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# HPE Linear Tape File System Linux and Mac User Guide

## **Abstract**

This document provides information about the HPE Linear Tape File System (LTFS), which presents an LTO-5, LTO-6, or LTO-7 SAS tape drive and media as a disk volume.

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# 1 Introduction

This guide provides information about the HPE Linear Tape File System (HPE LTFS) Software. HPE LTFS makes tape self-describing, file-based, and easy-to-use and provides users with the ability to use standard file operations on tape media for accessing, managing, and sharing files with an interface that behaves as a hard disk. In addition, HPE LTFS provides the ability to share data across platforms, as you would with a USB drive or memory stick.

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**NOTE:** A firmware update may be required. HPE LTFS checks and indicates the required updates for tape drive.

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## Features

The following are some of the main features supported by the HPE LTFS:

- Enables you to use LTO tape media as a disk.
- Based on Open Source software.
- Precompiled application versions provided for supported platforms.
- Full source code available.
- Supported on Linux and Mac OS X.
- 'LTFS smart copy' utility for efficient data transfer from tape to disk.

## Benefits

The wide range of benefits that HPE StoreEver LTO tape drives have to offer, HPE StoreEver LTO-5, LTO-6, and LTO-7 with Linear Tape File System (LTFS) functionality also deliver:

- **Faster access to data:** When a tape is mounted, the files and directories stored on it appear on desktop in the same way as a disk directory listing.
- **Simple drag and drop:** HPE LTFS increases ease of use, simply drag and drop files to and from the tape.
- **Compatibility across your environment:** Tape media written using HPE LTFS is self-describing so that data retrieval from tape is independent of any hardware or software platforms.
- **Increased data mobility:** Easily share content to increase data mobility; tapes written with the HPE LTFS application can be exchanged more easily between users working in different operating systems, using different software and in different locations.
- **A single storage media standard.** Unify organizationwide file sharing with HPE StoreEver LTO-5, LTO-6, and LTO-7. Tapes can move across libraries and vendors with the ease of video cassettes, while files on tape can be accessed using straightforward drag-and-drop.

## Intended usage

The HPE LTFS application presents the contents of the tape as a disk volume. However it is important to bear in mind that it is not a true disk, and therefore there are some best practices to follow to ensure satisfactory performance and a good user experience.

- HPE LTFS is designed to work best in a single-user environment, where just one user is copying files to or from the tape. Multiple users or processes trying to write and/or read at the same time will result in poor performance due to the sequential access nature of tape.
- For the same reasons, the tape drive must not be shared between different systems. A single tape drive must be connected to a single host bus adapter (HBA).
- The expected usage model is to transfer large files between systems, by mounting the tape on one system, writing the files, unmounting, mounting on the second system, and reading

the files. Treating the tape volume as a true random access device (for example frequently reading and updating individual files) will not perform as well as streaming large files to and from tape.

- The HPE LTFS application will work in conjunction with graphical file explorer programs such as Nautilus or Konqueror (on Linux). However, because these applications pre-read files in the directory, using the graphical explorer window may lead to poor performance. For optimum performance, use a terminal window and issue shell commands to copy data, view directory contents, and so on.

## Architecture

HPE LTFS is a user space application, it uses the FUSE kernel mode subsystem included in Linux systems. On the Apple Mac OS platform, it uses the OSXFUSE module (or, for Leopard or Snow Leopard systems, the MacFUSE module).

## Supported configurations

HPE LTFS supports:

- LTO-7 Ultrium 16000 tape drives with SAS interface
- LTO-5 Ultrium 3000 and 3280 tape drives with SAS interfaces
- LTO-6 Ultrium 6650 and 6250 tape drives with SAS interfaces
- Red Hat Enterprise Linux (RHEL) 6 up to 6.8 (32-bit and 64-bit)
- Red Hat Enterprise Linux (RHEL) 7 up to 7.2 (64-bit)
- Mac OS X 10.7 to 10.11

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**NOTE:** Only the binaries supplied by Hewlett Packard Enterprise are supported, not from other source. See the Compatibility Matrix on <http://www.hpe.com/storage/StoreOpen> for the latest details on supported operating system configurations and supported HBA and hardware configurations.

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## 2 Linux: Installation and configuration

When using HPE LTFS with LTO-5, LTO-6, or LTO-7 tape drives, the following components are required:

- A drive firmware revision that supports dual partitioning. HPE LTFS checks and tell you any required updates for your tape drive . HPE L&TT must be used if a firmware update is required.
- The software package that contains the “run-time” executable. This package can be found at:  
<http://www.hpe.com/storage/StoreOpen>
- The FUSE kernel module.
- The International Components for Unicode (ICU) libraries.

