



**Hewlett Packard**  
Enterprise

# **Data protection using HPE StoreEver Tape Libraries and IBM Tivoli Storage Manager**

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## Introduction

Hewlett Packard Enterprise tape implementations provide scalable solutions with reliable and high-speed devices for IBM Tivoli Storage Manager (TSM) backup and restore operations. Physical tape environments are suitable migration destinations for primary TSM disk pool data, and HPE StoreEver Tape Storage offers long-term, copy pool, and permanent data storage.

Setting up an HPE tape library in a shared SAN environment with IBM Tivoli Storage Manager can be accomplished using this guide. This guide is not meant to be an exhaustive list of commands and parameters for TSM configuration. It documents the methods used in HPE testing to setup and administer an HPE tape library in a SAN.

## Technology overview

### HPE StoreEver Tape Libraries—key features and benefits

HPE StoreEver Tape Libraries have the lowest cost per terabyte for long-term storage with limited power or energy requirements and are dependable, and ideal storage technologies for archiving cold or active data with a media shelf life of up to 30 years in normal ambient conditions. You can easily transport rugged linear tape–open (LTO) cartridges off-site for disaster recovery purposes, and use WORM media for protection against accidental overwrite. LTO data cartridges are portable, high-density storage, having a small footprint with up to 15 TB of compressed data on a single LTO-7 data cartridge. HPE StoreOpen Linear Tape File System (LTFS) provides file management capabilities, making tape as easy to access and share as disks. LTFS enables file retrieval from long-term storage without depending on backup software or hardware. Your administrators can manage, configure, and use HPE StoreEver ESL G3 and MSL6480 Tape Libraries from across the room or across the globe with HPE-unique, Web-based remote management and diagnostic tools that can proactively and intelligently monitor utilization, operational performance, and overall life and health of the library, drives, and media.

The HPE StoreEver ESL G3 Tape Library delivers enormous scalability to keep pace with unpredictable data growth. Choose from a range of base configurations and scale up to 12,006 tape cartridges in increments of 100 slots for capacity on demand that reaches up to 180 PB (compressed 2.5:1) of a backup or archive data. Supporting growth is only part of the story.

The HPE StoreEver ESL G3 Tape Library also delivers high availability through redundant power supplies and dual-robotics capabilities, while host-path connectivity failover provides better library performance. Management and control of multiple tape libraries is delivered by an intelligent command GUI.

Features:

- **Broad scalability for consolidated data protection with capacity on demand**

Quickly and easily add capacity without disruption, the HPE StoreEver ESL G3 Tape Library scales from 100 to 12,006 tape cartridges, from 1 to 192 LTO-5 or newer Ultrium Tape drives, and 1 to 16 library frames.

Customer configurable import and export slots from 24 to 528 for fast bulk load and unload. A 72-slot mailbox provides one of the largest import/export capabilities.

Each frame is equal to a standard 19-inch rack form factor for the most efficient use of floor space.

- **High availability features for near continuous availability**

To make the most of your library performance, the HPE StoreEver ESL G3 Tape Library includes both control path failover and drive to port failover, delivering and supporting ongoing host and SAN connectivity under a variety of adverse conditions. Active-active dual robotics capability paves the way for near continuous data access and even higher reliability.

- **Easing the management burden and reducing the total cost of ownership (TCO) of enterprise data protection**

It helps simplify managing complex environments with library partitioning. HPE Secure Manager Tape Library software allows the user to divide the library into up to twelve virtual tape libraries logically. This function is especially useful when multiple SANs or backup software packages are present. Advanced partitioning support is provided by an automated media pool, which automatically reallocates partition space as data storage requirements grow without having to reconfigure software applications.

The HPE StoreEver MSL6480 Tape Library is the gold standard for mid-range tape automation, delivering proven scalability, density, and performance to meet your short-term backup and disaster recovery data protection needs, as well as long-term archival requirements. Keep pace with data growth by seamlessly scaling up to seven modules—without disrupting daily data protection. Reduce TCO by reusing current MSL tape drives and adding more capacity and performance as you need it.

Features:

- **Driving the industry in scalability for a better tape solution**

Scale vertically from 80 to 560 cartridge slots to store up to 8.4 PB (assumes LTO-7 with 2.5:1 compression) in a single 19-inch rack; add in between 1 to 42 LTO-4 or newer half-height SAS or Fibre Channel (FC) drives or 1 to 24

LTO-4 or newer full-height SAS or FC drives for speed of up to 113.4 TB/hr (assumes LTO-7 with 2.5:1 compression).

You can easily manage expansion module installations, as they are simple to configure and remove. The StoreEver MSL6480 Tape Library features a touch-operator control panel with wizards for easy installation and configuration.

HPE StoreEver MSL Tape Libraries easily manage your media either in or out of the tape library with a standard bar code reader and configurable 10-slot removable magazines.

- **Save money—reduce power, cooling, floor space, and hardware costs**

The HPE StoreEver MSL6480 Tape Library offers up to 195 TB/s (equivalent to 13 LTO-7 tape cartridges) per 1U of rack space using LTO-7 drives, providing flexible options to consider for your business.

For unmatched investment protection, you can reuse any MSL2024, MSL4048, MSL8048, and MSL8096 tape drive canisters in the StoreEver MSL6480 Tape Library.

Partitioning allows each partitioned library to be presented to the host as an independent library, separate from other partitions in the library.

- **Reduce risk—dependable multi-year data protection and security**

Safeguard your data in the library after export and when it's off-site with several security encryption offerings. Select from either the low-cost security solution for small to medium business or leverage larger enterprise encryption options with the support of Key Management Interoperability Protocol (KMIP) compliant encryption key servers.

High availability path failover uses host drivers in conjunction with library and drive firmware to manage multiple paths across multiple SANs, present a single drive or robot path to applications, and automatically transfer commands to the new path if the original path is lost.

## **Data Agile Partner Program**

The [HPE Data Agile Partner Program](#) offers partners a programmatic framework to self-certify the interoperability of their applications across the entire Hewlett Packard Enterprise Storage portfolio of BURA products—including HPE StoreOnce Backup, HPE StoreAll Storage, and HPE StoreEver Tape. The Data Agile Partner Program enables partners to learn about the HPE BURA portfolio, test and certify their applications in a dedicated HPE lab environment and take advantage of unique marketing opportunities. Program members also have access to specialized trainings and technical assistance.

Provide powerful solutions to your customers and expand market opportunities through a partnership with HPE Storage.

## **IBM Tivoli Storage Manager**

IBM Tivoli Storage Manager (TSM) provides automated, centrally scheduled, policy-managed backup, archive, and space-management capabilities for file servers, workstations, virtual machines, and applications.

### **IBM TSM Operations Center overview**

The Operations Center includes an **Overview** page where you can view high-level status information. From the Overview page, you can navigate to other pages that provide more details. The Overview page of the Operations Center includes the following sections:

- TSM clients
- Alerts
- Network traffic
- Inventory

### Managing the TSM server from the command line

Tivoli Storage Manager configuration and other operations are performed through various CLIs. TSM provides two CLIs:

- TSM administrative command-line client
- TSM backup-archive client

The administrative command-line client is a program that runs on a file server, workstation, or mainframe. It is installed as part of the Tivoli Storage Manager server installation process. With the administrative client, you can issue any server commands.

The Operations Center is a Web-based interface for managing your storage environment. It provides visibility to the key aspects of your Tivoli Storage Manager environment, including clients, servers, policy, storage pools, and storage devices. Through the Operations Center, you can also access the Tivoli Storage Manager command line.

Server scripts provide for automation of common administrative tasks. A macro is a file that contains one or more Tivoli Storage Manager administrative commands. When you issue the **MACRO** command, the server processes all commands in the macro file in order, including commands contained in any nested macros.

## Integrating HPE StoreEver Tape with IBM Tivoli Storage Manager

### Installation checklist

If the answer to each of the following questions is yes, then all components on the SAN are logged in and configured properly:

- Are all of the following hardware components at the minimum supported firmware revisions specified in the current [HPE Data Agile BURA Compatibility Matrix](#): servers, host bus adapters (HBAs), FC switches, HPE Command View Tape Library, tape drives, and library robots?
- Is the minimum patch-level support for each operating system installed?
- Is the minimum supported drivers specified in the [HPE Data Agile BURA Compatibility Matrix](#) installed (HBA, tape drives)?
- Is the HPE StoreEver Tape Library or partition(s) online?
- Is the TSM backup server HBA correctly logged in to the Fibre Channel switch?
- If the Fibre Channel switches are cascaded or meshed, are all inter-switch link (ISL) ports correctly logged in?
- Are all tape and robotic devices zoned, configured, and presented to each host from the Fibre Channel switch?
- Are the Tivoli Storage Manager server HBA, and tape and robotic devices in the same switch zone(s)? See the following note.
- Does Tivoli Storage Manager server detect all of the tape and robotic devices intended to be used?
- Are all HPE StoreEver storage devices seen by HPE Command View Tape Library?
- Has connectivity been verified using HPE Library and Tape Tools or operating system specific tools (for example, the server utility in Linux®)?

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### Note

Hewlett Packard Enterprise strongly recommends creating zones by HBA port. For more detailed information on creating zones by HBA port, refer to the [HPE Design Guide for Backup and Archive](#).

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## Installation and configuration

After all SAN-attached devices are logged in to the SAN and configured, you are ready to consider TSM installation. It is recommended that you review the following resources, provided by IBM as support, for planning to install TSM on a SAN.

- Review the [OS requirements for IBM TSM](#).
- Review the [TSM overview](#) and [installable components](#).
- Review the guide to plan for storage agent installation and configuration in a [TSM LAN-free \(SAN\) environment](#).
- For Windows® servers, the User Account Control (UAC) policy must be set for the slide bar to **never notify** on Windows 2008 R2. Access the UAC settings by simply typing **user account settings** into the Windows search bar on the **Start** menu. Check Microsoft® Windows documentation for other Windows versions.

