IBM System Storage TS3500 Tape Library new Models L23, D23, L53, and D53 support the TS1120 and TS1030 Tape Drives with enhanced performance and capabilities

Overview

New models of the IBM System Storage TS3500 Tape Library (machine type 3584) are designed to provide enhanced tape drive technology and support while helping to protect the investment of existing IBM TotalStorage 3584 Tape Library installations.

The TS3500 Tape Library is designed to be a highly scalable, automated tape library combining IBM automation technology for midrange to enterprise open systems environments. The new TS3500 Tape Library Model L53 and D53 frames integrate the IBM System Storage TS1030 Linear Tape-Open (LTO) Ultrium 3 4-Gbps Fibre Channel Tape Drive, and the Model L23 and D23 frames integrate the IBM System Storage TS1120 Tape Drive with 4-Gbps dual-ported switched fabric Fibre Channel attachment.

The new TS3500 Tape Library frames include an enhanced power architecture and frame control assembly, an optimized dual-gripper cartridge accessor, portable drive canister packaging, and 16-slot Input/Output (I/O) stations. Additional new functions and features associated with this TS3500 Tape Library include dual Ethernet ports, nondisruptive design for library firmware updates, IBM System Storage TS3000 System Console designed to provide remote reliability support, new Web UI option to enable operator panel security, and enhanced data gathering and reporting for library, drive, and media usage or performance via the Ethernet ports and call home.

Previously announced features and capabilities such as, Multi-Path Architecture which is designed to partition the library into up to 192 logical libraries, ALMS which is designed to provide enhanced automation functionality, and COD level additions can also be implemented through license key upgrades.

The new TS3500 Tape Library Model D23 and D53 frames can be attached to Model L23 or L53 frames, or to installed 3584 Model L22, L32, L52, D22, D32, or D52 frames, and can be intermixed within the same TS3500 library. You can tailor the library to match your system capacity, performance, and application requirements using up to 192 drives in up to 16 TS3500 Tape Library frames. It has an available physical storage capacity of up to 9,390 TB (with 3:1 compression) using TS1120 Tape Drives, or up to 5,510 TB (with 2:1 compression) using TS1030 Tape Drives.

These advancements in performance, reliability, and function help enhance library management, and provide flexibility, growth, and a foundation for automation across an enterprise or business installation.

Key prerequisites

Appropriate levels of host software are required to attach the TS3500 Tape Library with the TS1030 or TS1120 Tape Drives to selected IBM System i™, IBM System p™, or IBM System z™ products, and xSeries®, Hewlett Packard, Sun, UNIX®, Linux™, and Windows™ servers. Refer to the Technical information section for details.

At a glance

The TS3500 Tape Library combines IBM tape and automation reliability at open systems prices. New models expand capacity and function and are designed to provide the following enhancements:

- Support for both IBM LTO Tape Drives and TS1120 Tape Drives (in separate frames)
- Enhanced power architecture and frame control assembly
- Dual Ethernet ports
- Intermix of the new models with installed TS3500 or 3584 libraries
- Enhanced automation functionality with Advanced Library Management System (ALMS), enhanced data gathering and reporting, and nondisruptive firmware update design
- Lower-entry capacity configurations with capacity on demand (COD) level additions

Planned availability date

June 9, 2006
The TS3500 Tape Library is part of the family of tape library storage solutions designed for the large, unattended storage requirements from today’s midrange to high-end systems. Each aspect of the subsystem is designed to optimize access to data and reliability. The TS3500 Tape Library includes an enhanced power architecture and frame control assembly. This enhanced frame control assembly has fewer parts and is designed with hot-swappable redundant parts to help improve reliability. The enhanced frame control assembly comes standard on Models L23 and L53 and can be ordered as an optional feature on Models D23 and D53.

