LTO Technology

& Storage Area Networks

A Winning Combination

Hewlett-Packard

IBM Corporation

Seagate Removable Storage Solutions

Introduction

Explosive data growth, 24x7 operations and business-critical applications have made data storage a central issue for many enterprises. Corporate data is the strategic competitive advantage companies possess, and to lose this information is to effectively lose a vital element of their business backbone. Successful operation of a global business now requires timely and reliable access to business information assets. Many enterprises are seeking new solutions to ensure the effective use of these storage assets, to enable a seamless response to change and to allow rapid diagnosis and repair of problems.

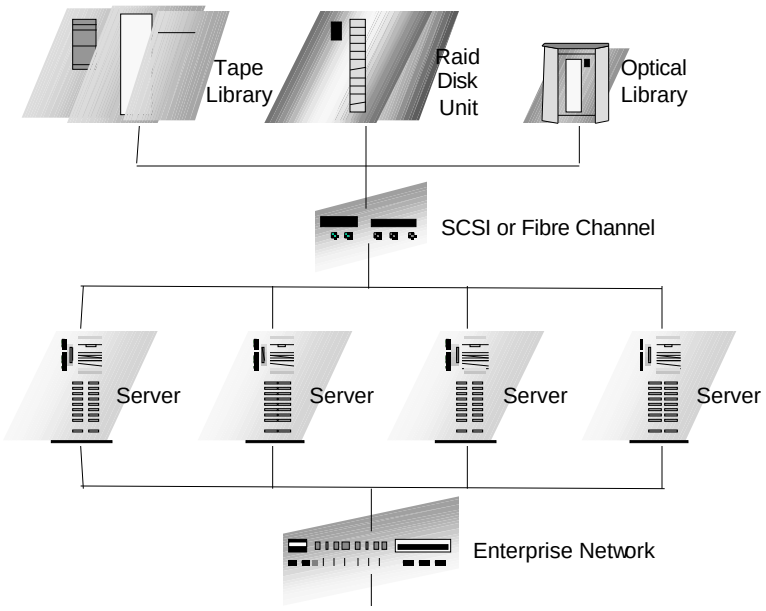
Storage Area Networks (SANs) are fast becoming the architecture of choice to meet these needs. By improving access to data, facilitating resource sharing, increasing performance, simplifying storage management and bolstering reliability, SANs can solve many of the data storage problems facing the modern enterprise, and are beginning to play a critical role in enterprise technology strategies.

Tape is a cornerstone of any enterprise storage plan, and because of tape's central role in the data-protection strategy of the enterprise, the move to SANs will bring both urgency and new importance to the development of a long-term tape storage plan.

Linear Tape-Open (LTO) Technology, a joint initiative of Hewlett-Packard, IBM and Seagate, offers enterprise IT shops a tape solution that addresses the performance, capacity, reliability and management issues faced when choosing a tape solution. LTO Technology is ideal in the SAN environment because it meets the special tape demands that SANs create.

Storage Area Networks

A typical SAN consists of servers, disk storage systems and tape libraries connected to a dedicated network via Fibre Channel or SCSI. Backup software, hierarchical storage management (HSM) software and SAN management software combine to facilitate SAN operation and to effectively utilize the SAN resources.



These hardware and software tools can provide servers with shared access to vast quantities of data stored on disk arrays as well as on tape or optical storage libraries. The SAN can provide the performance, capacity and reliability required by modern enterprise applications, including Web-based e-commerce and customer relationship management (CRM) tools.

Further, by providing enterprise end users with access to the SAN storage architecture, IT departments can begin to address the numerous risks and inefficiencies posed by end-user data management, including redundant data storage, file and document version-control problems and infrequent or non-existent backups. Finally, SANs can alleviate common IT management headaches including shrinking backup windows and storage capacity problems.

Exploding Growth

Expenditures on SAN storage are expected to grow at close to 50 percent per year over the next three to four years, while spending for traditional direct-attached disk storage systems remains essentially flat. Fibre Channel attachment of new storage devices is likely to replace SCSI attachment during this same period.

The technology industry is heavily focused on this opportunity. Server manufacturers are producing servers configured to capitalize on the increased capacity and performance offered by the SAN. Demand is exploding for the Fibre Channel host bus adapters (HBAs) that connect hosts to Fibre Channel networks, as well as the bridges, routers, switches and hubs used to create the Fibre Channel fabric. Storage vendors see great potential for SAN products, including Fibre Channel-enabled disk drives and arrays as well as tape drives and libraries designed for SAN environments. Finally, great opportunities exist for Independent Software Vendors (ISVs) that produce software for managing the fabric, storage and data in a SAN environment and making these resources available to end users as well as enterprise applications.

Tape and the SAN

SANs offer the potential to overcome many of the difficulties traditionally found with tape usage. The SAN creates an independent, or outboard, storage resource, which can centralize storage management functions, mask device or format dependencies and simplify tape drive or library sharing. Further, it can offload data-intensive tape operations from the mainstream application servers and the primary enterprise network.

This can translate into decreased or eliminated backup windows, backups that encompass more client data and the realization of opportunities presented by hierarchical storage management.

The most common use of tape or tape libraries is backup, which is becoming increasingly important and complex. With the global nature of the Internet, as well as the processing demands of enterprise applications, backup windows are quickly becoming a thing of the past. By using SAN-based tape as a backup target, the ever-increasing backup workload can be separated from application servers and the enterprise network and distributed across the storage area network. IT organizations can now establish better disciplines for end-user backup and the whole process becomes more thorough, orderly, and complete.

