



# IBM System Storage TS3500 Tape Library supports LTO 4 Ultrium and 4X I/O stations with increased performance and capacities

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## At a glance

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The IBM System Storage TS3500 Tape Library combines IBM tape and automation reliability at open systems prices. The models expand capacity and function, and are designed to provide:

- Integration of the new IBM System Storage TS1040 Tape Drive 3588 Model F4A for improved performance
- Support for both IBM LTO Tape Drives and TS1120 Tape Drives (in separate frames)
- Expansion of the available physical storage capacity up to 13.14 PB (with 3:1 compression) for 3592 drives and cartridges, and 10.19 PB (with 2:1 compression) for Ultrium 4 drives and cartridges
- Support for four I/O stations or 64 I/O slots on Model D23 or D53
- Encryption capabilities designed to work with the new Encryption Key Manager component for TS1120 (3592 E05) and TS1040 (3588 F4A) tape drives
- Lower entry capacity configurations with capacity on demand (CoD) level additions

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## Overview

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The **IBM System Storage™ TS3500 Tape Library** (machine type 3584) is designed to provide enhanced tape drive technology and support while helping to protect the investment of existing IBM 3584 Tape Library installations.

It is designed to be a highly scalable, automated tape library combining IBM automation technology for midrange to enterprise open systems environments. The TS3500 Tape Library Models L53 and D53 frames now integrate and support the IBM System Storage TS1040 Linear Tape-Open (LTO) Ultrium 4 Fibre Channel Tape Drive, with its enhanced native data rate of up to 120 MB/sec and 800 GB native LTO Ultrium 4 data cartridge physical capacity. The TS3500 Tape Library Models L23 and D23 frames integrate the IBM System Storage TS1120 Tape Drive with 4-Gbps dual-ported switched fabric Fibre Channel attachment.

The IBM System Storage TS1040 LTO Ultrium 4 Tape Drive supports data encryption on the base drive with Ultrium 4 media meeting LTO consortium specifications and Application Managed Encryption. Support System Managed and Library Managed Encryption, and associated IBM Encryption Key Manager access is available as a chargeable licensed key feature under the TS3500 Tape Library L-frames.

For bulk media handling and useful for customers who import and export many cartridges per day, the TS3500 Tape Library supports four I/O stations in newly purchased Models D23 or D53 frames. The D-frame with I/O installed is comprised of four independently accessible

I/O station doors that have a total of 64 slots (16 in each I/O station door). Additionally, two LED indicators are provided for each I/O station in a D-frame in order to indicate if the I/O station is empty or full and if the I/O station door is locked or unlocked. This plant feature reduces the frame storage slot capacity by 160 for a Model D23 and by 176 for a Model D53. The I/O stations increase the maximum library I/O slot capacity from 32 to 224 due to a maximum of three D23 or D53 I/O frames in a 16-frame library. The multiple I/O stations double the maximum insert/eject throughput compared to L-frames only I/O stations. The D23 and D53 Models are compatible with existing Models L22, L32, L52, D22, D32, and D52.

Additional functions and features for the TS3500 Tape Library include a single feed bifurcated AC line cord, rack mountable TS3000 Service Console, and custom control of Web user interface access.

You can tailor the library to match your system capacity, performance, and application requirements by using up to 192 drives in up to 16 TS3500 Tape Library frames. The TS3500 Tape Library has an available physical storage capacity of up to 13,146 TB (with 3:1 compression) using TS1120 Tape Drives and 3592 Tape Cartridges Extended, or up to 11,020 TB (with 2:1 compression) using TS1040 Tape Drives and LTO Ultrium 4 800 GB tape cartridges.

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

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## Key prerequisites

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Appropriate levels of host software are required to attach the TS3500 Tape Library with the TS1040 or TS1120 Tape Drives to selected IBM System i™, IBM System p™, IBM System x™, IBM System z™ products, and Hewlett Packard, Sun, UNIX®, Linux™, and Windows™ servers. Refer to the Technical information section for details.