The TS3500 Tape Library supports the IBM System Storage TS1030 LTO Ultrium Tape Drive and IBM System Storage TS1120 Tape Drive. IBM LTO Ultrium Tape Drives are compact storage devices that are designed to support the highly intensive read and write operations required by today’s open-system servers. The IBM LTO Ultrium 3 Tape Drive is the third generation of LTO Ultrium Tape Drives in the IBM TotalStorage LTO Ultrium family of products. The TS1120 Tape Drives are designed to provide high levels of performance, functionality, and cartridge capacity supporting the 3592 tape format, including Write Once Read Many (WORM) media support.

The TS3500 or 3584 Tape Library Models D32, D52, D53, L32, L52, and L53 can be equipped with IBM TS1030 or LTO Ultrium Tape Drives, and Models D22, D23, D52, and L23 with the TS1120 or 3592 Tape Drives. The TS3500 Tape Library Models D22, D23, D52, D53, L22, L23, L52, and L53 have a smaller footprint than Model D32 or L32, so they take up less floor space. The Ultrium 3 Tape Drives and data cartridges can be resident in the same TS3500 Tape Library frame with Ultrium 1 or 2 Tape Drives and data cartridges, and adjacent frames can have TS1120 or 3592 Tape Drives and data cartridges. The TS3500 Tape Library supports mixed media in the same library by supporting the intermix of Models D22, D23, D32, D52, and D53 within a TS3500 Tape Library. Input/Output (I/O) stations are located on Model L22, L23, L32, L52, or L53 to facilitate tape loading and unloading.

The TS3500 Tape Library is designed to provide an excellent network data backup/archive solution. With the granularity and scalability to follow your requirements from a few servers to hundreds of clients, from gigabytes to terabytes, this powerful pairing can grow with you, helping to protect your investment.

**TS3500 Tape Library means high performance**

The IBM TS1030 LTO Ultrium Tape Drives and TS1120 Tape Drives are designed for high performance in a streaming mode of operation. Automatic data caching, using an expanded cache memory and read/write buffering, help enhance performance even further. The TS3500 Tape Library is designed for high data transfer performance.

Cartridge move time within the TS3500 Tape Library can be as short as 3.0 seconds or less in a single-frame library. The dual-gripper accessor is designed to retrieve the next cartridge to be mounted, unload the current cartridge, and load the next cartridge, helping provide the following potential benefits as compared to a single gripper:

- Save complete move operations
- Improve overall library performance
- Increase redundancy and reliability

**TS3500 Tape Library defines high reliability**

Leading-edge technology positions the TS1120 Tape Drives and TS1030 LTO Ultrium Tape Drives as among the industry leaders. Highly accurate recording is supported by an exclusive thin-film write module designed by IBM with read-after-write data verification. Data read is managed by IBM’s Magneto Resistive (MR) heads, designed for accuracy, high reliability, and durability. The TS3500 drives and library robotics are TapeAlert-compatible, and are designed to provide tape drive and library error and diagnostic reporting. Drive cleaning is an automatic function that can be performed by the library when required by the drive, without requiring operator intervention.

**High granularity in library configurations**

Features and capacities are designed to address a wide variety of customer requirements. You can attach up to 15 Model D22, D23, D32, D52, or D53 expansion frames to a Model L22, L23, L32, L52, or L53 base frame to tailor the library to match your system capacity and performance needs. This provides a cartridge capacity with Ultrium 3 data cartridges of up to 6,887 cartridges from 26 TB to 2,755 TB of physical capacity (51 TB to 5,510 TB with 2:1 compression), or with 3592 data cartridges of up to 6,260 cartridges from 29 TB to 3,130 TB of physical capacity (87 TB to 9,390 TB with 3:1 compression). Or, you can intermix cartridges and drive types in different frames and have up to 192 tape drives in up to 16 total TS3500 library frames.

**Model L23 (base frame)**

The TS3500 Tape Library Model L23 is a base frame designed for TS1120 or 3592 Tape Drives and 3592 data cartridges. The Model L23 base frame has 58 to 260 cartridge slots and support for up to 12 tape drives with an incremental reduction of storage slots for more than four drives or with the additional I/O station installed. This model has a smaller footprint than the Model L32. The TS3500 Tape Library Model L23 is designed with an optimized gripper for use with LTO or 3592 tape cartridges. Up to 12 logical libraries (one per tape drive) can be configured for each frame.