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**NOTE:** HPE L&TT can be downloaded from <http://www.hpe.com/info/tapetools>.

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### Downloading and installing HPE LTFS (precompiled binaries)

1. Before starting to install and use HPE LTFS, you must ensure that the FUSE kernel module is present and loaded.

To check, execute the following command:

```
$ lsmod | grep fuse
```

- If the module is not listed as currently loaded, you must load it before proceeding:  

```
$ modprobe fuse
```
- If the module is not present on your system, you must first obtain and install it. Details are beyond the scope of this guide; refer to <http://fuse.sourceforge.net/> for further information.

2. Determine whether you want to use precompiled binaries or build your own version of the HPE LTFS application.

To build your own, download and unpack the tar source file and then follow the instructions in `ltfs-<version>/doc/BUILDING.linux`.

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- ① **IMPORTANT:** Only the installations that use Hewlett Packard Enterprise supplied binaries are supported.
- 

3. To use precompiled binaries, download the appropriate package file and unpack it.

For example, the installation package for RHEL x64 contains the following files:

- RPM package file for installation on 64-bit systems
- README file (general usage information)
- `INSTALLING.linux` (prerequisites and installation instructions)
- `COPYING.lib` (LGPL v2.1 required licensing text)

4. Install the appropriate RPM package depending on your architecture:

```
$ rpm -ivh <file_name>
```

---

**NOTE:** Upgrading to SOS 3.1.0 is not supported, you must uninstall the current version before installing SOS 3.1.0 version. For installation instructions on Linux and Mac operating systems, see `INSTALLING.linux` or `INSTALLING.macosx` file respectively.

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5. HPE LTFS is now installed. See (page 10) for next steps.

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- ① **IMPORTANT:** The precompiled binaries supplied by Hewlett Packard Enterprise require additional shared libraries which may not be present on every system, or which may need to be updated in order for the binaries to execute. Refer to the LTFS release notes for more details. If the dependencies are installed by compiling the source, you must use the `--nodeps` switch with the `rpm` command for installing the rpm.
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## To uninstall HPE LTFS

To uninstall HPE LTFS from your system:

```
$ rpm -e hpe-sos
```

## 3 Mac OS X: Installation and configuration

When using HPE LTFS with LTO-5, LTO-6, or LTO-7 tape drives, the following components are required:

- A drive firmware revision that supports dual partitioning
- The software package that contains the “run-time” executable
- The OSXFUSE kernel module (or, for older systems, the MacFUSE kernel module)
- The ICU libraries (included in the Installer package)

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**NOTE:** HPE LTFS will check and tell you for required updates for your tape drive. HPE L&TT must be used if a firmware update is required. It can be downloaded from <http://www.hpe.com/info/tapetools>.

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### Downloading and installing HPE LTFS (precompiled binaries)

1. Determine whether you want to use precompiled binaries or build your own version of the HPE LTFS application.

To build your own, download and unpack the source tar file and then follow the instructions in `ltfs-<version>/doc/BUILDING.macosx`. In this case, you must also obtain and install the OSXFUSE and ICU packages.

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❗ **IMPORTANT:** Only the installations that use HPE supplied binaries are supported.

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2. To use precompiled binaries, download and install file for Mac Os.  
This file contains the three packages that are necessary for operation: OSXFUSE, ICU, and LTFS.
3. Install the ICU package first by double-clicking the file `ICUFramework-<version>.pkg` and following the instructions.
4. Install the OSXFUSE package in a similar way.

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**NOTE:** While installing OSXFUSE, make sure that "MacFUSE compatibility Layer" is selected for installation. See [\*\*\*HPE BURA Compatibility Matrix\*\*\*](#) for compatibility of versions of OSXFUSE/MacFUSE with corresponding Mac OS X versions.

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5. Install the HPE LTFS package by double-clicking the install file and following the instructions.
6. HPE LTFS is now installed. The installation package also places a “HPE Linear Tape File System” application in your Applications folder which can be used to simplify the tasks of preparing, formatting, and mounting an LTFS volume.

See “Using HPE LTFS” (page 10) for next steps.



## To uninstall LTFS

If at a later date you want to uninstall HPE LTFS from your system, delete `/usr/local/bin/*ltfs*` and then delete the tree under `/Library/Frameworks/LTFS.framework`.

