authorization code certificate to obtain your license key. The authorization code you were sent will not activate the feature on the library.

Please refer to the Dell PowerVault™ TL2000 Tape Library and TL4000 Tape Library User's Guide for instructions on accessing and navigating the RMU.

The library validates the entered license key and provides a "Failover Enabled" message upon successful completion. In the event you enter the wrong license key, the library returns a "Key Not Validated" failure message.

1. Navigate to Configure Library → Path Failover.
2. Enter the Path Failover 12-digit license key in the spaces provided.



Figure 12: PowerVault™ TL4000 Failover Activation screen

3. Click Activate to save the license key and activate failover on the library. The following screen displays if you have correctly entered the license key.



Figure 13: PowerVault™ TL4000 RMU screen after failover has been activated

Entering Path Failover Feature Activation Key via Operator Control Panel (OCP)

If you ordered failover at point of sale, the envelope containing the failover authorization code is located in the accessory box that came with your unit. If you ordered failover after point of sale, an envelope containing your failover authorization code was sent to you. Please follow the instructions on the failover authorization code certificate to obtain your license key. The authorization code you were sent will not activate the feature on the library.

Please refer to the Dell PowerVault™ TL2000 tape Library and TL4000 Tape library User's Guide for instructions for navigating with the OCP.



Dell PowerVault™ TL4000/TL2000 Failover Guide

The library validates the entered license key and provides a “Failover Enabled” message upon successful completion. In the event you enter the wrong license key, the library returns a “Key Not Validated” failure message.

1. Navigate to Configure → Path Failover
2. Press the SELECT button to highlight the first digit of the 12-digit license key.
3. Use the UP and DOWN buttons to select each digit.
4. Press the SELECT button to move to the next digit.
5. After entering the final digit, press the DOWN button and select one of the following:
 - Save - to apply your settings
 - Cancel - to delete your settings

Configure the Dell PowerVault™ TL2000/TL4000 control path in the secondary drives

By default, the library has only one control path via drive 1 in the library regardless of the number of drives installed. In order to configure control path failover, you must enable the control path in the drive settings for the secondary drive. Please refer to the Dell PowerVault™ TL2000 Tape Library and TL4000 Tape Library User’s Guide for instructions on enabling control path. Enabled control path for all additional drives in the library

Bring the Library Back Offline

Please refer to the Dell PowerVault™ TL2000 Tape Library and TL4000 Tape Library User’s Guide for instructions on bringing the library back online.

Backup Host Control Path Failover Setup

The host system must have Microsoft Windows 2003, 2008 Or 2008 R2 (32- or 64-bit). You must install the Dell PowerVault™ TL4000 device driver on your backup host system. The Dell PowerVault™ TL2000/TL4000 driver can be downloaded from <http://support.dell.com>. Please follow the installation Instructions included in the driver package.

Verify the OS sees the library. There will be a drives listed in the Device Manager for each physical connection to the drive(s)

Backup Application Setup and Support

CommVault is the only backup application that currently supports failover. Install the backup application; please refer to your CommVault documentation for installation instructions

*Important Note: Ensure your CommVault installation install has all the updates required for LT05 tape support



Dell PowerVault™ TL4000/TL2000 Failover Guide

Note: Please follow the steps under Backup Application Setup and Support for Configuring Dual Host Bus Adapters even if your library configuration contains SAS drives or Fibre Channel direct attached drives. The configuration settings under Configuring Dual Host Bus Adapters will allow your SAS or direct attached Fibre Channel configuration to support failover.

Once CommVault is installed, there are additional steps to configure failover. Access the CommVault failover configuration instructions at <http://www.commvault.com/>.

- Navigate to the Services tab
- Select Support Services then Documentation
- Select the Books Online link for your software version
- Select the search option located in the upper right side of the page
- Search for keywords "SAN-Attached Libraries"
- Locate the article named "SAN-Attached Libraries" and follow the instructions provided for "Configuring Dual Host Bus Adapters (HBA)"

Once CommVault is correctly configured for failover, the screen shown in Figure 14 below is displayed.