Each Model L23 library has a standard 16-slot cartridge I/O station for importing or exporting 3592 tape cartridges from the library without requiring a re-inventory. An additional 16-slot cartridge I/O is optionally available for each LTO or 3592 data cartridges. Libraries containing a mixture of LTO and 3592 drive technologies must have one LTO I/O station and one 3592 I/O station. For bulk loading of tape cartridges, the library door can be opened. Each time the library door is closed, a bar code reader mounted on the autochanger is designed to scan the cartridge labels enabling a re-inventory of the cartridges in the library frame in as little as 60 seconds. A door lock is included to restrict physical access to cartridges in the library.

**Model L53 (base frame)**

The TS3500 Tape Library Model L53 is a base frame designed for IBM TS1030 LTO Ultrium Fibre Channel Tape Drives and LTO data cartridges. The Model L53 base frame has 64 to 287 cartridge slots and support for up to 12 tape drives with an incremental reduction of storage slots for more than four drives or with the additional I/O station installed. This model has a smaller footprint than the Model L32. The TS3500 Tape Library Model L53 is designed with an optimized gripper for use with LTO or 3592 tape cartridges. Data capacity for the Model L53 depends on the types of LTO Ultrium cartridges, up to 230 TB of physical capacity (at 2:1 compression) using LTO-DC with Ultrium 3 data cartridges. Up to 12 logical
libraries (one per tape drive) can be configured for each frame.

Each Model L53 library has a standard 16-slot cartridge I/O station for importing or exporting LTO tape cartridges from the library without requiring a re-inventory. An additional 16-slot cartridge I/O is optionally available for either LTO or 3592 data cartridges. Libraries containing a mixture of LTO and 3592 drive technologies must have one LTO I/O station and one 3592 I/O station. For bulk loading of tape cartridges, the library door can be opened. Each time the library door is closed, a bar code reader mounted on the autochanger is designed to scan the cartridge labels enabling a re-inventory of the cartridges in the library frame in as little as 60 seconds. A door lock is included to restrict physical access to cartridges in the library.

**Model D23 (expansion frame)**

The TS3500 Tape Library Model D23 expansion frame is designed for TS1120 or 3592 Tape Drives and 3592 data cartridges. Up to 15 Model D23 expansion frames may be added to the TS3500 Model L22, L23, L32, L52, or L53 base frame to increase 3592 cartridge storage or drive capacity. Each Model D23 supports up to 400 3592 cartridge slots and up to 12 3592 Tape Drives, with an incremental reduction of storage slots for each set of four tape drives installed. Each frame can have up to 12 logical libraries or 12 control paths (one per tape drive).

**Model D53 (expansion frame)**

The TS3500 Tape Library Model D53 expansion frame is designed for IBM TS1030 LTO Ultrium Fibre Channel Tape Drives and LTO data cartridges. Up to 15 Model D53 expansion frames may be added to the TS3500 Tape Library Model L22, L23, L32, L52, or L53 base frame to increase LTO cartridge storage or drive capacity. Each Model D53 supports up to 440 LTO cartridge slots and up to 12 IBM LTO Ultrium 3 Tape Drives, with an incremental reduction of storage slots for each set of four tape drives installed. Each frame can have up to 12 logical libraries or 12 control paths (one per tape drive).

**Designed for availability**

If you are looking to maximize availability with minimum downtime for service-related activities, you will appreciate that the library is designed to preserve tape drive configuration settings, such as Fibre Channel World Wide Node Names (WWNN), when a tape drive is replaced. This helps to ensure that the replacement drive has the same WWNN as the original drive and may help avoid the need to re-IPL or reconfigure host systems. Fibre Channel drives require only a quiesce of the individual drive. Redundant hot-swap library and drive power supplies can also be replaced while avoiding impact to host systems.