## Installation tips for IBM Tivoli Storage Manager software

For this guide, the following components were installed on the **TSM server**.

1. **IBM Tivoli Storage Manager server.**
2. **IBM Tivoli Storage Manager licenses.**
3. **IBM Tivoli Storage Manager device driver.**
4. **IBM Tivoli Storage Manager Operations Center (optional).**
5. In addition to the standard server components, the **TSM backup and archive client** must also be installed if you wish to connect to tape devices and perform backups from the TSM server.

Configuring additional TSM **LAN-free** storage agent client or TSM library client backups to shared SAN storage requires significant configuration and will not be covered in detail in this guide. To set up the following components must be installed:

1. **TSM “pass-thru” device drivers**
2. **TSM LAN-free storage agent**
3. **TSM backup and archive client**

Refer to the IBM documentation for configuration:

- Windows: [configure TSM for LAN-free data movement](#)
- Linux/UNIX®: [configure TSM for LAN-free data movement](#)

Installation is a 2-step process:

1. First use the installation disk or downloaded installation files to install all necessary components as outlined earlier in this section.
2. After initial installation is complete, the following components must be configured before device setup.
  - a. **IBM Tivoli Storage Manager:** Choose the correct server platform for your configuration and use the “taking the first steps after you install Tivoli Storage Manager” section in the appropriate [IBM server installation documentation](#). Use either the “Configuring TSM configuration wizard,” or the manual server instance configuration for the appropriate platform.
  - b. **Operations Center:**
    - I. After configuring Operations Center, open it by entering the following address in a supported browser:  
**https://localhost:11090/oc/**. Connect to **Localhost:1500** in the dialogue box that will appear in the browser. The required user name and password for initial Operations Center entry will be the one that was created during the configuration wizard process in the previous step.
    - II. Initial access to the Operations Center will require another password to be created for entry into **dsmadmcli** CLI. The default user will be in the following format: **IBM-OC-ServerName**. *This login and password will be critical for logging into the administration CLI (dsmadmcli).*
  - c. **Backup and archive client:** In order to initiate a tape backup, the **backup and archive** client must be configured by setting up the options file in **[install directory]\Tivoli\TSM\baclient\dsm.opt** to include the following options:
    - I. To set up the **client**, install the appropriate client services by following the instructions provided by IBM TSM for the correct OS, and set up the dsm.opt file located in the baclient directory. See the following example from a Windows host.
      - For TSM v7.1 client setup, complete instructions are available [here](#)
      - Set up the client options file located in **[install directory]\baclient\dsm.opt** file. Refer to [TSM documentation](#) for options
      - The following is an example dsm.opt file from a Windows TSM server:

```
COMMMethod TCPIP
NODENAME node1

TCPServeraddress 10.40.xx.xxx
TCPPOINT 1500

Compression no

passwordaccess generate
RESOURCEUTILIZATION 10
TXNBYTELIMIT 10g

TCPWindowSize 128

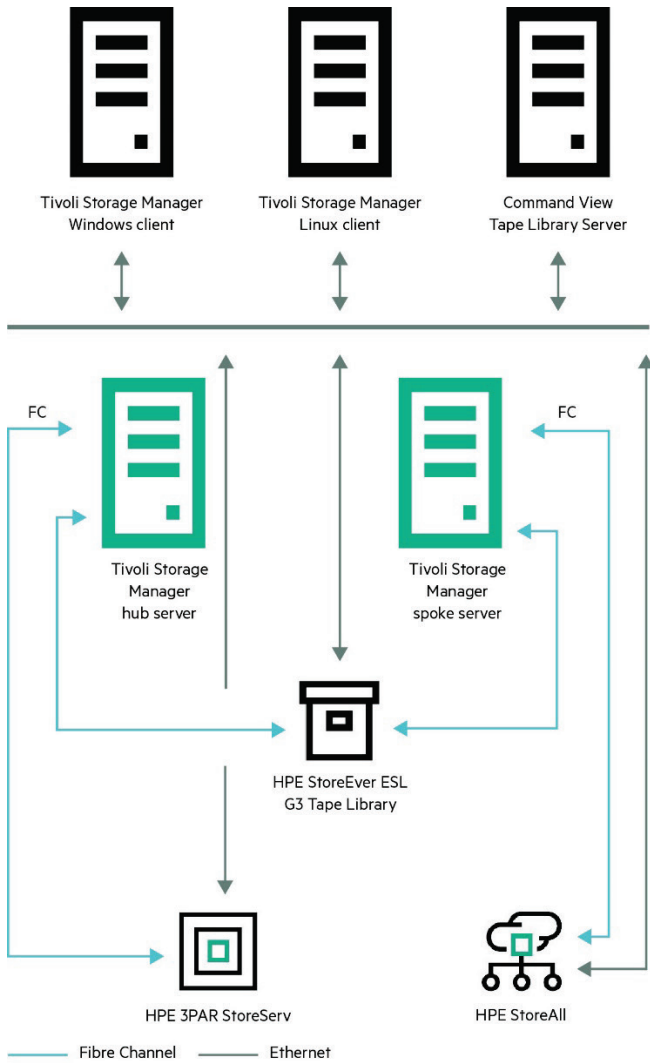
TCPBUFFSIZE 128

SCHEDMODE prompted

SCHEDLOGNAME "C:\Program Files\Tivoli\TSM\baclient\dsmsched.log"
ERRORLOGNAME "C:\Program Files\Tivoli\TSM\baclient\dsmerror.log"
```

For this guide the [Tivoli Storage Manager v7.1 installation guide](#) was used to install a TSM hub server on a Windows platform.

Figure 1 illustrates an example of possible architecture for a TSM SAN.



**Figure 1.** Tivoli Storage Manager sample architecture with HPE StoreEver ESL G3 Tape Library, HPE 3PAR StoreServ, and HPE StoreAll

### Discovering the tape library with IBM Tivoli Storage Manager

The following section provides configuration recommendations for using the TSM CLI administrative commands and associated parameters to configure an HPE StoreEver ESL G3 Tape Library with Ultrium drives. The full command name, a brief description, and some command line examples will be given. The examples and descriptions are not exhaustive. [Consult the IBM Tivoli Storage Manager administrative guides](#) of the appropriate product version for more information.

Use the **dsmadm** command line window. With a standard TSM server installation, the location will be in `[install path]\Tivoli\Server\tsmdiag`.

### Important

After installation of the various components is complete, be sure to enable TSM licensing by running the following command from the **dsmadm** administration console: **register lic file=\*lic**.



Optionally, log in to TSM Operations Center (TSM v7.1) and click on the **world** icon in the upper right hand corner of the browser. A **tsmdiag** CLI will open automatically.

**Note**

Log in to the **dsmadm** CLI with the user ID and password setup during the communications setup in the Operations Center configuration. The default format for the username is IBM-OC-Server1.

1. TSM **SANDISCOVERY** simplifies device configuration for SAN-attached storage devices. TSM’s SAN device mapping (SDM) function utilizes the Storage Networking Industry Association (SNIA) HBA application programming interface (API) to perform SAN discovery operations. The device serial number, manufacturer, and worldwide name are initially recorded for each tape device. When tape device configuration changes, TSM automatically updates the device path information without the need for device persistent binding.

Only newer versions of TSM and specific SANDISCOVERY-supported hardware configurations are SDM-enabled. For SANDISCOVERY-supported TSM server and LAN-free storage agents running TSM v6.3.3 or higher, TSM will track the physical HPE LTO devices upon system reboot and persistent bindings are not required. All other TSM platform configurations will require tape devices to be persistently bound to the OS to avoid logical unit number (LUN) shifting upon reboot. For recommendations regarding persistent binding for HPE-supported Oss, see the [HPE Design Guide for Backup and Archive](#).

Ensure that **SANDISCOVERY** is enabled either in the TSM options file or by running the **setopt** command as shown in figure 2.

```
tsm: LUCY>setopt SANDISCOVERY on
Do you wish to proceed? <Yes <Y>/No <N>> y
ANR2119I The SANDISCOVERY option has been changed in the options file.
tsm: LUCY>_
```

Figure 2. Example output from the **setopt** command

2. To verify that TSM is able to communicate with the Fibre Channel HBA, check the output of the **q san** command. The **q san** will only be shown if the HBA is supported. In the example (figure 3), the q san output indicates that one tape library and two drives have been discovered.<sup>1</sup>

```
tsm: LUCY>q san
Session established with server LUCY: Windows
Server Version 7, Release 1, Level 0.0
Server date/time: 06/18/2014 11:11:12 Last access: 06/18/2014 10:59:25

Device      Vendor      Product      Serial Number      Device
Type
-----
DRIVE       HP          Ultrium 5-SCSI 80023B500D         Tape0
LIBRARY     HP          ESL G3 Series 2031000166_LL1    Changer0
DRIVE       HP          Ultrium 5-SCSI 80023B5013         Tape1

tsm: LUCY>
```

Figure 3. Example output from the **QUERY SAN** with a supported HBA

<sup>1</sup> The example shows that the device files used are not IBM device files. Refer to the section of this paper labeled **TSM “pass-thru” device configuration by platform** for further configuration guidelines.

## TSM “pass-thru” device configuration by platform

IBM Tape Drives utilize proprietary IBM Tape Device Drivers on all TSM supported OSs. However, non-IBM Tape hardware utilizes TSM “pass-thru” device drivers. These TSM devices are installed as part of the TSM application installation on the TSM server or LAN-free TSM storage agent. To configure these TSM “pass-thru” devices for all HPE tape devices, the following steps for configuration must be performed for each applicable OS. Once the steps in this section have been performed, the TSM “pass-thru” devices will be found in the locations listed in table 1 on the TSM server, library client, or LAN-free storage agent.