The other common use of tape is for near-line storage of data in tape libraries. When data quantities are so large that on-line (disk) storage of data is impractical, a tape library can provide a holding place for data that is needed at some point, but not immediately. The SAN environment can improve the utility of tape libraries by connecting all the tape drives and the library robotics via Fibre

Channel. By doing this, hosts no longer have to be connected to individual drives or libraries. Libraries can be easier to share among heterogeneous hosts and dynamic library reconfiguration can be implemented.

Combining software that makes a library into a virtual file system for its attached host with HSM software that automatically moves less used data further and further off-line enables a tape library to provide users with seamless access to nearly limitless quantities of storage.

To achieve its promise, the SAN environment will rely heavily on high-capacity, high-performance and high-reliability tape solutions, and the SAN will place dramatically increased demands on tape systems. In a SAN backup environment, both the increased capacity of the SAN architecture and the increased performance capabilities of a 4Gb/second network intensify the demands on the tape system. In addition, the centralization and concentration of data on the SAN will make data integrity and reliability absolutely critical.

The highly competitive tape market has created numerous tape formats, and most have made tradeoffs – tradeoffs of reliability for performance, performance for capacity, or all three for price.

We are beginning to witness the availability of the next generation of tape formats and users are being presented with some very important, but difficult choices. Users with a SAN strategy will need a clear tape strategy that reaches well into the future and keeps pace with the growth enabled by the SAN architecture. So the right tape choice is a critical component of any SAN strategy.

That's where LTO technology comes in.

The LTO Solution: Technology and a Process

Linear Tape-Open (LTO) Technology is an initiative by HP, IBM and Seagate to solve the problems posed by the fragmented tape market. These vendors saw a need for tape technology without tradeoffs and with a clearly defined growth path. The goal of the LTO initiative is to provide users of tape technology, including those in the SAN market, with a leading-edge tape format based on proven technologies that provide choices, not tradeoffs.

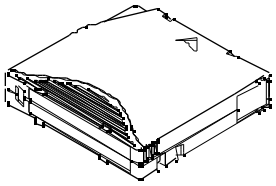
The premise of the LTO initiative:

- Embrace and extend proven tape technologies as the foundation for best-of-breed products
- Provide accessible technology specifications through open licensing
- Enable product development by multiple vendors to create a competitive market
- Establish format verification testing procedures to help assure data integrity and cartridge interchangeability
- Define a credible future growth path to protect customer investments

Ultrium Format

LTO technology consists of a tape format specification and process for licensing LTO Technology to other vendors and certifying that the media and devices these vendors create are compliant with the specification. The result of the initiative is a solid technology foundation with plenty of room for licensees to create products in a competitive environment.

The LTO specification provides for the Ultrium format which is designed for high capacity and the high speed backup of data. The Ultrium format minimizes the common tradeoffs made between reliability, capacity, and data transfer rates.



Ultrium Tape Cartridge

The Ultrium format offers a unique best-of-breed approach and technical innovations designed to position LTO Technology as the leading enterprise tape technology. More details about the Ultrium format is available on the LTO Web site at http://www.ultrium.com.

In addition to the current specification, the Ultrium format has a four-generation roadmap for future growth. Over this roadmap, Ultrium will see an 800 percent increase in capacity, bringing its compressed capacity to 1.6 TB. The transfer rate for Ultrium format based products are anticipated to increase from Generation One's 20 to 40 MB/sec to as much as 320 MB/sec in Generation Four.

LTO Format Enhancement Roadmap

Format	Generation One	Generation Two	Generation Three	Generation Four
ULTRIUM:				
Capacity *	200 GB	400 GB	800 GB	1.6 TB
Transfer Rate *	20 – 40 MB/s	40 – 80 MB/s	80 – 160 MB/s	160 – 320 MB/s

*Capacities and Transfer Rates assume data compression at 2:1
(Hewlett-Packard, IBM and Seagate reserve the right to change the information in this roadmap without notice.)

This four-generation roadmap, with its anticipated dramatic improvements in capacity and transfer rate, should help IT shops plan a tape strategy well into the future. With regular progress on the roadmap, ever expanding storage requirements can be met by a tape format that will keep pace with business needs.

LTO and the SAN

With its technical foundation and strong growth path, LTO Technology is the clear choice to meet the tape storage challenges of the SAN environment. Whether the requirements are data transfer rates, capacity, attachment options or data interchange, the Ultrium format can meet today's SAN needs and tomorrow's challenges.

Data integrity is the most critical requirement for tape in the backup application. The superior track- following technology and error-correcting code built into the LTO Ultrium format help to ensure that backups made to Ultrium format tape will be there when they are needed.

Capacity and performance are also critical backup issues, and the Ultrium format's high capacity and rapid transfer rates make it a superior solution. And with the Ultrium format's dramatic four-generation growth path, it will grow as SAN backup needs grow, with minimal impact on the IT infrastructure.

Many SAN implementations will demand both capacity and fast, reliable backups. With its capacity and performance capabilities, the Ultrium format can meet these requirements.

A Winning Combination

Whether the need is performance, capacity, reliability or all three, LTO's Ultrium format offers a best-of-breed SAN tape solution for today and tomorrow as indicated by the clearly defined, credible four-generation growth path. This will be critical for IT managers who desire confidence when planning a tape SAN implementation.

The LTO specification leaves tape vendors with freedom to control the implementation and pricing of the LTO drives and media they produce. Drive vendors will have control over the footprint of their drives and how they are integrated into servers and libraries. Because of this, there should be an extremely competitive market for LTO Technology. This is sure to benefit the consumer and offer choices not available in the past, where the only available option for the customer was best-of-breed solutions have been based on proprietary formats.

With the choices that this competitive market produces, the LTO Technology is designed to provide an outstanding solution for the tape needs of Storage Area Networks.