The GUI management application can be uninstalled by dragging it to the Trash. To cause the Package Manager subsystem to remove references to LTFS, execute the command:

```
pkgutil --forget com.hpe.ltfs
```

To delete the ICU package as well, delete the tree under `/Library/Frameworks/ICU.framework`.

# 4 Using HPE LTFS

## How to use LTFS

**NOTE:** On Mac OS X, you can execute steps 1–3 and 5 more easily using the HPE StoreOpen Standalone application, installed by default in your Applications folder when HPE LTFS is installed. This graphical user interface (GUI) application will guide you through the steps required to select a tape drive, load and format a tape cartridge, and then mount the cartridge into the file system. However command-line tools are also installed and, you can use them instead of the GUI application.

1. Open a terminal window on your system. Ensure that `/usr/local/bin/` is in your command search path. For example:

```
$ export PATH="$PATH:/usr/local/bin"
```

2. Load a tape cartridge into the drive, and then format it in LTFS format:

*For Linux:*

```
$ mkltsfs -d /dev/sg3
```

*For Mac OS X:*

```
$ mkltsfs -d 0
```

**mkltsfs options:**

<code>-d, --device=&lt;name&gt;</code>	Tape device (required). For Linux, use the device name, such as <code>/dev/st0</code> . For MacOS X, use the instance number of the tape drive, assigned sequentially by the system, starting from 0.
<code>-f, --force</code>	Force to format medium
<code>-s, --tape-serial=&lt;id&gt;</code>	Tape serial number (6 alphanumeric ASCII characters)
<code>-n, --volume-name=&lt;name&gt;</code>	Tape volume name (LTFS VOLUME by default)
<code>-r, --rules=&lt;rules&gt;</code>	Rules for choosing files to write to the index partition. The syntax of the rules argument is: <ul style="list-style-type: none"><li>• <code>size=1M</code></li><li>• <code>size=1M/name=pattern</code></li><li>• <code>size=1M/name=pattern1:pattern2:pattern3</code></li></ul> If a file not larger than the given size and matches atleast one of the parameters (if specified), then a file is written to the index partition . The size argument accepts K, M, and G suffixes. Name patterns may contain the special characters '?' (match any single character) and '*' (match zero or more characters).
<code>--no-override</code>	Disallow mount-time data placement policy changes.
<code>-w, --wipe</code>	Restore the LTFS medium to an unpartitioned medium (format to a legacy scratch medium).
<code>-q, --quiet</code>	Suppress progress information and general messages
<code>-t, --trace</code>	Enable function call tracing (only useful for debugging).
<code>--syslogtrace</code>	Enable diagnostic output to <code>stderr</code> and <code>syslog</code> .
<code>-V, --version</code>	Version information
<code>-h, --help</code>	This help
<code>-p, --advanced-help</code>	Full help, including advanced options
<code>-g, --interactive</code>	Interactive mode

### 3. Mount the formatted tape cartridge:

```
$ mkdir /mnt/lto5
```

```
$ ltfs /mnt/lto5
```

ltfs options:

<code>-o devname=&lt;dev&gt;</code>	Tape device ( <i>default</i> : /dev/nst0)
<code>-o work_directory=&lt;dir&gt;</code>	LTFS work directory ( <i>default</i> : /tmp/ltfs/)
<code>-o trace</code>	Enable diagnostic output (same as <code>verbose=3</code> )
<code>-o eject</code>	Eject the cartridge after unmount
<code>-o sync_type=&lt;type&gt;</code>	Specify sync type ( <i>default</i> : <code>time@5</code> ). <code>&lt;type&gt;</code> specifies as follows: <ul style="list-style-type: none"><li><code>time@min</code>: LTFS attempts to write an index each <code>min</code> minute; <code>min</code> must be a decimal number from 1 to 35791394. It is equivalent to “<code>-o sync_type=unmount</code>” when 0 is specified (<i>default</i>: <code>min=5</code>).</li><li><code>close</code>: LTFS attempts to write an index when a file is closed.</li><li><code>unmount</code>: LTFS attempts to write an index when the medium is unmounted.</li></ul>
<code>-o force_mount_no_eod</code>	Skip the EOD existence check when mounting (read-only mount). Only use for a CM-corrupted medium.
<code>-o rollback_mount=&lt;gen&gt;</code>	Attempt to mount on previous index generation (read-only mount).
<code>-o release_device</code>	Clear device reservation (must be specified with <code>—o devname</code> )
<code>-o symlink_type=&lt;type&gt;</code>	Specify symbolic link type (default: <code>posix</code> ). <code>&lt;type&gt;</code> must be specified with one of the following values: <ul style="list-style-type: none"><li><code>posix</code>: LTFS behavior is same as standard symbolic link</li><li><code>live</code>: LTFS replaces mount point path by current mount point</li></ul>
<code>-a</code>	Advanced help, including standard FUSE options
<code>-V, --version</code>	Output version information and exit.
<code>-h, --help</code>	Display this help and exit.
FUSE options:	
<code>-o umask=M</code>	Set file permissions (octal)
<code>-o uid=N</code>	Set file owner
<code>-o gid=N</code>	Set file group