**Table 1.** TSM “pass-thru” device files

TSM SERVER OS	TSM “PASS-THRU” DRIVER TAPE DRIVE DEVICE	TSM “PASS-THRU” DRIVER LIBRARY DEVICE
AIX	/dev/mt1	/dev/lb1
Linux	/dev/tsm SCSI/mt1	/dev/tsm SCSI/lb1
HPE-UX	/dev/rmt/tsmm1	/dev/rmt/tsmlb1
Solaris	/dev/rmt/1mt	/dev/rmt/1lb
Windows	mt1.0.0.2	lb1.0.0.2

### AIX

The following procedure is used to configure TSM device drivers for auto-changers for non-IBM libraries, like HPE StoreEver physical tape libraries.

1. Run the SMIT program to configure the device driver for each HPE tape auto-changer device:

- a. Select **Devices**
- b. Select **TSM Devices**
- c. Select **Library/MediumChanger**
- d. Select **Add a Library/MediumChanger**
- e. Select the **TSM-SCSI-LB for any TSM supported library**
- f. Select the parent adapter to which you are connecting the device
- g. To find the parent adapter execute: **lsdev -Cc adapter** as shown as follows:

```
root # > lsdev -Cc adapter
fcs0 Available 04-00 4Gb FC PCI Express Adapter (df1000fe)
fcs1 Available 05-00 4Gb FC PCI Express Adapter (df1000fe)
fcs2 Available 07-00 4Gb FC PCI Express Adapter (df1000fe)
root # > lsdev -Cc tape
rmt0 Defined 07-00-02 Ultrium Tape Drive (FCP)
rmt1 Defined 07-00-02 Ultrium Tape Drive (FCP)
```

*The parent SCSI adapter in this example is 07-00.*

- h. When prompted, enter the CONNECTION address of the device you are installing.
- i. Click on the DO button. Output will be similar to the example as follows:
 

```
mt0 Available
mt1 Available
mt2 Available
mt3 Available
lb0 Available
```

2. Prior to configuring the HPE tape library, drives, and paths in TSM, all the original HPE tape **/dev/rmt** devices listed as **Other FC SCSI Tape Drive** must be deleted off the AIX OS.

```
root # > lsdev -Clgrep mt
mt0 Available 07-00-01 Tape Drive
mt1 Available 07-00-01 Tape Drive
```

```
mt2 Available 07-00-01 Tape Drive
mt3 Available 07-00-01 Tape Drive
rmt0 Available 07-00-01 Other FC SCSI Tape Drive
rmt1 Available 07-00-01 Other FC SCSI Tape Drive
rmt2 Available 07-00-01 Other FC SCSI Tape Drive
rmt3 Available 07-00-01 Other FC SCSI Tape Drive
```

```
root # > rmdev -dl rmt[X]
```

```
rmt[X] deleted
```

- This will leave only the TSM “pass-thru” devices on the AIX OS for the HPE tape devices:

```
root # > lsdev -Clgrep mt
```

```
mt0 Available 07-00-01 Tape Drive
mt1 Available 07-00-01 Tape Drive
mt2 Available 07-00-01 Tape Drive
mt3 Available 07-00-01 Tape Drive
```

Ensure the TSM “pass-thru” device for the HPE tape robot was created:

```
root # > lsdev -Clgrep lb
```

```
lb0 Available 07-00-02 Library/MediumChanger
```

The HPE tape library is now ready to be created in TSM.

### Note

If the original HPE tape **rmt** devices are not deleted off the AIX OS prior to creating the HPE tape library devices in TSM, and if the TSM **perform libaction define** command is being used to auto-configure the library, TSM will configure the wrong devices. TSM will configure **/dev/rmt** devices instead of the “pass-thru” **/dev/mt** devices. I/O errors will occur when attempting to communicate with the HPE tape library devices when this occurs.

### Linux

There are two TSM “pass-thru” driver configuration methods available in the TSM device driver package: **autoconf** and **tsmscsi**. Both of these methods perform the same function. Due to ease of use, **autoconf** is the recommended method and it is the only method shown in the following.

- Run the **autoconf** utility to build the necessary TSM “pass-thru” driver devices, and utilize the -a option to set the permissions correctly for the TSM user as illustrated in the example that follows:

```
[root@rhel6 /opt/Tivoli/tsm/devices/bin]# ./autoconf -a
```

```
*****
```

```
* IBM TIVOLI STORAGE MANAGER *
```

```
* Autoconf Utility Program for Linux *
```

```
*****
```

```
Licensed Materials - Property of IBM
```

```
(C) Copyright IBM Corporation 2009. All rights reserved.
```

```
U.S. Government Users Restricted Rights - Use, duplication or disclosure
```

```
restricted by GSA ADP Schedule Contract with IBM Corporation.
```

```
Added the read and write permissions for all users to /dev/sg10.
```

```
Added the read and write permissions for all users to /dev/sg11.
```

```
Added the read and write permissions for all users to /dev/sg12.
```

```
Integration and Best Practices Guide | HPE Storage and IBM TSM
```

```
Added the read and write permissions for all users to /dev/sg13.
```

```
Added the read and write permissions for all users to /dev/sg14.
```

Added the read and write permissions for all users to /dev/sg15.  
 Added the read and write permissions for all users to /dev/sg16.  
 Added the read and write permissions for all users to /dev/sg17.  
 Added the read and write permissions for all users to /dev/sg18.  
 Added the read and write permissions for all users to /dev/sg19.  
 Added the read and write permissions for all users to /dev/sg20.  
 Added the read and write permissions for all users to /dev/sg21.  
 Added the read and write permissions for all users to /dev/sg22.

**Table 2.** Tivoli Tape Drives<sup>2</sup>

INDEX	MINOR	HOST	CHN	ID	LUN	TYPE	VENDOR_ID	DEVICE_SERIAL_NUMBER	PRODUCT_ID	REV.
004	010	009	000	006	000	001	HPE	H103989817	Ultrium 4-SCSI	ED41
005	012	009	000	008	000	001	HPE	H103989815	Ultrium 4-SCSI	ED41
006	013	009	000	009	000	001	HPE	H10398980W	Ultrium 4-SCSI	ED41
007	014	009	000	010	000	001	HPE	H10398980Z	Ultrium 4-SCSI	ED41
008	015	009	000	011	000	001	HPE	H103989814	Ultrium 4-SCSI	ED41
009	016	009	000	012	000	001	HPE	H103989813	Ultrium 4-SCSI	ED41
010	017	009	000	013	000	001	HPE	H103989811	Ultrium 4-SCSI	ED41
011	018	009	000	014	000	001	HPE	H103989812	Ultrium 4-SCSI	ED41
012	019	009	000	015	000	001	HPE	H10398980X	Ultrium 4-SCSI	ED41
013	020	009	000	016	000	001	HPE	H10398980Y	Ultrium 4-SCSI	ED41
014	021	009	000	017	000	001	HPE	H103989816	Ultrium 4-SCSI	ED41
015	022	009	000	018	000	001	HPE	H103989810	Ultrium 4-SCSI	ED41

**Table 3.** Tivoli Medium Changer Devices

INDEX	MINOR	HOST	CHN	ID	LUN	TYPE	VENDOR_ID	DEVICE_SERIAL_NUMBER	PRODUCT_ID	REV.
001	011	009	000	000	000	008	HPE	H303989866	D2DBS	EL01

<sup>2</sup> The example output is for an HPE StoreOnce tape emulation rather than from a physical HPE StoreEver Tape Library.

2. The **autoconf** command builds the **lbinfo** and **mtinfo** device information files. These files are located in the **/dev/tsm SCSI** directory. The index field represents the TSM “pass-thru” device path. This path will be manually inserted into TSM path stanza by the administrator. For instance, **/dev/tsm SCSI/lb0** is the path for the robot, **/dev/tsm SCSI/mt4** is the path for the first tape drive, and **/dev/tsm SCSI/mt15** is the path for the last tape drive in this HPE StoreOnce virtual tape library /TSM library.

```
[root@rhel6 bin]# cat /dev/tsm SCSI/lbinfo
```

Index	Minor	Host	CHN	ID	LUN	Type	Vendor_ID	Device_Serial_Number	Product_ID	Rev.
000	011	009	000	000	000	008	HPE	H303989866	D2DBS	EL01

```
[root@rhel6 bin]# cat /dev/tsm SCSI/mtinfo
```

---

## Note

In some distributions of Linux, like Red Hat®, the tape devices are owned by the **disk** group and have permissions 660 (= -rw-rw----), so only root and members of the **disk** group can use the tape devices by default. This is not suitable for most TSM environments where the TSM application is installed as a non-root user. In that case, the device permissions must be changed in order for TSM to be able to use the Linux generic tape devices. By executing **autoconf -a**, a symbolic permission change will be performed on the StoreEver Linux **sg** devices. Without adding the **-a** to the **autoconf** command, TSM will not be able to access the Linux tape devices and an I/O error will occur during the TSM **DEFINE PATH** operation.

---

## HPE-UX

The TSM “pass-thru” driver is supported on HPE-UX 11i v2 and v3 on the IA64 architecture. The device configuration tools, **autoconf** and **tsmdlst**, are included in the device driver package and are installed to the **/opt/tivoli/tsm/devices/bin** directory unless a different location is specified.