The Advanced Library Management System (ALMS) is an optional feature that is designed to avoid outages when adding capacity on demand (COD) storage, adding or removing logical libraries, or when changing logical library storage allocation. The use of ALMS may also help reduce outages when adding expansion frames, adding or removing tape drives, or changing logical drive allocation.

The TS3500 Tape Library includes an enhanced power architecture and frame control assembly. This enhanced power architecture has fewer parts and is designed with hot-swappable 2N power supplies and line cords. The enhanced frame control assembly includes features that were previously ordered separately from the 3584 frame control assembly including dual ac power, a Fibre Channel patch panel, additional redundant power supplies, and additional 10/100 Ethernet support.

**Multi-Path support**

The Multi-Path Architecture of the TS3500 Tape Library is designed to provide the capability for sharing of the library robotics. This is accomplished by partitioning the library into up to 192 multiple logical libraries (up to the number of drives installed), and providing each logical library its own separate and distinct drives, storage slots, and control paths. I/O slots are shared on a first-come-first-served basis. This type of partitioning is designed to allow heterogeneous applications to share the library robotics independent of each other. Cartridges under library control are not shared between logical libraries, nor allowed to be moved between logical libraries. An example of heterogeneous sharing is a Microsoft Windows 2003 application using the drive and storage slots of one logical library, while a UNIX application uses the drive and slots of another logical library.

Logical libraries can also be used for separating Ultrium 2 Tape Drives and cartridges from Ultrium 3 Tape Drives and cartridges, or TS1120 or 3592 Tape Drives and cartridges, for applications which do not support mixing the drives in the same logical library.

**ALMS**

ALMS is the next generation of patented IBM Multi-Path Architecture. ALMS provides a license key to enable dynamic management of cartridges, cartridge storage slots, tape drives, and logical libraries. Tape drives can be assigned to any logical library using a Web user interface. It is designed to allow logical libraries to be added, deleted, or easily changed non-disruptively, and storage capacity to be changed while avoiding impact to host applications in many instances.

**Path failover**

You may use path failover to help enhance availability. This optional feature is designed to provide automatic control path failover to a preconfigured redundant control path in the event of a loss of a host adapter or control path drive, without aborting the current job in progress. Support is provided under various operating systems such as, AIX®, Linux, Solaris, HP-UX, and Windows for Fibre Channel attachments when the IBM device driver is used.

Data path failover and load balancing support native Fibre Channel Ultrium Tape Drives and TS1120 or 3592 Tape Drives in the TS3500 Tape Library using the IBM device driver for AIX, Linux, Windows, and Solaris. Data path failover is designed to provide a failover mechanism in the IBM device driver, to enable configuration of multiple redundant paths in a SAN environment. In the event of a path or component failure, the failover mechanism is designed to automatically provide error recovery to retry the current operation using an alternate, preconfigured path without aborting the current job in progress. This allows you flexibility in SAN configuration, availability, and management.

When accessing a tape drive device that has been configured with alternate pathing across multiple host ports, the IBM device driver is designed to automatically select a path through the host bus adapter (HBA) that has the fewest open tape devices and assign that path to the application. This autonomic self-optimizing capability is called load balancing. The dynamic load balancing support is designed to optimize resources for devices that have physical connections to multiple HBAs in the same machine. The device driver is designed to dynamically...
track the usage on each HBA as applications open and close devices, and balance the number of applications using each HBA in the machine. This may help optimize HBA resources and improve overall performance. Further, data path failover is designed to provide autonomic self-healing capabilities similar to control path failover, and is designed to failover to an alternate data path in the event of a failure in the primary host-side path. Data path failover and load balancing for Ultrium 3 Tape Drives require the optional path failover feature.

**Fibre Channel connectivity**

Tape drives in the TS3500 Tape Library Models D22, D23, D52, D53, L22, L23, L52, and L53 are designed to connect to host systems using Fibre Channel interfaces. An LTO Ultrium Tape Drive with a Fibre Channel interface or 3592 Tape Drive can be selected for attachment to host systems and servers utilizing Fibre Channel adapters. Fibre Channel connection distances up to 500 meters are possible. By utilizing selected Fibre Channel switches distances exceeding 500 meters are possible.