### 4. Write files to the LTFS volume. For example:

```
$ cp -r /root /mnt/lto5/
```

5. Unmount the tape cartridge, which flushes the data buffer of the file system to the tape cartridge, and prepares for eject.

```
$ umount /mnt/lto5
```

Or

```
$ fusermount -u /mnt/lto5
```

**CAUTION:** The `umount` (or `fusermount`) command displays immediately, but the drive is still be busy writing cached data to tape. Do not attempt to remove the tape cartridge from the drive until all activity has finished. Check the front panel LEDs and wait for them to stop flashing. Attempting to remove the cartridge before this activity may cause corruption of the tape format.

**NOTE:** `fusermount` is only available on Linux.

## Usage details

### Format version compatibility

Earlier versions of the HPE LTFS application supported the previous LTFS format specification; v2.1.0 onwards supports the updated LTFS format specification. LTFS volumes created with application v2.1.0 or later will not be readable in older versions of the LTFS application, as shown in the following table:

**Table 1 LTFS compatibility**

LTFS application	Cartridge written by LTFS application v1.1.0 or earlier	Cartridge written by v2.1.0 or later
v1.1.0 or earlier	Can be read and written	Cannot be mounted
v2.1.0 or later	Can be read; automatically be converted to the new format when written	Can be read and written

Hewlett Packard Enterprise recommends that all instances of HPE LTFS must be updated to the latest version of SOS to avoid these compatibility issues.

If, for some reason, it is important to maintain cartridges readable by previous versions of the HPE LTFS application, care must be taken to avoid writing to those cartridges with the new version of the application. This option is accomplished by mounting the volume as read-only, or by using the cartridge write-protect tab to prevent cartridge updates. However, this option must be regarded as a temporary measure until all the application instances can be updated to v2.1.0 or later.

### Use of `sync_type` options

Previous versions of HPE LTFS supported a single mechanism for updating the tape index, in which the index was written to tape only when the volume was unmounted. In normal operation, this support is sufficient since the LTFS usage model requires the volume to be unmounted after use, so there is always a valid index. However, if power is removed from the drive without unmounting, for example due to an unplanned power outage or accidental unplugging, the volume is left in an inconsistent state, and making the added files since the last dismount operation inaccessible. The `ltfsck` utility may be able to recover the file data to the `_ltfs_lostandfound` directory but the metadata (such as filename, access dates) will be lost.

To address this exposure, HPE LTFS offers an additional mechanism for updating the tape index. This mechanism is to write a copy of the index to tape periodically while writing data. This mechanism is the default setting and the index is written out every five minutes. The time interval

can be set with a resolution of one minute. This method of index update reduces the number of power loss events, because there is always an index on tape, which is less than five minutes old (With the default interval setting).

In most cases the default HPE LTFS behavior offers the best solution, but the new features allow the behavior to be tailored to a particular situation. The following table summarizes the options now available for choosing when the index is updated.

**Table 2 Index update options**

sync_type	Index is flushed to tape	Potential benefits	Potential downsides
unmount	When a volume is unmounted (default LTFS v1.1.0 behavior)	<ul style="list-style-type: none"> <li>Minimal capacity overhead</li> <li>No impact on performance</li> </ul>	<ul style="list-style-type: none"> <li>Exposure to risk of power fails during writing</li> </ul>
time@n	Every <i>n</i> minutes during writing (default LTFS behavior from v1.2.0, <i>n</i> =5)	<ul style="list-style-type: none"> <li>Exposure to risk of power failure is limited to the last <i>n</i> minutes</li> </ul>	<ul style="list-style-type: none"> <li>Some capacity overhead since the index is written more frequently</li> <li>Negligible impact on performance</li> </ul>

## User permissions

On some systems, the logged-in user may not have access rights to the tape device (such as `/dev/st0`). The access rights can be provided in the following two ways:

- Have a super-user change the permissions on the tape device file
- Execute the `ltfs` command with the `sudo` command (such as `sudo ltfs /mnt/lto5`).