- For HPE-UX 11i v2, the **sctl** driver and the HPE-UX **stape**, **sdisk**, and **schgr** native drivers are required for device configuration for the TSM “pass-thru” device driver.
- Verify these drivers are loaded using the **lsdev** command. For HPE 11i v3 on IA64, the **esctl** driver and the HPE-UX **estape**, **esdisk**, and **eschgr** native drivers are required for device configuration.
- Verify these drivers are loaded in the HPE-UX kernel using the **lsdev** command. If these drivers are not loaded in to the HPE-UX kernel, then please reference the “HPE-UX configuration and operating system details” section from the [HPE BURA Design Guide for StoreEver and StoreOnce](#) for detailed information on installing drivers in an HPE-UX kernel.
- Once the HPE-UX **ioscan** utility shows the StoreEver devices on the HPE-UX server, run the **autoconf** utility to configure the TSM “pass-thru” device drivers.
- The **autoconf** utility uses the **tsmdcfg** script to configure devices and calls the **tsmdlst** utility to display all devices that are configured by the “pass-thru” device driver. The device information is saved to the **lbinfo** and **mtinfo** files located in the **devices/bin** directory.

## Solaris

For SCSI-attached devices, the following configuration files must contain one stanza for each SCSI-attached device that TSM is to use on the Solaris Server. The **mt.conf** file is used for HPE StoreEver Tape Drives, and the **lb.conf** file is used for StoreEver library devices. Configuration of the **st.conf** file is not required with Solaris 10 Update 5 (05/08) or later. Solaris 9 environments still require configuration of the appropriate HPE tape devices in the **/kernel/drv/st.conf** file. Please reference the “Solaris configuration and operating system details” section from the [HPE Design Guide for Backup and Archive](#) for detailed information on configuring tape devices on Solaris 9 OSs.

Complete the following steps to install the TSM device “pass-thru” drivers for tape drives and libraries on Solaris:

- Obtain the LUN and TARGET IDs for the HPE StoreEver library and drives using the Solaris **dmesg** or **/var/adm/** messages output
- Edit the **mt.conf** and **lb.conf** files, replacing the \$X\$ string with the SCSI ID of the tape or library drive and the \$Y\$ string with the SCSI LUN of the device. All other fields should be left as they appear. Add one stanza per line to the device configuration file for each device’s SCSI target ID LUN combination. This will allow the device driver to probe the system that you want to use for supported devices
- For tape drives: **/usr/kernel/drv/mt.conf**  
name="mt" class="scsi" target=\$X\$ lun=\$Y\$ fc-port-wwn=[WWN of StoreEver Tape Drive];
- For libraries: **/usr/kernel/drv/lb.conf** name="lb" class="scsi" target=\$X\$ lun=\$Y\$ fc-port-wwn=[WWN of StoreEver Robot];  
**root # > vi /usr/kernel/drv/lb.conf**  
name="lb" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3eca";  
**root # > vi /usr/kernel/drv/mt.conf**  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3ecb";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3ecc";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3ecd";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3ece";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3eca";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3e8a";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3e8b";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3e8c";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3e8d";  
name="mt" class="scsi" target=2 lun=0 fc-port-wwn="5001438017ae3e8e";

After completing the above steps, log in as the root user and run the **autoconf** command to install all the TSM pseudo **mt** drivers:

```
root # > /opt/tivoli/tsm/devices/bin/autoconf
```

The devices can also be added manually by using the following command:

```
root # > /usr/sbin/add_drv -v -m * 0666 [bin] [bin]' [lb|mt]
```

If adding the devices manually, then ensure the user and group are appropriate to grant the TSM user access to the devices; otherwise, a symbolic **chmod** will have to be performed on the underlying Solaris devices that the TSM “pass-thru” devices are mapped to. This must be done before TSM will be able to access the Solaris devices. If the permissions are not correct on the underlying Solaris device, TSM will report an I/O error when attempting to define the path for the library or robot device.

Locate the TSM “pass-thru” devices for the tape drives and library in the **/dev/rmt** directory. Their names have the form **/dev/rmt/xmt**, where **x** is a number. To determine the relationship between a physical device and the special file that was created for it, issue the following command:

```
root # > ls -l /dev/rmt/*mt
```

For tape libraries, the device special files appear in the **/dev/rmt** directory. Their names have the form **/dev/rmt/xlb**, where **x** is a number. To determine the relationship between a physical device and the special file that was created for it, issue the following command:

```
root # > ls -l /dev/rmt/*lb
```

These **/dev/rmt/\*lb** and **/dev/rmt/\*mt** pseudo device drivers will be used in the TSM application when defining the path (DEFINE PATH) to the HPE StoreEver device.

## Windows

When the TSM device driver is installed, some tape drives and medium changers may automatically be configured by the TSM device driver if the Windows device drivers for the devices are not available. For tape drives that are not automatically configured with the TSM driver installation, then they must be manually configured.

To see if a device has been automatically configured with the TSM device driver:

1. Go to **Device Manager**
2. Right click on the device
3. Select **Properties**
4. Select the **Driver** tab and **Driver File Details** (This will allow you to see the device driver that is currently controlling your device.)

You can also run **tsmdlst.exe** in the TSM console directory to see if devices have been configured with the TSM device driver. If the devices have not been configured with the TSM device driver, the TSM type will show as GENERICTAPE.

To configure devices for the TSM device driver (tsmscsi.sys) manually, perform the following steps:

- Locate the device in the **Device Manager** console (**devmgmt.msc**) and select it. Tape drives are listed under **Tape drives**, medium changers are under **Medium Changers**, and optical drives are under **Disk drives**.

Configure the device for use by **tsmscsi.sys**:

- Update the driver either by selecting the device, then choosing **Action -> Update Driver...** or by right clicking on the device and selecting **Update Driver Software...**
- Select **Browse my computer for driver software**
- Select **Let me pick from a list of device drivers on my computer**

Select one of the following options, depending on the device that you are configuring:

- For a tape drive, select **IBM Tivoli Storage Manager for Tape Drives**.
- For a medium changer, select **IBM Tivoli Storage Manager for Medium Changers**.
- Click **Next**.
- Click **Close**.
- Verify that the device has been configured correctly for **tsmscsi**.
- Right-click on the device and select **Properties**.
- Select the **Driver** tab and **Driver Details**.
- The **Driver Details** panel shows the device driver that is controlling the device. This should be **tsmscsi.sys** for 32-bit Windows Server® 2008 or **tsmscsi64.sys** for 64-bit Windows Server 2008. For Windows Server 2008 Server Core, devices cannot be configured through **Device Manager**. If the devices are not automatically configured, you must use the Tivoli Storage Manager CHANGE DEVDRIVER command to configure the devices. See [IBM Technote 1320150](#) for more information.

## Initial setup

---

### Note

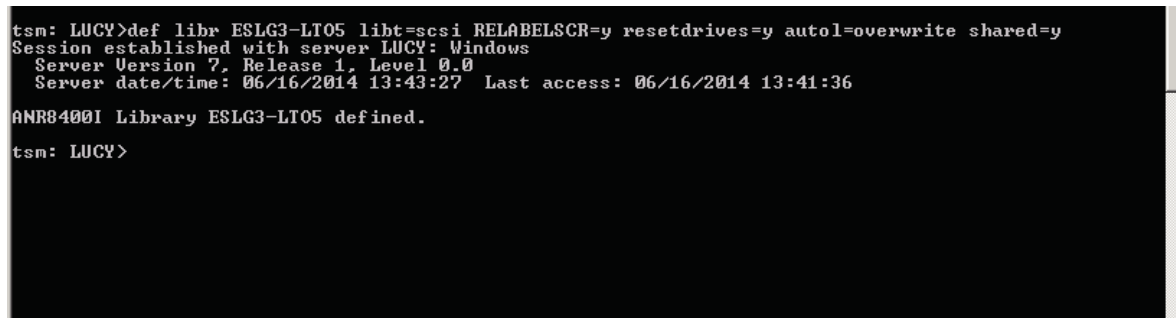
This guide will focus on the automatic CLI method of configuration. If older versions of Tivoli Storage Manager or legacy HPE hardware are being used, then the parameters and methodology will differ from this guide. In that case, consult the support resources for Tivoli Storage Manager.

---

### Define the tape library

Use the **DEFINE LIBRARY** (*def libr*) command to define a tape library (figure 4). As with other independent software vendor (ISV) packages, in a shared tape library environment, a library can be accessed by only one source—in this case, a Tivoli Storage Manager server. However, the drives in a library can be accessed by multiple sources. HPE tape libraries are an SCSI **library type** when using this command.

The default value of the **RESETDRIVES** parameter is conditional. If the **SHARED** parameter is set to **NO**, the value of the **RESETDRIVES** parameter is **NO**. If the **SHARED** parameter is set to **YES**, the value of the **RESETDRIVES** parameter is **YES**.



```
tsm: LUCY>def libr ESLG3-LT05 libt=scsi RELABELSCR=y resetdrives=y autol=overwrite shared=y
Session established with server LUCY: Windows
  Server Version 7, Release 1, Level 0.0
  Server date/time: 06/16/2014 13:43:27 Last access: 06/16/2014 13:41:36

ANR84001 Library ESLG3-LT05 defined.
tsm: LUCY>
```

Figure 4. Example output for the **def libr** command from a Windows TSM server

---

### Note

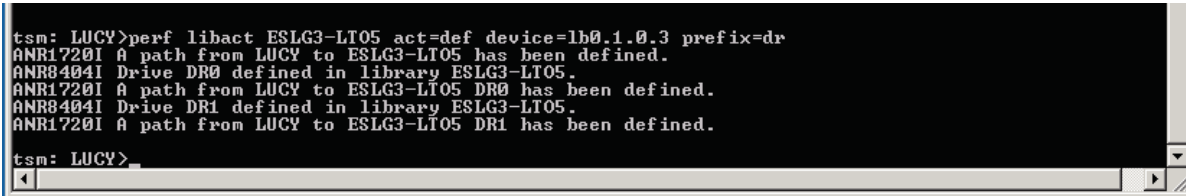
- Various **QUERY** commands will be useful to check that commands have expected results:
  - To verify that the library was defined and can be accessed, run the **QUERY LIBRARY** command:  
**q libr ESLG3-LT05** (Use the appropriate library name for your configuration.).
  - To verify that the drives are defined and can be accessed, use the **QUERY DRIVE** command: **q dr**.
  - To verify all of your library and tape paths can be accessed, use the **QUERY PATH** command: **q path**.
-



### Auto-configuring the tape library and drive paths

Use the **PERFORM LIBRARY ACTION** (*perf libact*) command to set up a library environment or modify an existing hardware setup that requires changes to many drive definitions. You can also delete all drives and paths for a library by issuing the command with **ACTION=DELETE**. Example commands with parameters are noted as follows. Figure 5 shows the command and output on a Tivoli Storage Manager Windows server. For an automated HPE tape library, the correct library type will be an **SCSI library** when referencing the administrative commands in the IBM TSM documentation.