**TS1030 Tape Drive Model F3B**

The IBM System Storage TS1030 Tape Drive Model F3B provides integration of IBM LTO Ultrium 3 Tape Drives in the TS3500 Tape Library and offers enhancements in performance, capacity, and reliability over today’s IBM Ultrium 2 Tape Drives. Continuing to build on the success and acceptance of IBM LTO Ultrium Tape technology, the TS1030 Tape Drive incorporates the new Linear Tape-Open (LTO) IBM Ultrium 3 Tape Drive, which more than doubles maximum tape drive throughput data rate performance over the IBM LTO generation 2 Tape Drive (Ultrium 2), to up to 80 MB/sec native data transfer rate (160 MB/sec with 2:1 compression). In addition, with the use of the new IBM TotalStorage LTO Ultrium 400 GB Data Cartridge, the 3588 doubles the tape cartridge capacity to up to 400 GB native physical capacity (800 GB with 2:1 compression). IBM Ultrium 3 Tape Drives can read and write Ultrium 3 (400 GB) data cartridges and read Ultrium 1 (100 GB) data cartridges. Ultrium 1, Ultrium 2, and Ultrium 3 data cartridges can be resident in the same 3584 Tape Library frame.

The 400 GB physical capacity is designed to help reduce solution costs and improve space utilization. Up to 80 MB/sec native throughput on Ultrium 3 Tape Drives helps reduce backup windows and speed data recovery. The proven durability of the cartridge helps reduce worry. Cartridge Memory (LTO-CM) can help enable fast, simultaneous transfer of cartridge-dependent data with IBM Ultrium 3 Tape Drives during media load and unload cycles.

The IBM LTO Ultrium 400 GB Data Cartridge is a cost-effective media offering that increases cartridge capacity over the IBM LTO Ultrium 200 GB Data Cartridge and can help reduce the amount of equipment, space, and human intervention required for daily tape operations. In addition, reducing the number of cartridges needed for backup and restore operations can help lower operational costs throughout the enterprise. The new blue-gray cartridge color helps distinguish it from previous generations of IBM LTO media.

**WORM media support**

The IBM TotalStorage 3589 Ultrium 400 GB WORM Tape Cartridges are designed for applications such as archiving and data retention as well as those applications requiring an audit trail. These cartridges work with the LTO Ultrium 3 Tape Drive to help prevent the alteration or deletion of user data. IBM Ultrium 400 GB WORM Data Cartridges can be ordered as unique 3589 models with the following features:

- Pre-labeling, with the ability to specify a starting volume serial and color-coding
- Packaging in individual jewel cases or in bulk
- Cartridge memory, built into every cartridge, which helps to enhance functionality and media reliability by storing access history and media performance information for use by the tape drive every time the cartridge is accessed
- Half-inch particle tape with a 400 GB WORM native capacity in a single cartridge

**TS1120 Tape Drive**
The TS1120 Model E05 Tape Drive has a native data rate of up to 100 MB/sec. With the use of the IBM TotalStorage Enterprise Tape Cartridge 3592, it provides a native cartridge physical capacity of up to 500 GB (1.5 TB with 3:1 compression). It uses an optimal dynamic compression method called byte level compression scheme swapping, which is designed to achieve maximum data compression, and unlike other tape drive compression methods, it is designed to prevent data expansion. The TS1120 Model E05 Tape Drive is designed for automation and uses a tape cartridge with a form factor similar to the 3590 and 3480 tape cartridges. The TS1120 Tape Drives and cartridges are supported in the TS3500 Tape Library Model L23 or D23 frames and in installed 3584 Tape Library Model L22 or D22 frames.