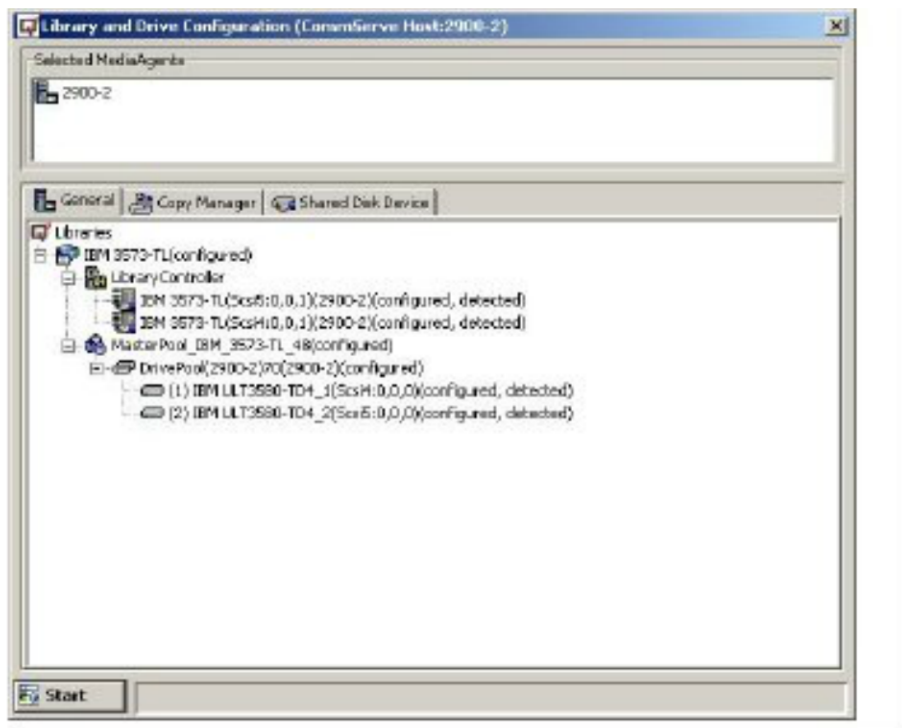


Figure 14: Fully configured CommVault Application



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover Configuration Verification

Follow the steps in the table below to test your configuration was completed successfully. The test procedure will take you through a user-induced failover event to validate the configuration, demonstrate the failover behavior, and demonstrate restoring the unit after a failover event.

Failover Test Procedure

Procedure Step Number	Test Procedure	Expected Result
1	Configure your library per the instructions in this document	Configuration is complete and library is configured in CommVault
2	Verify your library is accessible by running a small backup job with a piece of scarp media	Job completes successfully
3	Start a new backup to a single tape drive. Make note of the job ID.	Backup starts without error.
4	When the backup reaches the 50% mark disconnect the cable from the back of the tape drive actively running I/O.	Error message will be displayed in the CommVault Event Viewer. Media fails to unload. Job status goes to a pending state.
5	Let job sit in Pending state for 5 minutes. Right click the Job and select Resume.	Job restarts. New media is loaded into the second drive and job completes. Media is unloaded.
6	Start another backup job to the library.	Backup starts and completes.
7	Repair the broken link created in step 4 Verify OS recognizes the device	Device Manager shows device correctly.
8	Reset the library drive that contains the "stuck" tape from step 2. Refer to appendix A in this document	Drive unloads the media.
9	Perform a restore of the Job ID noted in step 3 This will be the backup job that contained the failover event. Direct the restore job to an alternate location for file comparison of the original data.	Restore begins and completes without error.
10	Compare the data from the restore job to the original data. Using your method of choice	100% match of the data.
11	Perform a backup that utilizes both drives in the library.	Backups begin and run in parallel. Jobs finish with success.



Dell PowerVault™ TL4000/TL2000 Failover Guide

Failover Performance considerations

The failover feature requires the Dell PowerVault™ TL2000/TL4000 library device driver. The additional driver functionality results in a noticeable performance impact.



Dell PowerVault™ TL4000/TL2000 Failover Guide

Appendix A - Recovering from a failover event

Recovering from a data path failover event in the tape backup application

The tape backup software application administrator must perform the necessary configuration maintenance to restore the backup system to full operation; there is no tape backup application configuration required.

Drive reset

In CommVault, navigate to the Storage Resources/Libraries/"your failed library"/Master pool. Right click on the failed drive and select reset. A message box appears asking the user to confirm drive reset. Select ok. At this point, the media in the drive is unloaded. A Media Recovery message will be posted in the CommVault event viewer after the tape unload completes.

Drive replacement or upgrade

In order to maintain failover support in the library, you must maintain the configuration consistent with the supported failover configurations when replacing a failed drive. Not all drive failures will result in a drive replacement.

Replacing the drive with the same type (generation) has no effect on failover settings. Refer to the PowerVault™ TL2000 Tape Library and TL4000 Tape Library User's Guide for the drive replacement instructions. After the drive is installed, you must ensure that the control path for both drives is active.

Replacing a drive with same generation or upgrading the drive to a newer generation. Under these circumstances, there is no configuration impact as long as the drive added supports failover. The Backup Application configuration must be updated to reflect the new drive(s) and their serial numbers. Remember to turn on the control path on the added drive(s).

Important note: Replacing a failover configured drive with an LT03 drive will result in no failover support without any feedback to the user.

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