- Linux/UNIX: **perf libact ESLG3-LT05 act=def device=/dev/tmsmcsi/lb4**
- Windows: **perf libact ESLG3-LT05 act=def device=lb0.1.0.3 prefix=dr**

A screenshot of a Windows command prompt window. The prompt is 'tsm: LUCY>'. The user has entered the command 'perf libact ESLG3-LT05 act=def device=lb0.1.0.3 prefix=dr'. The output consists of four lines of status messages: 'ANR1720I A path from LUCY to ESLG3-LT05 has been defined.', 'ANR8404I Drive DR0 defined in library ESLG3-LT05.', 'ANR1720I A path from LUCY to ESLG3-LT05 DR0 has been defined.', and 'ANR8404I Drive DR1 defined in library ESLG3-LT05.'. The final line shows the prompt 'tsm: LUCY>' again.

```
tsm: LUCY>perf libact ESLG3-LT05 act=def device=lb0.1.0.3 prefix=dr
ANR1720I A path from LUCY to ESLG3-LT05 has been defined.
ANR8404I Drive DR0 defined in library ESLG3-LT05.
ANR1720I A path from LUCY to ESLG3-LT05 DR0 has been defined.
ANR8404I Drive DR1 defined in library ESLG3-LT05.
ANR1720I A path from LUCY to ESLG3-LT05 DR1 has been defined.
tsm: LUCY>
```

Figure 5. Example output for the **perf libact** command on a Windows TSM server

**Check in storage volumes (tape media)**

To perform library inventory, TSM checks storage volumes in to the library using the **CHECKIN LIBVOLUME** command (*checkin libv*).

- For this example, we used the following parameters: **checkin libv ESLG3-LT05 search=y status=scra checkl=barcode**
- Run the **q log** (q ACTlog) command to view the log and ensure that all media is correctly processed as shown in figure 6
- Run the **q libv** command to query the tape library

**Note**

If you are reconfiguring an existing library in TSM (i.e., post-reboot) and you have volumes (tape media) that contain data on them, then you will also need to perform the following command to check-in those **private** and **non-scratch** volumes:

Example command line with parameters: **checkin libv ESLG3-LT05 search=yes status=private checkl=barcode**.

```

IBM Tivoli Storage Manager
06/20/2014 12:25:34 ANR2017I Administrator IBM-OC-LUCY issued command: CHECKIN
LIBVOLUME ESLG3-LT05 search=y status=scra checkl=barcode
<SESSION: 3401>
06/20/2014 12:25:34 ANR0984I Process 15 for CHECKIN LIBVOLUME started in the
BACKGROUND at 12:25:34. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:25:34 ANR0422I CHECKIN LIBVOLUME: Operation for library
ESLG3-LT05 started as process 15. <SESSION: 3401,
PROCESS: 15>
06/20/2014 12:25:34 ANR0439I SCSI library ESLG3-LT05 is ready for operations.
<SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9346L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9347L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9456L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9457L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9414L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9413L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9340L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9341L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9342L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9343L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9404L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9403L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:01 ANR0430I Volume DN9354L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
more... <ENTER> to continue, 'C' to cancel)
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:02 ANR0430I Volume DN9355L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:02 ANR0430I Volume DN9356L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:02 ANR0430I Volume DN9357L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:02 ANR0430I Volume DN9412L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:02 ANR0430I Volume DN9411L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:02 ANR0430I Volume DN9400L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:02 ANR0430I Volume DN9410L5 has been checked into library
ESLG3-LT05. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:26:02 ANR0431I CHECKIN LIBVOLUME process completed for library
ESLG3-LT05; 20 volume(s) found. <SESSION: 3401, PROCESS:
15>
06/20/2014 12:26:02 ANR0985I Process 15 for CHECKIN LIBVOLUME running in the
BACKGROUND completed with completion state SUCCESS at
12:26:02. <SESSION: 3401, PROCESS: 15>
06/20/2014 12:27:21 ANR1959I Status monitor collecting current data at
12:27:21.
06/20/2014 12:27:21 ANR1960I Status monitor finished collecting data at
12:27:21 and will sleep for 5 minutes.
06/20/2014 12:27:26 ANR0407I Session 3417 started for administrator ROOT
<DSMAPI> <Tcp/Ip Lucy.saniop.ctl(58372)>. <SESSION: 3417>
06/20/2014 12:27:26 ANR2034E SELECT: No match found using this criteria.
<SESSION: 3412>
06/20/2014 12:27:26 ANR2034E SELECT: No match found using this criteria.
<SESSION: 3413>
06/20/2014 12:27:26 ANR2034E SELECT: No match found using this criteria.
<SESSION: 3414>
06/20/2014 12:28:19 ANR2017I Administrator IBM-OC-LUCY issued command: QUERY
LOG <SESSION: 3401>
06/20/2014 12:28:49 ANR2017I Administrator IBM-OC-LUCY issued command: QUERY
ACTLOG <SESSION: 3401>
tsn: LUCY>
    
```

Figure 6. Activity log output

### Create a device class

Use the **DEFINE DEVCLASS** (*def devc*) command to define a device class for a type of storage device. The TSM server requires that a device class be defined to allow the use of a device.

The following examples assume Ultrium drives in the **ESLG3-LT05** library that was defined in earlier steps. For other drive types, consult the IBM Tivoli Storage Manager documentation. Choose a device class name that's appropriate for your device. For this example, we use Ultrium LTO-5 drives, so the device class name reflects that device type. Figure 7 shows example parameters and output for this command.

```
tsm: LUCY>def devc LT05 devtype=lto format=ULTRIUM5 library=ESLG3-LT05 MountWait=0 MOUNTRetention=0
Session established with server LUCY: Windows
Server Version 7, Release 1, Level 0.0
Server date/time: 06/23/2014 09:52:18 Last access: 06/23/2014 09:41:53

ANR2203I Device class LT05 defined.

tsm: LUCY>
```

Figure 7. Example output for the **def devc** command on a Windows TSM server

### Storage pools

- Create a primary storage pool, copy storage pool, or an active data pool by using the **DEFINE STGPOOL** (*def stgp*) command (**def stgp** also will work.). For the purpose of this example, we will define a primary storage pool for sequential-access devices. Figure 8 shows example parameters and output for this command.

```
tsm: LUCY>def stgpool POOL_ESLG-LT05 LT05 pooltype=primary collocate=no maxscratch=20
ANR2200I Storage pool POOL_ESLG-LT05 defined (device class LT05).

tsm: LUCY>
```

Figure 8. Example output for the **def stgp** command on a Windows TSM server

---

### Note

**maxscratch parameter:** This parameter can limit or help maximize the number of volumes that are immediately accessible. For this example, we used the entire number of volumes available in the library partition being tested.

**collocacte parameter:** See the “[performance tuning](#)” section of this guide for discussion about this parameter setting.

---

- Define storage policy settings by using various **DEFINE** commands, and then **ASSIGN** and **ACTIVATE** the policy sets defined. Various **DEFINE** commands are used to create TSM objects such as the policy domain, policy sets, management classes, and copy groups contained within that domain. A client is assigned to one policy domain. Use domain name, policy names, management class names, and copy group names that are appropriate for your environment. As before, the following examples will remain consistent with the rest of this document. Figure 9 through 14 show example commands and outputs on a Windows TSM server. The commands for defining each object should be performed in the order listed as follows.
- Use **DEFINE DOMAIN** (*def dom*) command to first define the policy domain that will contain the remaining objects as shown in figure 9.

```
tsm: LUCY>def dom DOM_ESLG3-LT05
Session established with server LUCY: Windows
Server Version 7, Release 1, Level 0.0
Server date/time: 06/24/2014 08:51:30 Last access: 06/24/2014 08:48:29

ANR1500I Policy domain DOM_ESLG3-LT05 defined.
```

Figure 9. Example output for the **def dom** command on a Windows TSM server

## Backup policies

TSM requires the user to define and activate several objects, in a specific order, to configure a traditional backup policy. In the following sequence **policy set**, **management class**, and **copy group** setup will be outlined.

Use **DEFINE POLICYSET** (*def policyset*) to define a policy set in a policy domain. Use the domain name in which you are placing the policy set in the command parameters as shown in figure 10. You can define one or more policy sets for each policy domain. Policy set activation will be covered in the next section of this document.

```
tsm: LUCY>def policyset DOM_ESLG3-LT05 PS_ESLG3-LT05
ANR1510I Policy set PS_ESLG3-LT05 defined in policy domain DOM_ESLG3-LT05.
```

Figure 10. Example output for the **def policyset** command on a Windows TSM server

- Use **DEFINE MGMTCLASS** (*def mg*) command to define a new management class in a policy set. To allow clients to use the new management class, you must activate the policy set that contains the new class.