The second approach is recommended as this preserves the integrity of the system.

## File permissions

The HPE LTFS application manages a common set of file permissions for all files and users; file and directory ownership is not recorded to tape. The only permission that is tracked is write-protect information. Files or directories that are write-protected have their permission bits set to `555`; write-enabled files and directories have their permission set to `777`. By default the user and group information is set to that of the current user; you can override this information by using the `-o uid` and `-o gid` options to the LTFS application.

## File types

The HPE LTFS application does not support the creation of symbolic links or hard links within the tape file system. Attempting to create a link or copy a link to tape will result in a “Function not implemented” error. If using the `cp` command to copy to tape, the `-L` option may be helpful to follow symlinks.

The HPE LTFS application also does not support creation of special files and will report “Function not implemented”.

## File names

To maintain compatibility when copying files between multiple platforms, it is recommended that the following characters must not be used in HPE LTFS for file names, directory names, or extended attributes: `* ? < > : " | / \`

## Limitations

- When the tape cartridge is almost full, further write operations will be prevented. The free space on the tape (such as from the `df` command) will indicate that there is still some capacity available, but that is reserved for updating the index when the tape is unmounted.
- Future mounts of a cartridge that is almost full (has passed the point at which “early warning” is reported) will mount as Read Only, to prevent further modifications which may not fit on tape. This status is cleared when a cartridge is reformatted (using `mkltfs`) or when the volume is rolled back, erasing history (using `ltfsck`).
- MAM and LTFS attributes cannot be listed using the `attr/xattr` command. The LTFS and MAM attributes are case-sensitive
- LTFS volume name cannot be modified on an LTFS tape which is full.
- Disconnecting or powering off a tape drive while it is mounted can make the LTFS volume inconsistent. Always unmount the LTFS volume before disconnecting or powering down the tape drive.

### MAC OS X only

- LTFS does not support moving a folder within LTFS volume. Any attempt to move a folder in such a manner will result in an “operation not permitted” error, and the operation will be ignored. The user can still move a file within LTFS, and also move a folder to and from between an LTFS and a non-LTFS file system.
- Mac OS X Spotlight will not display the files on LTFS as a result of a search.
- If the files are copied to the LTFS volume using 'finder', the modification time and access time for the files may show same as the source file.
- If the files are copied to the LTFS volume using the command terminal, the modification time and access time will be set to the current time on the system.

## Removing LTFS format

If at some time in the future, you wish to remove the LTFS format from the cartridge so that it can be reused for a different purpose, use the `unltfs` utility.

---

**△ CAUTION:** This option *irretrievably destroy* all contents of the cartridge, so use it only when you are sure that you wish to erase the LTFS volume.

---

`unltfs` options:

<code>-d, --device=&lt;name&gt;</code>	Specifies the tape drive to use.
<code>-y, --justdoit</code>	Omits normal verification steps, reformats without further prompting.
<code>-e, --eject</code>	Ejects the tape after the operation completes successfully.
<code>-q, --quiet</code>	Suppresses all progress output.
<code>-t, --trace</code>	Displays detailed progress.
<code>-h, --help</code>	Shows this help.
<code>-i, --configure=&lt;file&gt;</code>	Overrides the default configuration file.
<code>-b, --backend</code>	Specifies a different tape back-end subsystem.
<code>-x, --fulltrace</code>	Displays debug information (verbose).

## 5 LTFS smart copy

The LTFS smart copy utility provides the binary `ltfscopy` command that provides the following benefits to the LTFS users:

- Faster data transfer from tape to disk and tape to tape.
- File verification using hash values.

### LTFS smart copy for fast data transfer from tape

Tape being a sequential access medium, retrieving large number of files from the tape requires that the tape head has to seek the location of the file sequentially on the tape by winding the tape back and forth many times until it reads all the files that need to be copied. This sequential approach causes drastic delays when using the normal copy commands provided by the operating system because those commands do not care about the location of the files on tape. When these commands are used to copy multiple files from tape to disk or another tape, it will result in poor data transfer rates. The LTFS smart copy tool overcomes this limitation by rearranging the files to copy in such a way that all files can be copied in just one pass of the head. This tool significantly reduces the total seek time thus improving the overall performance for multifile copy operations.

