

IBM TS7700 Virtual Tape Library

Highlights

- Mission-critical data protection and business continuance with 19” frame
 - Powerful, scalable and cyber-resilient grid
 - Seamless hybrid multicloud integration with Transparent Cloud Tiering
 - Cloud-Based Disaster Recovery for Tape
 - Flexible storage to pay for what you need
 - Simplify IBM Z tape operations and improve batch window performance
 - 100% data encryption, at-rest, in-flight and in the cloud
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Massive scalability and always-on data availability for IBM Z environments in the cloud era

More than 85% of enterprises around the world now operate in hybrid multicloud environments, and in the next few years nearly all will move to these architectures.¹ At the same time, mainframe utilization has remained robust – IBM Z mainframes process 30 billion transactions each day, including 87% of all credit card transactions on the planet.²

These major technology trends all point to one important conclusion – more companies than ever before need economical mainframe-optimized, tape-based data storage solutions that can help them leverage the advantages of the public cloud. The IBM TS7700 family of virtual tape systems is designed specifically to meet these business-critical requirements.

Mission-critical data protection and business continuance with 19” frame

The IBM TS7700 family of virtual tape solutions brings over 20 years of innovation and 13 years of industry leadership. TS7700 systems enable mainframe-centric enterprises to implement a fully integrated tiered storage hierarchy by leveraging powerful virtualization capabilities. Through the use of virtualization and disk cache, the systems operate at disk speeds while maintaining compatibility with existing tape operations. TS7700 helps to create a fully integrated tiered storage hierarchy that can take advantage of both disk and tape technologies to deliver high performance for active data and better economics for inactive and archive data now in a 19-inch industry standard rack.

Because of its deep integration with IBM Z, TS7700 systems offer powerful advantages and synergies over other storage systems. The TS7700 systems are IBM Z intelligent – no additional z/OS software is required to support them – while IBM Z enjoys full access to all IBM proprietary tape library command sets. z/OS sees the entire TS7700 grid instead of a series of independent tape libraries.



Powerful, scalable and cyber resilient grid

TS7700 solutions can leverage the power of grid architectures that allow interconnection of up to eight systems in a grid configuration. This TS7700 function is comparable to IBM Metro Mirror and IBM Global Mirror. Because TS7700 systems typically reside in different locations to provide better availability and disaster recovery, grid communication is designed to help keep data available, even when a site experiences an outage. Once any cluster puts a volume in the cloud, all clusters (existing and future) in the same grid will have immediate access to the volume from the cloud, whether grid replicated or not, granting full grid awareness.

The grid helps maintain availability during planned maintenance, service or system upgrades, or unexpected outages and helps avoid the physical transportation of tape cartridges in the event of a disaster. The grid configuration also allows administrators to use TS7700 systems as archival solutions with full back-end physical tape functionality.

TS7700 grids offer multiple modes of synchronous and asynchronous replication. This can be assigned to volumes through an IBM Data Facility Storage Management Subsystem (DFSMS) policy providing flexibility in implementing business-continuity solutions.

Seamless hybrid multicloud integration with Transparent Cloud Tiering

TS7700 virtual tape solutions offer the capability to incorporate a public cloud storage tier through the power of Transparent Cloud Tiering (TCT) technology. TCT provides direct data transfer to multicloud environments for long-term data retention. TCT for virtual tape enables an alternative storage tier offering massive storage capacity for backup and recovery purposes. The technology supports a choice of multicloud options, and it allows direct attachment to physical tape for cost-effective long-term data retention.

TCT leverages existing TS7700 infrastructure for investment protection. It uses the existing Ethernet ports; includes encryption, auditing, and security features; it integrates with IBM Cloud Object Storage and can also provide transparent connectivity to IBM Cloud, Amazon S3 and another IBM TS7700 configured as an object storage target.

Thanks to deep integration with z/OS, TCT provides up to 50% savings in mainframe CPU utilization when migrating large datasets as compared to other traditional archiving methods.⁴

With TCT, the challenge of keeping up with explosive data growth becomes much more manageable. In fact, thanks to the scalability of cloud resources, enterprises can meet data growth challenges without significant capital investments. This highlights a powerful advantage of cloud storage – cost.