You can define one or more management classes for each policy set in a policy domain. A management class can contain a backup copy group, an archive copy group, or both. The user of a client node can select any management class in the active policy set or use the default management class (figure 11).

```
tsm: LUCY>def mg DOM_ESLG3-LT05 PS_ESLG3-LT05 MG_ESLG3-LT05
ANR1520I Management class MG_ESLG3-LT05 defined in policy domain DOM_ESLG3-LT05, set PS_ESLG3-LT05.
```

Figure 11. Example output for the **def mg** command on a Windows TSM server

- Use **ASSIGN DEFMGMTCLASS** (*assign defmgmtclass*) command to assign a default management class for a policy set. A default management class must be assigned before it can be activated. Figure 12 provides an example.

```
tsm: LUCY>assign defmgmtclass DOM_ESLG3-LT05 PS_ESLG3-LT05 MG_ESLG3-LT05
ANR1538I Default management class set to MG_ESLG3-LT05 for policy domain DOM_ESLG3-LT05, set PS_ESLG3-LT05.
```

Figure 12. Example output for the **assign defmgmtclass** command on a Windows TSM server

- Use **DEFINE COPYGROUP** (*def copygroup*) command to define a new backup copy group within a specific management class, policy set, and policy domain. In the example shown in figure 13, only the required parameters were used; however, several optional parameters may be desired depending on your specific environment. Optional parameters that might be useful include, but are not limited to type, verexists, verdeleted, retextra. As with all commands, consult the [administrative commands section in the TSM documentation](#) for additional parameters and correct syntax.

```
tsm: LUCY>def copygroup DOM_ESLG3-LT05 PS_ESLG3-LT05 MG_ESLG3-LT05 dest=POOL_ESLG3-LT05
Session established with server LUCY: Windows
Server Version 7, Release 1, Level 0.0
Server date/time: 06/24/2014 12:54:56 Last access: 06/24/2014 12:53:45

ANR1555W The BACKUP copy group in management class MG_ESLG3-LT05 specifies a destination that does not refer to a defined storage pool: POOL_ESLG3-LT05. If this pool does not exist when policy set PS_ESLG3-LT05 is activated, clients will fail when using this management class to backup files to the server.
ANR1530I Backup copy group STANDARD defined in policy domain DOM_ESLG3-LT05, set PS_ESLG3-LT05, management class MG_ESLG3-LT05.

tsm: LUCY>
```

Figure 13. Example output for the **def copygroup** command on a Windows TSM server

- The policy set must be activated by using the command **ACTIVATE POLICYSET** (*act policyset*). The active policy set in the policy domain determines the rules for clients that are assigned to the domain. The rules control the archive, backup, and space management services that are provided for the clients. See figure 14 for an example of the command and output.

```
tsm: LUCY>act policyset DOM_ESLG3-LT05 PS_ESLG3-LT05
Session established with server LUCY: Windows
Server Version 7. Release 1, Level 0.0
Server date/time: 06/24/2014 13:41:49 Last access: 06/24/2014 13:38:46

ANR1555W The BACKUP copy group in management class MG_ESLG3-LT05 specifies a destination that does
not refer to a defined storage pool: POOL_ESLG3-LT05. If this pool does not exist when policy set
PS_ESLG3-LT05 is activated, clients will fail when using this management class to backup files to the
server.
ANR1554W DEFAULT Management class MG_ESLG3-LT05 in policy set DOM_ESLG3-LT05 PS_ESLG3-LT05 does not
have an ARCHIVE copygroup: files will not be archived by default if this set is activated.

Do you wish to proceed? (Yes <Y>/No <N>) y
ANR1555W The BACKUP copy group in management class MG_ESLG3-LT05 specifies a destination that does
not refer to a defined storage pool: POOL_ESLG3-LT05. If this pool does not exist when policy set
PS_ESLG3-LT05 is activated, clients will fail when using this management class to backup files to the
server.
ANR1554W DEFAULT Management class MG_ESLG3-LT05 in policy set DOM_ESLG3-LT05 PS_ESLG3-LT05 does not
have an ARCHIVE copygroup: files will not be archived by default if this set is activated.
ANR1514I Policy set PS_ESLG3-LT05 activated in policy domain DOM_ESLG3-LT05.

tsm: LUCY>
```

Figure 14. Example output for the **act policyset** command on a Windows TSM server

## Backup and restore jobs

### Create a backup job

---

#### Important

Before setting up the backup schedule, ensure that the client schedule processes have been configured.

---

#### Define and start CLI schedule

Create a client backup schedule with the **DEFINE SCHEDULE** (*def sch*) command. The syntax and parameters for the client and administrative backup schedules are defined separately. **OPTIONS** are a component of defining schedules, and will also be included in the examples as follows.

- TSM uses the **DEFINE SCHEDULE** command with associated **OPTIONS** to set up the client backup schedule.
- In the example shown in figure 15, a schedule named SELECTIVE-1 was defined to back up a subdirectory on the F drive using the classic schedule and start date of 07/01/2014 to run daily using the following parameters:
  - DEFINE SCHEDULE SELECTIVE-1 TYPE=CLIENT ACTION=SELECTIVE
  - OBJECTS=""F:\Data\Backup\LT05\\*" OPTIONS=-su=yes
  - DESCRIPTION='StoreEver Tape Backups' SCHEDSTYLE=CLASSIC
  - STARTDATE=07/01/2014 STARTTIME=10:00:00 PERIOD=1 PERUNITS=days PRIORITY=1 DURATION=1 DURUNITS=HOURS
- Add client node to domain and schedule (also shown in figure 15).
- Use the **DEFINE ASSOCIATION** (*def assoc*) command to associate the node with the new tape schedule as shown in figure 15.

---

#### Note

If the client node hasn't been registered with the TSM server yet, you will get an error when trying to update the node. In the event that the node is not yet registered with the server, use the **REGISTER NODE** (*reg node*) command to associate it and then run the update node command.

For example, **reg node lucy password\_for\_lucy**.

---

```

tsm: LUCY>
tsm: LUCY>DEFINE SCHEDULE DOM_ESLG3-LT05 TEST03 TYPE=CLIENT ACTION=SELECTIVE OBJECTS="E:\Data\Backup\LT05\*" OPTIONS=subdirectory=yes DESCRIPTION='Store Ev
er Tape Test' SCHEDULE=CLASSIC STARTDATE=07/10/2014 STARTTIME=00:00:00 PERIOD=1 PERUNITS=days PRIORITY=1 DURATION=1 DURUNITS=HOURS
ANR25001 Schedule TEST03 defined in policy domain DOM_ESLG3-LT05.
tsm: LUCY>upd node LUCY do=DOM_ESLG3-LT05
ANR27279W This command will register the node to new domain DOM_ESLG3-LT05.
Changing the domain will cause the node to be disassociated from the schedule of original domain.
Do you wish to proceed? <Yes <Y>/No <N>> y
ANR20631 Node LUCY updated.
tsm: LUCY>def assoc DOM_ESLG3-LT05 TEST03 LUCY
ANR25161 Node LUCY associated with schedule TEST03 in policy domain DOM_ESLG3-LT05.
    
```

Figure 15. Example command and parameters for the **def schedule**, **def association**, and **upd node** commands on a Windows TSM server

- Once the schedule is started, you can use the **query mount (q mo)** command to check which tape is being mounted, and the **query event command (q ev \* \*)** to see the status of the job (figure 16).

```

tsm: LUCY>q mo
ANR83301 LTO volume DN9342L5 is mounted R/W in drive DR1 <mt1.0.0.3>, status: IN USE.
ANR83341 1 matches found.
tsm: LUCY>q ev * *
Scheduled Start      Actual Start      Schedule Name      Node Name      Status
-----
07/23/2014 10:04:34  07/23/2014 10:05:00  TEST04          LUCY           Completed
    
```

Figure 16. Example output from **q mo** command with tape loaded (Windows TSM server)

### Create a backup job using the backup and archive client GUI<sup>3</sup>

Alternatively, you can define a backup using the backup and archive client GUI. Use the **Utilities>Setup Wizard**, then select the radio button labeled **Help me configure the TSM Client Options File** to set up the backup options for the client. Then choose **Backup** from the GUI to select files to be backed up as shown in figure 17.

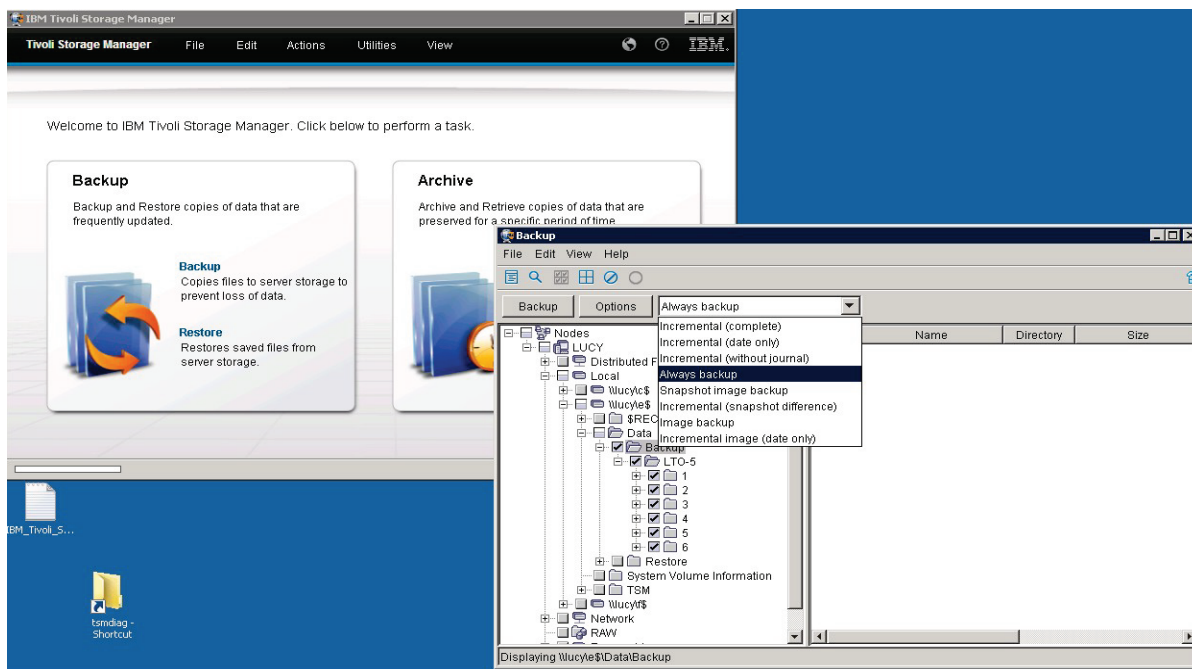


Figure 17. Backup window for TSM GUI client on Windows

<sup>3</sup> This method provides fewer options than the CLI method for setting up the client options and controlling backup schedules.