### Planned availability dates

- April 27, 2007: Features 1663, 1678, and 9682
- May 4, 2007: All features except features 1604, 1655, 1656, 1663, 1678, and 9682
- June 8, 2007: Features 1604, 1655, and 1656
- July 6, 2007: Encryption Key Manager for LTO Ultrium 4 on HP, Sun Solaris, and Microsoft™ Windows

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## Description

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The TS3500 Tape Library is part of the family of tape library storage solutions designed for the large, unattended storage requirements in 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, an optimized dual-gripper cartridge accessor, portable drive canister packaging, and 16-slot Input/Output (I/O) stations. The enhanced frame control assembly has fewer parts than the previous generation of power architecture and is designed with hot-swappable redundant parts to help improve reliability. The enhanced frame control assembly is 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 TS1040 LTO Ultrium 4 and TS1030 LTO Ultrium 3 Tape Drive and the 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 4 Tape Drive is the fourth generation of LTO Ultrium tape drives in the IBM 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 TS1040, TS1030, or LTO Ultrium Tape Drives, and Models D22, D23, L22, 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 4 Tape Drives and data cartridges can be resident in the same TS3500 Tape Library frame with Ultrium 3 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. I/O stations are located on Models L22, L23, L32, L52, or L53 and selected D23 and D53 models to facilitate tape loading and unloading.

Additional functions and features associated with the TS3500 Tape Library include dual Ethernet ports and library firmware upgrades, IBM System Storage TS3000 System Console designed to provide remote reliability support, Web user interface selections 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 capacity on demand (CoD) level additions, can also be implemented through license key upgrades.

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 TS1040 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.

### **TS3500 Tape Library defines high reliability**

Leading-edge technology positions the TS1120 Tape Drives and TS1040 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 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 physical capacity with 800 GB Ultrium 4 data cartridges of up to 5,551 TB of physical capacity (102 TB to 11,020 TB with 2:1 compression), or with 3592 data cartridges of up to 4,382 TB of physical capacity (123 TB to 13,146 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 a total of 16 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 supports 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 another 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 or D23 frames with an optional I/O can also be used. Each time the library door is closed, a bar code reader mounted on the autchanger 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 help 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 TS1040 or other 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 460 TB of physical capacity (at 2:1 compression) using LTO data compression (LTO-DC) with Ultrium 4 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 another 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 or D53 frames with an optional I/O can also be used. Each time the library door is closed, a bar code reader mounted on the autochanger is designed to scan the cartridge labels enabling another inventory of the cartridges in the library frame in as little as 60 seconds. A door lock is included to help 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).

A Model D23 can be ordered from the plant with feature number 1656, which provides I/O stations installed comprised of four independently accessible I/O station doors with a total of 64 slots (16 in each I/O station door). A maximum of three D23 I/O frames are allowed in any TS3500 library string. This will increase the maximum I/O slot capacity from 32 to 224. There will be a loss of storage capacity of 160 cartridge for each Model D23 with an optional I/O capability.

#### **Model D53 (expansion frame)**

The TS3500 Tape Library Model D53 expansion frame is designed for IBM TS1040 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 4 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).

A Model D53 can be ordered from the plant with feature number 1655, which provides I/O stations installed comprised of four independently accessible I/O station doors with a total of 64 slots (16 in each I/O station door). A maximum of three D53 I/O frames are allowed in any TS3500 library string. This will increase the maximum I/O slot capacity from 32 to 224. There will be a loss of storage capacity of 176 cartridges for each D53 with optional I/O capability.

#### **Designed for availability**

If you are looking to maximize availability and minimize 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 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 are designed to allow for replacement while avoiding impact to host systems.

The Advanced Library Management System (ALMS) is an optional feature that is designed to avoid outages when adding 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 than the previous generation power architecture 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 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 or 3 Tape Drives and cartridges from Ultrium 4 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 the 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 without disruption, and storage capacity to be changed while avoiding impact to host applications in many instances. ALMS is required in high availability and dual accessor environments and recommended where logical libraries and partitioning are being used.

## **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 Sun 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. For Ultrium 4 Tape Drives, data path failover and load balancing 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.

## **TS1120 encryption**

The IBM System Storage TS1120 (3592 E05) Tape Drive and IBM System Storage TS1040 (3588 F4A) Tape Drive support encryption of data on a tape cartridge. TS1120 (3592 E05) Tape Drives, that are currently shipping, are encryption capable. A chargeable upgrade is available for previously installed TS1120 E05 tape drives. All 3592 media, including WORM cartridges, can be encrypted.

In addition, a required Encryption Key Manager program is designed to support advanced encryption methods. The Encryption Key Manager program uses standard key repositories on

supported platforms. This software is required on a supported server and interface with the tape drive to support encryption in a System or Library Managed Encryption implementation.