The TS1120 Model E05 Tape Drive has dual-ported 4-Gbps native switched fabric Fibre Channel interfaces. This offers attachment flexibility in an open systems environment. The drives can be directly attached to open systems servers with Fibre Channel attachments. The TS1120 Model E05 uses SARS to assist in isolating failures between media and hardware. It is designed to use the cartridge performance history saved in the cartridge and drive performance history kept in the drive to determine the more likely cause of failure. It is designed to cause the drive to mark the media as degraded, and to indicate that the hardware has degraded.

The TS1120 Model E05 is designed to support capacity scaling of JA tape cartridges to 100 GB. Capacity scaling is designed to allow the utilized length of tape to be logically shortened, helping improve data access times in trade-off for reduced capacity. The tapes can subsequently be scaled back to full capacity as needed. Multiple scale settings are supported on the Model E05 Tape Drive including a 100 GB, 20% scaled JA cartridge.

The TS1120 E05 Tape Drive allows an application to issue a command to scale the IBM TotalStorage Tape Data Cartridge 3592 to 100 GB. Cartridges pre-scaled for 100 GB physical capacity are also available for order with the 3599 Models E11, E21, 011, and 021. These pre-scaled cartridges can be ordered (and labeled) for a specific VOLSER range. This allows capacity scaling to be exploited by an application that permits media pools to be defined by VOLSER range. For information on which Independent Software Vendors (ISV) support capacity scaling by command or with the pre-scaled cartridges, refer to the TS1120 or 3592 ISV Web site that can be accessed at http://www.ibm.com/servers/storage/tape

The TS1120 Model E05 incorporates tape enhancements introduced with the 3592 Model J1A Tape Drive, which are designed to help improve performance, capacity, and availability, including:

- N+1 power supplies: The TS1120 Model E05 incorporates n+1 power supplies when it is installed in an automation frame. This is designed to help increase drive availability in the event of a power supply failure.
- Digital speed matching: The TS1120 Model E05 is designed to dynamically perform digital speed matching to adjust the drive’s native data rate to the net host data rate (after data compressibility has been factored out). This is designed to help allow slower hosts to stream the tape drive.
- Channel calibration: The channel calibration feature is designed to allow for customization of each read/write data channel for optimum performance. The customization can enable compensation for variations in the recording channel transfer function, media characteristics, and read/write head characteristics. The TS1120 Model E05 is designed to automatically perform recalibration in the field if it detects degraded performance.
- High resolution tape directory plus enhanced search speed: The TS1120 Model E05 Tape Drive maintains a tape directory structure with a high granularity of information about the physical position of data blocks on the media. This feature, plus the increased search speed, allows the TS1120 Model E05 to have improved nominal and average access times for locate operations versus previous IBM tape drives.
- Streaming Lossless Data Compression (SLDC) algorithm: SLDC is an implementation of a Lempel-Ziv class 1 (LZ-1) data compression algorithm. It is an extension to Adaptive Lossless Data Compression (ALDC) and is designed to offer an improvement over previous IBM lossless compression algorithms. In addition, the TS1120 Model E05 offers the following enhancements over the 3592 Model J1A Tape Drive:
  - New dual-stage, 16-head actuator designed to provide precision head alignment to help support higher track density and improved data integrity.
  - Improvement in physical load/ready time of over 20% versus 3592 Model J1A.
  - Large internal data buffer: The TS1120 Model E05 Tape Drive has a 512 MB internal data buffer versus a 128 MB maximum in the 3592 Model J1A and a 16 MB maximum in the 3590 Tape Drive. Along with enabling higher performance characteristics, the data buffer is designed to use support read ahead of approximately 500 MB of compressed data from tape and provide high performance random skip forward sequential (short hop) locates common in database search and tape software recycle operations.
  - Improved error correction capabilities (ECC): The correction power of the ECC code has been increased over the previous design offered with the 3592 Model J1A format, which is designed to offer increased data reliability.
  - Offboard data string searching: The TS1120 Model E05 Tape Drive can search the data content of host records for string matches offboard from the host server. The tape drive is designed to perform this search at up to maximum data rate (100 MB/sec native) while it would take much longer for a host server to read the data, buffer the data to disk, and then parse the actual datastream with host software routines.
  - Enhanced logic to report Logical End-of-Tape (LEOT): LEOT is now reported based on a combination of capacity-based and position-based LEOT indicators. The TS1120 Model E05 is designed to monitor the total accumulated number of physical tape datasets written to the volume and report LEOT based on this capacity-based LEOT value. This is designed to allow tape copies to complete without overflow a much higher percentage of the time.
  - Native search speed increased to up to 10 MB per second.