Monitor backup progress using the **Report** button on the **Backup** window as illustrated in figure 18.

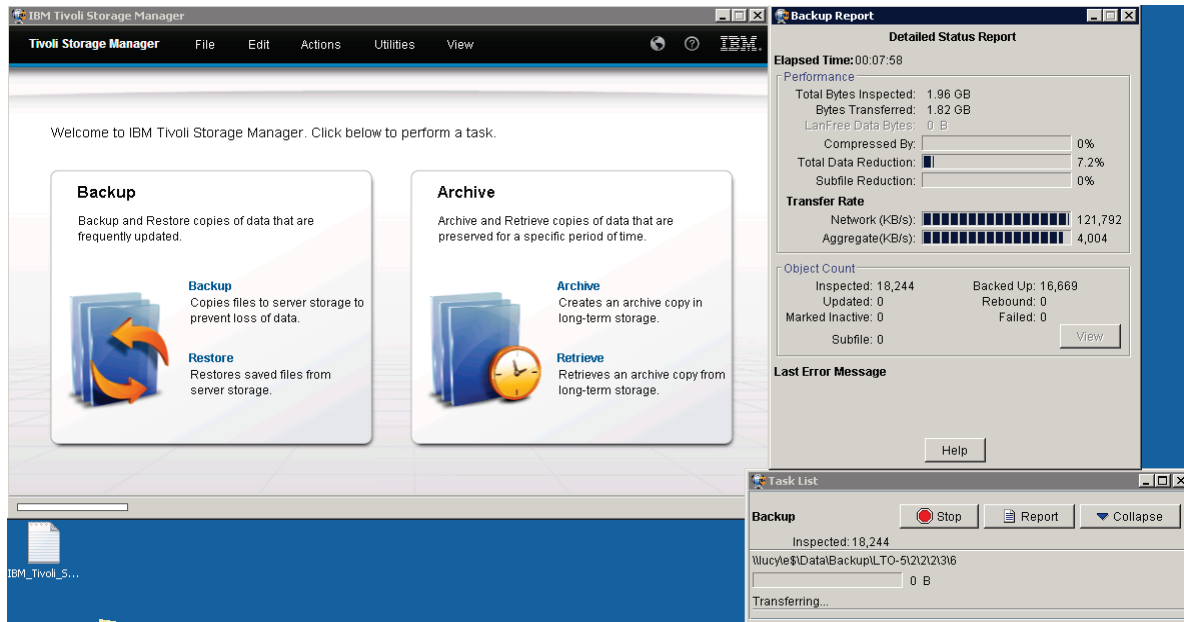


Figure 18. Backup status report in backup and archive client GUI on a Windows TSM server

**Create a restore job**

Define a restore using the backup and archive client GUI. Select **Restore** from the main window. Use the **Restore** window that opens to choose from a list of backups as shown in figure 19. Next, select the **Restore** button located in the top left of the window.

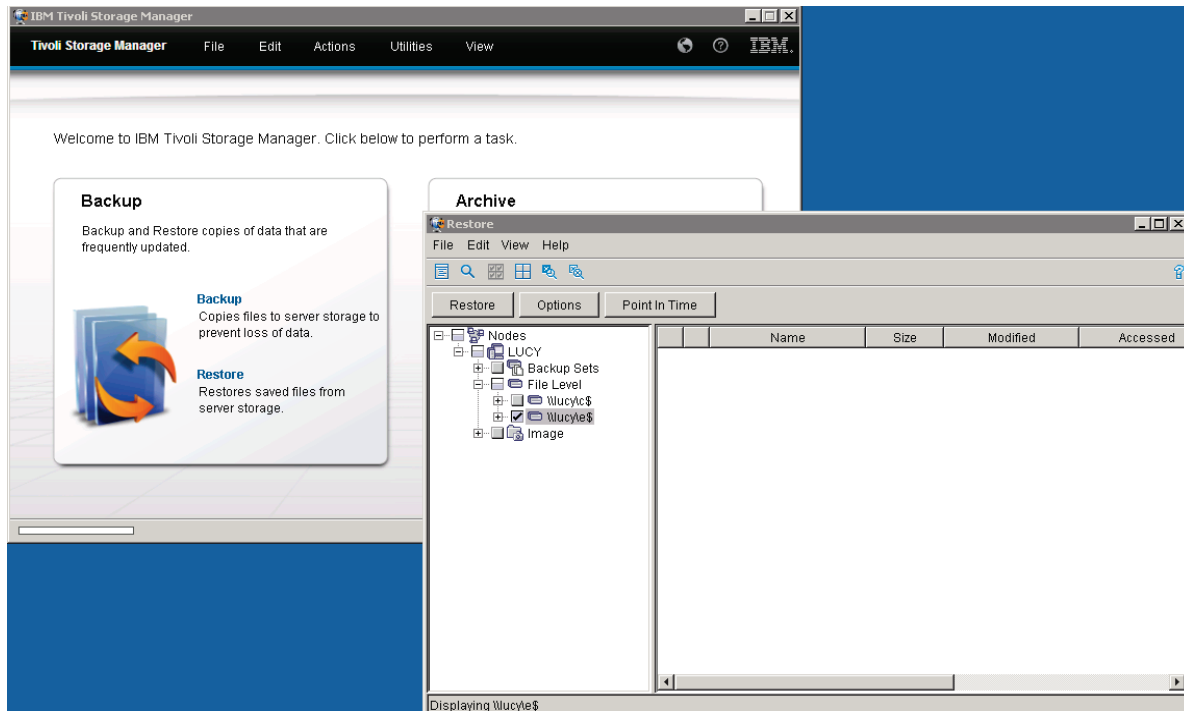
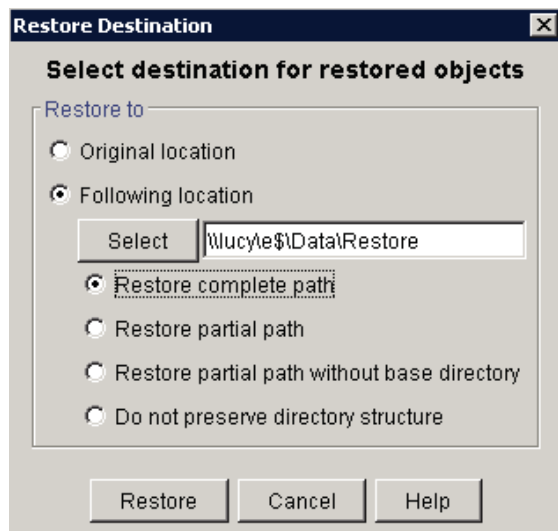


Figure 19. Choose a file to restore using the backup and archive client GUI on a Windows TSM server

A **Restore Destination** window will open as shown in figure 20. Make the appropriate selections for the restore destination and path, and then select the **Restore** button at the bottom of the **Restore Destination** window.



**Figure 20.** Choose restore destination using the backup and archive client GUI on a Windows TSM server



Once the restore is initiated, the **Task List** window will automatically open. Choose the **Report** button to see the progress of the restore as shown in figure 21. Once the restore completes, a status message will be displayed.