**NOTE:** This utility does not offer any performance improvement when transferring data from disk to tape.

---

### LTFS smart copy for verifying files

LTFS smart copy provides the facility to verify the files on tape using a hash generated from the original source on the disk or any other storage medium. You can use this feature in two ways:

- Verify each file after copying to tape — When copying many files from disk to tape or from tape to tape, enabling this feature will make sure that each file is verified using the hash immediately after copying the file to the target tape. After successfully verifying each file, smart copy will set the hash value as an extended attribute to the file. The tool aborts the copy operation when a file fails verification.
- Verify the files on a previously created LTFS volume — In this mode, the user provides a source path and the existing destination path on the LTFS volume. Smart copy verifies each file on the tape against the files on the source by generating hash for the file on source and the corresponding file on tape and comparing it. After the verify operation, smart copy will provide a summary indicating how many files passed the verification and how many failed. If there were failures, it provides the list of files that failed the verification.

### LTFS smart copy modes of operation

LTFS smart copy has three available modes of operation. You will use the command-line options described below with the `ltfscopy` command to define the mode of smart copy operations.

- Copy Only — In this mode the user provides a source path and path to the target LTFS volume. Smart copy does not verify the file in this mode of operation. In this mode, smart copy only copies the source files to the target LTFS volume. If the source is on an LTFS tape, smart copy improves the performance by copying files based on their location on tape.
- Copy and Verify — In this mode the user provides a source path and the path to the LTFS volume with `--copy` and `--verify` options. Smart copy verifies each file on the source to the LTFS Volume and verifies the files immediately. It will abort the copy operation when a file fails verification.
- Verify Only — In this mode the user provides a source path and a destination path on tape and gives a `--verify` option. Smart copy generates hash values for each source file, and compares it with the hash generated for the file on tape.

## LTFS smart copy command-line options

The following are the command-line options for the `ltfscopy` command:

<code>-c, --copy</code>	Copy contents. It is mandatory to provide for copy and verification of contents.
<code>-d, --destination[=path]</code>	Path to destination directory.
<code>-i, --interactive</code>	Run in interactive mode. Prompts before overwrite.
<code>-p, --pattern[""]</code>	A search expression that describes the set of files to be copied. The expression can include wildcards <code>*</code> and <code>?</code> .
<code>-r, --recursive</code>	Operate recursively.
<code>-s, --source[=path]</code>	Path to source directory.
<code>-v, --verify</code>	Verify files hash value and set the same as extended attribute for <code>ltfs-volume</code> files.
<code>--help</code>	Display this help and exit.
<code>--verbose</code>	Explain what is being done.
<code>--version</code>	Output version information and exit.

## Running ltfscopy on Linux and Mac OS

The `ltfscopy` tool is installed by default when you install HPE StoreOpen Standalone. The executable name is `ltfscopy` and will be available at `/usr/local/bin` on Linux platforms.

Command examples:

---

**NOTE:** In these examples, assume that `/mnt/ltfs` is where the tape drive is mounted.

---

To copy the files from cartridge to `/tmp/photos`:

```
$ ltfscopy -s /mnt/ltfs -d /tmp/photos
```

To copy files and all subfolders and files recursively:

```
$ ltfscopy -s /mnt/ltfs -d /tmp/photos --recursive
```



To copy files and all subfolders and files recursively and verify:

```
$ ltfscopy -s /mnt/ltfs -d /tmp/photos --copy -verify --recursive
```

To verify previously copied data by comparing it with source:

```
$ ltfscopy -s /mnt/ltfs -d /tmp/photos -verify -recursive
```

## 6 HPE StoreEver TapeAssure drive monitoring

A drive-monitoring service for HPE LTFS on Linux and on Mac OS X is available as a separate download, offering access to:

- Drive Health—write/read quality levels, key drive life indicators, and any service actions
- Drive Performance—host and media transfer rates and compression ratios
- Drive Utilization—the time the drive is in use, as a percentage
- Tape Health—effective capacity, key tape life indicators, and any service actions
- Tape Utilization—write and read data volumes and capacity used

The download has two parts:

- The TapeAssure service that runs on the LTFS server
- CommandView TL, which is used to store and view the TapeAssure data

CommandView TL is a web-based management application for HPE StoreEver enterprise tape libraries that runs on Windows systems and must have network connectivity with the TapeAssure service. It is used with the HPE LTFS TapeAssure service in this configuration for access to the TapeAssure data only and references to library functionality must be ignored.

See <http://www.hpe.com/info/TapeAssure> for further details, downloads, and user guides.

# 7 Troubleshooting

## General

If problems occur during HPE LTFS operation, entries may be made in the system log (such as `/var/log/messages` on RHEL systems). Check for entries made with the service name “`ltfs`”.