Refer to the TS1120 Model E05 Sales Manual for more information.

3592 Tape Cartridge

The TS1120 Model E05 uses the IBM TotalStorage Enterprise Tape Cartridge 3592, which contains an
advanced metal particle tape specifically optimized for the enterprise tape environment, providing a native cartridge physical capacity of up to 500 GB (or up to 1.5 TB with 3:1 compression). This can be very beneficial in space savings and economy of data storage since it can help lower the cost of storage per megabyte. For applications that fill current data cartridges, this can help reduce the number of tape cartridges required. The reduced number of cartridges may also help free up floor space for other requirements.

The robust 3590-style cartridge shell is designed to sustain a one-meter drop. The cartridge has a similar form factor as the 3590 and 3490 tape cartridges. It contains cartridge memory that is a passive, contactless silicon storage device. It is used to hold information about the specific cartridge, including the VOLSER, the media in the cartridge, and the drive.

Economy cartridges with a native cartridge physical capacity of up to 100 GB (or up to 300 GB with 3:1 compression) are available. In addition, WORM cartridges in both sizes are available. The TS3500 Tape Library supports the use of Ultrium 1, Ultrium 2, Ultrium 3, and 3592 data cartridges within the same library.

**TS1120 Tape Controller**

The IBM System Storage TS1120 Tape Controller Model C06 is designed to provide superior performance and improved reliability for S/390® and IBM System z® customers. The TS1120 Tape Controller, 3592 Model C06, has up to four 4-Gbps FICON™ attachments, twice the FICON bandwidth connectivity that the IBM TotalStorage Enterprise Tape Controller 3592 Model J70 offers. The TS1120 Tape Controller also has up to eight ESCON® attachments, or an intermix of ESCON and FICON™ attachments. Up to 16 of the TS1120 or IBM 3592 Tape Drives can be attached to a single TS1120 Tape Controller.

The TS1120 Tape Controller can be installed in an IBM 3593 Tape Frame Model F05, in an IBM 3592 Tape Frame Model F05, or in a stand-alone rack, supporting TS1120 or 3592 Tape Drives installed in 3494 frames, 3584 frames, 3592 Model C20 frames, and stand-alone racks. To control TS1120 or 3592 Tape Drives in a TS3500 Tape Library, the TS1120 Tape Controller must be installed in a 3593 Model F05 frame, which is external to the TS3500 Tape Library and may be installed away from the TS3500 Tape Library frames. For additional information on the TS1120 Tape Controller Model C06, refer to Product Announcement letter ZG06-0387 dated May 09, 2006. For additional information on the 3593 Tape Frame Model F05, refer to Product Announcement letter ZG05-0327 dated May 10, 2005.

**Product positioning**

As you compare competitive tape solutions, consider:

- Library scalability: 1 to 16 frames, 1 to 192 tape drives, 58 to 6,887 cartridge slots
- Capacity, performance, and library management requirements
- Data integrity, reliability, and availability
- Storage usage and application requirements
- Affordability
- Loyalty to legacy or existing tape formats, including LTO and 3592 drive technology
- Server attachment and operating system support

The TS3500 Tape Library and industry-leading software applications excel in addressing these requirements and can constitute a functionally rich tape storage solution incorporating LTO Ultrium and 3592 tape technology. You also gain flexibility of automated tape library management and unattended save/restore operations.

The TS3500 Tape Library models are a smart choice for tape automation for IBM System i, IBM System p, or IBM System z products, and xSeries and other popular open systems. The TS3500 Tape Library utilizes the patented Multi-Path Architecture, designed to allow homogeneous or heterogeneous open systems applications to share the library robotics, with ALMS for storage slot pooling and flexible drive assignment.