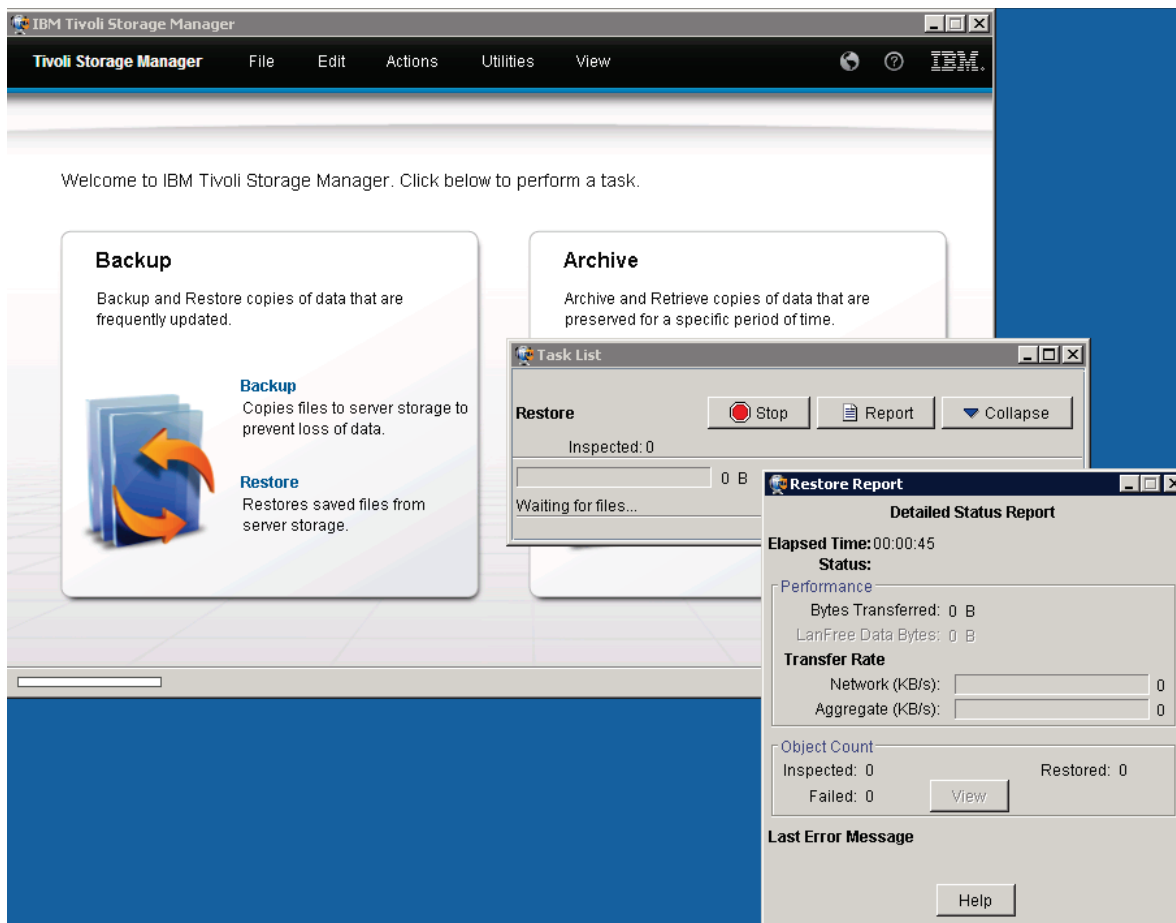


Figure 21. Successfully completed restore message on a Windows TSM server

## Performance and tuning

To analyze speed and performance, it is necessary to examine the entire backup and archive process as a system. Although many factors contribute to the overall performance of the system, there are five main factors that must be thoroughly understood to determine the maximum performance in any specific situation. These factors are:

- **Storage connection**—For HPE StoreEver Tape Libraries, this is the Fibre Channel connection.
- **TSM parameter settings**—See the following section regarding changes that can be made in TSM to improve backup or restore performance.
- **File (data) compression ratio**—The amount of compression has a direct impact on the rate at which a tape drive can read/write data.
- **Source disk and file systems**—Data source, local disk, RAID array storage, file system type, and volume type.
- **Tape drive**—There are the various types of tape drives in HPE StoreEver storage.

---

### Note

To achieve the outstanding results, first optimize your environment by installing the latest drivers and firmware, optimize your network, and so on. Refer to the [installation checklist](#) provided earlier in this document.

---

## TSM parameter settings

### Client options file

#### RESOURCEUTILIZATION

Use the **resourceutilization** option in your option file to regulate the level of resources the Tivoli Storage Manager server and client can use during processing.

- **Regulating backup and archive sessions**

When a backup or archive is requested, the client can use more than one session to the server. The default is to use a maximum of two sessions: one to query the server and one to send file data. The client can use only one server session if you set the **resourceutilization** option to 1. A client can use more than the default number of sessions when it connects to the TSM server. For example, setting the option to **10** permits up to 8 sessions with the server, thereby allowing multiple sessions to be used for querying the server and sending file data.

- **Regulating restore sessions**

When you request a restore, the default parameter is **1** session. Additional restore sessions are based on several factors, including: **resourceutilization** value, the number of tapes on which the data is stored, the number of tape drives available, and the maximum number of mount points that are allowed for the node.

For example, if the data to be restored is on five different tape volumes, the maximum number of mount points is 5 for a give node and **resourceutilization** is set to 3, then three sessions are used for the restore. If you increase the **resourceutilization** setting to 5, then five sessions are used for the restore. There is a one-to-one relationship between the number of restore sessions that are allowed and the **resourceutilization** setting. Multiple restore sessions are only allowed for no-query restore operations.

#### TXNBYTELIMIT

The **txnbytelimit** equates to the transaction buffer size. It specifies the number of kilobytes the client program buffers before it sends a transaction to the server.

- You can control the amount of data sent between the client and the server, before the server commits the data and changes to the server database, using the **txnbytelimit** option. Controlling the amount of data sent changes the speed of the client to perform the transactions. The amount of data sent applies when files are batched together during backup or when receiving files from the server during a restore procedure.

#### TCPWINDOWSIZE

Use the **tcpwindowsize** option to specify, in kilobytes, the size to be used for the TCP/IP sliding window for the client node. The sending host cannot send more data until it receives an acknowledgment and a TCP receive-window update. Each TCP packet contains the advertised TCP receive-window on the connection. A larger window allows the sender to continue sending data and can improve communication performance.

### Storage pool parameters

#### MAX PROCESS

- Using multiple, parallel processes may improve throughput for the backup. The expectation is that the time needed to perform the storage pool backup will be decreased by using multiple processes. However, when multiple processes are running, in some cases one or more of the processes needs to wait to use a volume that is already in use by a different backup process.
- When determining this value, consider the number of logical and physical drives that can be dedicated to this operation. To access a sequential access volume, Tivoli Storage Manager uses a mount point and, if the device type is not FILE, a physical drive. The number of available mount points and drives depends on other Tivoli Storage Manager and system activity, and on the mount limits of the device classes for the sequential access storage pools that are involved in the backup.
- Each process needs a mount point for copy storage pool volumes, and, if the device type is not FILE, each process also needs a drive. If you are backing up a sequential storage pool, each process needs an additional mount point for primary storage pool volumes and, if the device type is not FILE, an additional drive. For example, suppose you specify a maximum of three processes to back up a primary sequential storage pool to a copy storage pool of the same device class, each process will require two mount points and two drives. Each process requires two mount points and two drives. To run all three processes, the device class must have a mount limit of at least six, and at least six mount points and six drives must be available.

**COLLOCATION**

- Collocation reduces the number of sequential access media mounts for restore, retrieve, and recall operations, thereby reducing restore times. Collocation also increases both the amount of server time that is needed to collocate files for storing (backup or archive) and the number of volumes required.
- Collocation specifies whether the server attempts to keep data, stored on as few volumes as possible that belong to one of the following candidates: a client node, a group of file spaces, a group of client nodes, or a client file space. This parameter is optional; the default value is GROUP.

**File (data) compression ratio**

Hewlett Packard Enterprise tests show that not all data can be compressed equally. The compression ratio affects the amount of data that can be stored on each tape cartridge, as well as the speed at which the tape drives can read or write the data. Table 4 shows typical compression ratios of various applications.

Table 4. Typical file compression ratios

DATA TYPE	TYPICAL COMPRESSION
CAD	3.8:1
Excel spreadsheet/Word processing	2.5:1
Typical file/print server	2.0:1
Lotus Notes Databases	1.6:1
Microsoft Exchange/SQL Server Databases	1.4:1
Oracle/SAP® Databases	1.2:1

**Source disk and file systems**

In the past, tape performance was typically identified as a bottleneck. However, tape performance has now surpassed many of the source systems available today. Items to consider when calculating desired throughput and performance metrics include:

- Source hardware (disk subsystems)
- Source file system status
- Server configuration

The following factors critically affect the speed of backup from disk to tape:

- **Data file size**—The larger the number of smaller files, the larger the overhead associated with backing them up. The worst-case scenario for backup is large numbers of small files due to system overhead of file accession.
- **Data compressibility**—Incompressible data will back up slower than higher compressible data. For example, JPEG files are not very compressible, but database files can be highly compressible. The accepted standard for quoting tape backup specifications revolves around an arbitrary figure of 2:1 compressible data.
- **Disk array performance**—It is often overlooked that data cannot be put onto tape any faster than it can be read from disk. Backup is more sequential in nature than random (from a disk array access perspective). Disk array performance depends on the number of disks, RAID configuration, the number of Fibre Channel ports accessing the array, and queue depth available, for example.
- **Fragmentation**—The more fragmented the files are on disk, the more random will be the disk access method, hence the backup will take longer. If the system has a defragmentation utility, it is advisable to run it before full backups or on a regular scheduled basis to ensure that files are contiguously arranged on the disk.

**Tape drive**

The tape drives is the fifth factor in determining backup and restore performance. HPE StoreEver Tape Drives have varying levels of performance. Factors such as file size (larger is better), directory depth, and data compressibility all affects system performance. Data interleaving during backup also affects restore performance. Table 5 shows performance information for various HPE StoreEver Tape Drives.

**Table 5.** Tape drive throughput speed [native]

TAPE DRIVE	NATIVE THROUGHPUT MBPS
Ultrium 15750 (LTO-7 FH)	300
Ultrium 15000 (LTO-7 HH)	300
Ultrium 6650 (LTO-6 FH)	160
Ultrium 6250 (LTO-6 HH)	160
Ultrium 3280 (LTO-5 FH)	140
Ultrium 3000 (LTO-5 HH)	140
Ultrium 1760 (LTO-4 HH)	80
Ultrium 1840 (LTO-4 HH)	120

## Conclusion

Hewlett Packard Enterprise offers a variety of reliable data protection storage solutions to provide an efficient, reliable data growth management backup system environment, while keeping costs under control. HPE StoreEver Tape systems offer significant cost, energy, and footprint advantages, while addressing data growth by adding drives and capacity on-demand as needed. HPE StoreEver Storage with IBM Tivoli Storage Manager can provide a complete solution in itself or be used as a major constituent of a disk-to-disk-to-tape implementation. HPE StoreEver Backup systems integrate with IBM Tivoli Storage Manager to protect important data for mission-critical applications.

## Resources

[HPE Data Agile BURA Compatibility Matrix](#) (also known as the HPE Enterprise BURA Solutions [EBS] Compatibility)

[IBM TSM support site](#)

Learn more at

[hp.com/go/StoreEver](http://hp.com/go/StoreEver)



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