Both `ltfs` and `mkltfs` have command-line options to report further details of the operations undertaken, which may help when trying to troubleshoot problems.

If there is a problem with drive interaction, HPE LTFS will attempt to create a snapshot of the drive internal state at the time of failure. A snapshot may also be taken at unmount time.

- **On Linux systems:** this option in the system log directory (such as `/var/log/`) and will take the form `ltfs_datestamp_timestamp_driveSerialNum.ltd`.
- **On Mac OS X systems:** the snapshots are stored in the directory `~/var/tmp/LTFS/`.

These files are not otherwise used by HPE LTFS and you can safely remove them from the system, when not necessary for troubleshooting.

Logs may not be created, and warning messages issued, in either of the following cases:

- The `ltfs` process does not have write permissions for the log directory  
*Resolution:* Run `ltfs` as root, or use the `log_directory` option to specify a directory for which it does have the required permissions.
- The log directory does not exist  
*Resolution:* Create the log directory indicated, or use the `log_directory` option to specify a existing directory.

## Shared libraries

On some systems, trying to execute the `ltfs` command may result in an error message of the form “`libltfs.so.0: cannot open shared object file: No such file or directory`”.

To resolve this issue, it is necessary to tell the linker or loader how to locate the required dynamic library files. Following are the ways to locate the required dynamic library files:

- Add `/usr/local/lib/` to the environment variable `LD_LIBRARY_PATH`.  
Or
- (As root) Add `/usr/local/lib/` to the file `/etc/ld.so.conf`, and then execute `/sbin/ldconfig`.

Refer to the man pages for `ld.so` and `ldconfig` for further details.

Similar error messages may occur if one or more required shared libraries are not present on the system, or are present but at the wrong revision. Refer to the Release Notes for the particular dependencies of the HPE LTFS release.

## Drive connection

The HPE LTFS application requires that the LTO-5, LTO-6, or LTO-7 tape drive is powered up and connected to the system. These prerequisites can be verified using:

- **Linux:** `cat /proc/scsi/sg/device_strs`
- **Mac OS X:** Use the System Profiler tool (**Applications > Utilities**) to check specific devices connected to your SAS controller.

If the LTO drive is not shown, check the cabling, power, and so on. HPE LTFS will not be able to operate until the drive is detected.

## Using HPE LTFS to check the cartridge

Every time a cartridge is mounted onto the system, the HPE LTFS application will perform a consistency check to ensure that the index information is accurate and up-to-date with the data on the tape. If for some reason there is a problem, the mount operation will fail.

To recover the tape to a consistent state, you can use the `ltfsck` utility to check and repair the LTFS volume. The options to `ltfsck` are shown below; the only required parameter is the device name (such as `/dev/st0` on Linux), but the behavior of `ltfsck` can be controlled through the following:

**Usage:** `ltfsck <options> filesystem`

Where `filesystem` is the device file for the tape drive

<code>-g, --generation=&lt;generation&gt;</code>	To rollback, specify the generation
<code>-r, --rollback</code>	Rollback to the point specified by <code>-g</code> .
<code>-n, --no-rollback</code>	Do not roll back. Verify the point specified by <code>-g</code> ( <i>default</i> ).
<code>-f, --full-recovery</code>	Recover extra data blocks into directory <code>_ltfs_lostandfound</code> .
<code>-z, --deep-recovery</code>	Recover EOD missing cartridge. Some blocks might be erased, but recover to final unmount point with an index version of at least 2.0.0 or earlier. You must use this option for a cartridge that is not recoverable by a normal option.)
<code>-l, --list-rollback-points</code>	List rollback points.
<code>-m, --full-index info</code>	Displays full index information (effective only for <code>-l</code> option).
<code>-v, --traverse=&lt;strategy&gt;</code>	Sets traverse mode for listing rollback points. Strategy must be forward or backward (default: backward).
<code>-j, --erase-history</code>	Erase the history at rollback.
<code>-k, --keep-history</code>	Keep the history at rollback (default).
<code>-q, --quiet</code>	Suppresses informational messages
<code>-t, --trace</code>	Enable diagnostic output.
<code>--syslogtrace</code>	Enable diagnostic output to <code>stderr</code> and <code>syslog</code> .
<code>-V, --version</code>	Version information.
<code>-h, --help</code>	This help.
<code>-p, --advanced-help</code>	Full help, including advanced options.

---

**NOTE:** Use the `-z` option when a mount operation has failed and `ltfs` has advised that deep recovery is required.

Note also that the “erase history” operation cannot be undone, so only use this option when you are sure that you need it.