The TS3500 Tape Library Base Frame Model L53 offers 64 to 287 slots for LTO Ultrium tape cartridge media and up to 12 IBM LTO Ultrium Fibre Channel Tape Drives. It is designed to provide excellent price and performance in the open systems environments where the tape automation requirements are satisfied by 1 to 12 drives or a library native capacity of up to 115 TB.

The TS3500 Tape Library Base Frame Model L23 offers 58 to 260 slots for 3592 tape cartridge media and up to 12 IBM TS1120 Tape Drives, with a library native capacity of up to 130 TB. The TS1120 Tape Drives are designed to provide high capacity, performance, and reliability in open systems environments with tape drive flexibility to accommodate capacity as well as fast access where these requirements are needed.

Up to 15 TS3500 Tape Library Expansion Frame 3584 Model D22, D23, D32, D52, or D53 can be added to either the Model L22, L23, L32, L52, or L53. The Model D23 provides up to 400 cartridge slots for 3592 media, and can contain up to 12 TS1120 Tape Drives. The Model D53 provides up to 440 slots for LTO media, and can contain up to 12 Ultrium Fibre Channel Tape Drives. This can provide a total TS3500 library capacity of up to 192 IBM LTO Ultrium or TS1120 Tape Drives, with up to 6,887 Ultrium cartridge slots holding up to 2,755 TB of native physical capacity, or with up to 6,260 3592 cartridge slots holding up to 3,130 TB of native physical capacity.

The TS3500, part of a family of IBM System Storage tape products, can be the answer to growing storage requirements and shrinking backup windows.

If you have existing digital linear tape experience or require high-performance automated tape backup, the TS3500 Tape Library constitutes an excellent tape storage solution. In addition to reading and writing on LTO Ultrium-format tape cartridges, the TS3500 tape drives provide an enhanced functional alternative to DLT/SDLT, 1/4-inch, 4mm, 8mm, or IBM Magstar® MP 3570 tape drives.

For capacity requirements less than 28.8 TB (compressed), a wide spectrum of tape libraries are available from the family of IBM System Storage Ultrium Tape products, depending on your storage usage and requirements. Tape automation products to choose from include the IBM System Storage TS3310 Tape Library (up to 169.6 TB compressed), IBM System Storage TS3200 Tape Library (up to 35.2 TB compressed), and IBM System Storage TS3100 Tape Library (up to 17.6 TB compressed).

**Reference information**

- The 3588 Model F3B, Product Announcement letter ZG06-0395 dated May 09, 2006
- The TS1120 Tape Controller Model C06, Product Announcement letter ZG06-0387 dated May 09, 2006
- The IBM System Storage TS1120 Tape Drive Model E05, Product Announcement letter ZG05-0651 dated October 11, 2005
- The 3584 Model HA1, Product Announcement letter ZG05-0166 dated February 15, 2005
- The 3588 Model F3A, Product Announcement letter ZG05-0170 dated February 15, 2005
- The 3584 Models D22, D52, L22, and L52, Product Announcement letter ZG04-0296 dated April 27, 2004
- The IBM TotalStorage Enterprise Tape Drive 3592 Model J1A, Product Announcement letter ZG03-0509 dated September 09, 2003
- The improved functions and expanded attachment to 16 frames in the UltraScalable Tape Library 3584, Product Announcement letter ZG03-0368 dated June 03, 2003
- The Ultrium 2 Tape Drive in the UltraScalable Tape Library 3584, Product Announcement letter ZG03-0126 dated January 28, 2003
- Expanded I/O and remote library access features for the UltraScalable Tape Library 3584, Product Announcement letter ZG01-0327 dated June 12, 2001
- Native Fibre Channel Support for the UltraScalable Tape Library 3584, Product Announcement letter ZG01-0214 dated February 20, 2001
- The UltraScalable Tape Library 3584, Product Announcement letter ZG00-0180 dated August 23, 2000

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