Encryption is available for System z and open systems environments. Three different methods of encryption are supported.

**Application Managed:** The TS1120 Tape Drive supports Application Managed Encryption for open systems environments such as AIX, Linux, Solaris and Windows. The application controls the encryption process, and generates, and provides keys to the TS1120 tape drive. Tivoli® Storage Manager has been enhanced to support this capability.

**Library Managed:** Encryption by volume and drive policy is supported in open system environments. The user sets up and controls the encryption through the library interface. The Encryption Key Manager program is required for this support.

**System Managed:** With System Managed Encryption, the encryption policy is passed between the server and the drives. This is the only vehicle for z/OS® environments and requires the Encryption Key Manager program. DFSMS supports the Encryption Key Manager component. System Managed Encryption is also available for AIX and Solaris on open systems. This support requires a new tape device driver, as well as the Encryption Key Manager program.

The TS1120 Tape Drive may be installed and is supported in the IBM TS3500 Tape Library Models L23, D23, L22, and D22. Support for the TS1120 encryption function requires a minimum level of microcode firmware and it is your responsibility to load, configure, and maintain on the TS3500 Tape Library. Feature number 9900 (Encryption Configuration) should be ordered on the TS3500 Tape Library. You need to download the latest version of library firmware.

### **TS1040 encryption**

The TS1040 Tape Drive may be installed and is supported in IBM TS3500 Tape Library Models L32, L52, L53, D32, D52, and D53. Support for Application Managed Encryption is standard for TS1040 Tape Drives. Support for the TS1040 System Managed and Library Managed methods requires a license key that is provided with feature number 1604 (Transparent LTO Encryption).

Feature number 1604 may be ordered on Models L32, L52, and L53 libraries, and may be ordered on Models L22 and L23 where LTO D-frames are attached.

Feature number 9900 (Encryption Configuration) should be ordered on the TS3500 Tape Library. You will need to download the latest version of library firmware.

The TS1120 and TS1040 Tape Drive's encryption capability and its subsystem integration support help provide customers with a flexible tape data encryption solution that supports encryption and key management across a variety of environments. It is designed to provide a single point of control for all encryption keys and, most importantly, can help customers protect tape data in a cost effective way.

### **TS1040 Tape Drive Model F4A**

The IBM System Storage TS1040 Tape Drive Model F4A provides integration of IBM LTO Ultrium 4 Tape Drives in the TS3500 Tape Library and offers enhancements in performance, capacity, encryption, and reliability over today's IBM Ultrium 3 Tape Drives. Continuing to build on the success and acceptance of IBM LTO Ultrium Tape technology, the TS1040 Tape Drive incorporates the new Linear Tape-Open (LTO) IBM Ultrium 4 Tape Drive, which enhances tape drive throughput data rate performance over the IBM LTO generation 3 Tape Drive (Ultrium 3), from 80 MB/sec native data transfer rate to 120 MB/sec. In addition, with the use of the new IBM LTO Ultrium 800 GB Data Cartridge, the 3588 Model F4A doubles the tape cartridge capacity to up to 800 GB native physical capacity (1,600 GB with 2:1 compression). IBM Ultrium 4 Tape Drives can read and write LTO Ultrium 3 Data Cartridges and read LTO Ultrium 2 Data Cartridges. The TS1040 Model F4A comes with a single port 4-Gbps native Fibre Channel interface, for connection to a wide spectrum of open system servers.

The new Fibre Channel TS1040 Tape Drives and LTO Ultrium 4 data cartridges are supported in newly purchased TS3500 Model L53 and D53 frames, and installed 3584 Models L52, L32, D52, and D32 frames with the same capabilities provided for hot-swap Ultrium 4 drives today. In addition, the Ultrium 4 Tape Drive is designed to provide:

- Ability to configure Ultrium 2, Ultrium 3, and Ultrium 4 tape drives in the same frame and same logical library
- Ability to distinguish between Ultrium 2, Ultrium 3, and Ultrium 4 Tape Drives on all user interfaces (using inquiry data), on the front of the drive, and at the rear of the drive canister
- Ability to maintain the Ultrium 4 drive serial number during a FRU replacement in the same

manner that the TS1120 or 3592 drive serial number is maintained

- Data security through encryption capability
- A larger 256 MB internal drive buffer
- 8 KB cartridge memory with Ultrium 4 media
- Customer centric Statistical Analysis Reporting System (ccSARS)
- More highly integrated electronics using IBM-engineered copper technology

For details on the TS1040 Model F4A Tape Drive, refer to Hardware Announcement [ZG07-0294](#), dated April 24, 2007.