---

## 8 Frequently asked questions

**Q: How do I get HPE LTFS?**

**A:** All application downloads and documentation are available from The website at: <http://www.hpe.com/storage/StoreOpen>.

**Q: What are the minimum system requirements?**

**A:** Any server that fulfills the needs of the supported configurations detailed in [Supported configurations \(page 5\)](#).

**Q: Does HPE LTFS support DDS/DAT devices?**

**A:** No. Only LTO-5, LTO-6, and LTO-7 drives are supported.

**Q: Does HPE LTFS support non-HPE devices?**

**A:** Although the application may recognize and work with LTO drives from other manufacturers, Hewlett Packard Enterprise is only able to support use with HPE StoreEver LTO-5, LTO-6, and LTO-7 drives.

**Q: Why does HPE LTFS not work with my LTO-4 or earlier drives?**

**A:** HPE LTFS relies on a drive feature called partitioning, which was added to the LTO-5 format. It is not part of the LTO-4 or earlier tape formats and they cannot be used.

**Q: Can I use LTO-4 media in my LTO-5 or LTO-6 drive?**

**A:** LTO-5 drives can load, read and write LTO-4 media, and LTO-6 drives can load and read (but not write) LTO-4 media. However, the LTO-4 format does not support partitioning, so LTO-4 media cannot be used with HPE LTFS.

**Q: Can I use WORM media with HPE LTFS?**

**A:** No, WORM media cannot be partitioned, and so is not usable with HPE LTFS.

**Q: Can I uninstall HPE LTFS?**

**A:** Yes.

**Linux:** Delete the four executable files (`ltfs`, `mkltfs`, `ltfsck`, `unltfs`) from `/usr/local/bin`. Delete the `ltfs` library files `/usr/local/lib/libltfs*` and `/usr/local/lib/ltfs/*`. Delete the `ltfs` support files `/usr/local/etc/ltfs*` and `/usr/local/share/ltfs/ltfs`.

Starting HPE StoreOpen Standalone v2.3.0, you can use the `$ rpm -e` command to uninstall the HPE LTFS.

**Mac OS X:** Delete the tree under `/Library/Frameworks/LTFS.framework` and the four `ltfs` symbolic links in `/usr/local/bin` (`ltfs`, `mkltfs`, `ltfsck`, `unltfs`). To delete the ICU package as well, delete the tree under `/Library/Frameworks/ICU.framework`.

**Q: Where do I go, when I have a problem?**

**A:** For most common issues, see [Troubleshooting \(page 19\)](#). If this section does not address the issue, send an email to [storeopen.cpe@hpe.com](mailto:storeopen.cpe@hpe.com).

**Q: Does HPE LTFS replace my existing backup software?**

**A:** In most cases Hewlett Packard Enterprise recommends that you continue to use your existing backup application. HPE LTFS provides a good method of storing and transporting large files but is not generally a direct replacement for a backup application.

**Q: Is source code available for HPE LTFS?**

**A:** Yes, full source code is released under the terms of the LGPLv2.1 and can be downloaded from <http://www.hpe.com/storage/StoreOpen>. Customers who choose to download and build their own versions of the HPE LTFS application are not supported.

# 9 Support and other resources

## Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:  
[www.hpe.com/assistance](http://www.hpe.com/assistance)
- To access documentation and support services, go to the Hewlett Packard Enterprise Support Center website:  
[www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)

### Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

## Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.
- To download product updates, go to either of the following:
  - Hewlett Packard Enterprise Support Center **Get connected with updates** page:  
[www.hpe.com/support/e-updates](http://www.hpe.com/support/e-updates)
  - Software Depot website:  
[www.hpe.com/support/softwaredepot](http://www.hpe.com/support/softwaredepot)
- To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center **More Information on Access to Support Materials** page:  
[www.hpe.com/support/AccessToSupportMaterials](http://www.hpe.com/support/AccessToSupportMaterials)

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- ① **IMPORTANT:** Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HP Passport set up with relevant entitlements.
- 

## Related information

For diagnosing Library and Tape drive related issues, you can use “HPE Library and Tape Tools”. For more information about using L&TT, refer to the L&TT user guide available at <http://www.hpe.com/support/>.

## Websites

For additional information, see the following Hewlett Packard Enterprise websites:

- <http://http://www.hpe.com/storage/ltfs>
- <http://www.hpe.com>
- <http://www.hpe.com/storage>
- <http://www.hpe.com/support/manuals>
- <http://www.hpe.com/support/downloads>

## Documentation feedback

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