### **IBM LTO Ultrium 800 GB Data Cartridge**

The tape cartridge capacity of the IBM LTO Ultrium 800 GB Data Cartridge has doubled over the IBM LTO Ultrium 400 GB Data Cartridge to 800 GB native physical capacity (1,600 GB with 2:1 compression). IBM Ultrium 4 Tape Drives can read and write Ultrium 3 (400 GB) data cartridges and read Ultrium 2 (200 GB) data cartridges. Ultrium 2, Ultrium 3, and Ultrium 4 data cartridges can be resident in the same 3584 Tape Library frame.

The 800 GB physical capacity is designed to help reduce solution costs and improve space utilization. Up to 120 MB/sec native throughput on Ultrium 4 tape drives helps reduce backup windows and speed data recovery. The proven durability of the cartridge helps reduce worry. 8 KB Cartridge Memory (LTO-CM) can help enable fast, simultaneous transfer of cartridge-dependent data with IBM Ultrium 4 Tape Drives during media load and unload cycles.

The IBM LTO Ultrium 800 GB Data Cartridge is a cost-effective media offering that increases cartridge capacity over the IBM LTO Ultrium 400 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.

### **LTO WORM media support**

The IBM 3589 Ultrium 800 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 4 Tape Drive to help prevent the alteration or deletion of user data. IBM Ultrium 800 GB WORM Data Cartridges can be ordered as unique 3589 models and have 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 800 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 Enterprise Tape Cartridge 3592 Extended-JB, it provides a native cartridge physical capacity of up to 700 GB (2.1 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 Statistical Analysis Reporting System (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 JB tape cartridges to 120 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 120 GB, JB cartridge.

The TS1120 E05 Tape Drive allows an application to issue a command to scale the IBM TotalStorage® Tape Data Cartridge 3592 to 120 GB. You can order cartridges pre-scaled for 100 GB physical capacity 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/storage/tape>

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

### **3592 Tape Cartridge**

The TS120 Model E05 uses the IBM Tape Cartridge 3592 Extended Data (JB) or the IBM Enterprise Tape Cartridge 3592 (JA), which contain an advanced metal particle tape specifically optimized for the enterprise tape environment and provides a native physical cartridge capacity of up to 700 GB (2.1 TB with 3:1 compression) or 500 GB (1.5 TB with 3:1 compression).

The higher capacity tape cartridges are designed for applications such as archiving and data retention, as well as those applications requiring security or an audit trail. These cartridges work with the IBM System Storage TS1120 Tape Drive to help prevent the unauthorized access, alteration, or deletion of user data and are supported by the encryption capability in the TS1120 Model E05 Tape Drive and its associated Encryption Key Manager component.

Write-once, read-many (WORM) versions of the cartridges are also available in 700 GB (JX media), 500 GB (JW media), or 100 GB capacities. Economy cartridges, with a native physical capacity of up to 100 GB (300 GB with 3:1 compression), are also available.

### **TS1120 Tape Controller**

The **IBM System Storage TS1120 Tape Controller Model C06** is designed to provide better 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 of the IBM TotalStorage Enterprise Tape Controller 3592 Model J70. 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.

To control TS1120 or 3592 Tape Drives in a TS3500 Tape Library, the TS1120 Tape Controller must be installed in a 3953 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 Hardware Announcement [ZG06-0387](#), dated May 9, 2006. For additional information on the 3953 Tape Frame Model F05, refer to Hardware Announcement [ZG05-0327](#), dated May 10, 2005.

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## **Product positioning**

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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 and encryption, 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 is designed to address these requirements and can constitute a



functionally rich tape storage solution incorporating LTO Ultrium and 3592 tape technology. It is designed to give you the 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, IBM System z, or IBM System x products, and other popular open systems. The TS3500 Tape Library utilizes the 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/performance in the open systems environments where the tape automation requirements are satisfied by 1 to 12 drives or a library native physical capacity of up to 230 TB with Ultrium 4 media.

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 physical capacity of up to 182 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 Models 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.

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 additional capacity requirements, 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, IBM System Storage TS3200 Tape Library, and IBM System Storage TS3100 Tape Library.

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