TS7700 systems with TCT offer powerful new solutions for unstructured data as well. On average, unstructured data is moved 10 times within different storage tiers during its lifetime.⁵ The ability to quickly move data where and when required is crucial to deriving business value from growing unstructured data sets. TCT enables TS7700 users to determine where file system data should reside and create policies to automatically move the data. This capability allows for informed decisions concerning when and how enterprise data is moved and how to most effectively migrate the data to the appropriate storage tier, keeping costs lower and storage utilization optimal.

Object storage offers many advantages for unstructured and less active data sets. TCT integrates well with IBM Cloud Object Storage, which can provide the foundational object storage layer for on-premises private cloud implementations or be used to build an off-premises object store using public cloud resources.

Cloud-Based Disaster Recovery for Tape

Ensure your critical data is available where and when it is needed while building up your grid. TCT offers an excellent solution for increasing cyber resilience by making use of the immutability features provided by cloud repositories. It can also be used to create offline point-in-time data backups to the cloud which can then be restored to an empty TS7700 cloud connect system. This dovetails nicely with new cloud-based disaster recovery capabilities for IBM VTL and tape solutions. Data sets can now be restored to an empty TS7770/60 system outside of the grid using Cloud Connect technology. As volumes are created in a grid, TS7770 Cloud Connect copies them to the assigned cloud pools where they can be managed by the Data Facility Storage Management Subsystem (DFSMS). Version retention is enabled within each cloud pool, allowing previous versions to be retained long enough to meet any requirement. These new capabilities are supported in IBM Cloud, AWS S3, IBM Cloud Object Storage on-prem, and RStor.

Flexible storage to pay for what you need

TS7770 offers a smaller footprint and lower entry cost option, as well as flexible deployments designed for organizations of different sizes with different needs. The powerful capabilities of IBM's virtual tape are delivered as prepackaged racked solutions or client-supplied 19" industry-standard rack configurations. This capability enables clients to order one TS7770 Server 3957 Model VED, one Cache Controller 3956 Model CSB, and up to nine Cache Module Model XSBs, as well as all other associated features to be installed in their own client-supplied rack.

Also, the TS7700 family has the ability to increase capacity in 20 TB and 100 TB increments concurrently on the new TS7770 cache subsystem using larger 10 TB 7.2K SAS Drives with 157 TB usable capacity per drawer pair. The TS7770 delivers up to 2.36 PB with one expansion frame and 3.94 PB with two expansion frames.



IBM TS7770 19" industry standard rack mount configuration

Enhanced modern data protection and retention

For long-term data retention, TS7700 solutions can be directly attached to physical tape storage. The systems write data to high-capacity, high-performance IBM TS1150 and earlier IBM TS1100 Series tape drives installed in IBM TS4500 and IBM TS3500 tape libraries.

Data security is another area of enhancement within the Storage for IBM Z ecosystem. TS7700 supports the IBM Z suite of data protection technologies collectively labeled “pervasive encryption.” Essentially, pervasive encryption means that IBM Z and integrated systems such as TS7700 now encrypt data at the host level, in-flight across the network over Ethernet and at rest in storage. By adding SP 800-131A compliant encryption, in-flight encryption can be extended between DS8900F arrays and all individual VTL systems in a TS7700 grid. And because there’s no need to configure key groups, key managers, or other configurable items, encryption is now even easier within mission-critical, hybrid multicloud environments.

Replication in the grid cloud is handled through Secure Sockets Layer (SSL) transmission over Ethernet. SSL cryptography uses public and private keys to create the secure link between clusters, protecting data in flight from unauthorized access. AES-256 disk-based encryption is used for data at rest within the disk cache repositories. IBM Security Key Lifecycle Manager can generate and manage encryption keys for both disk and tape drives across the enterprise. This feature delivers advanced, federated, cross-domain key management designed to help lock down organizational data more comprehensively and easily than ever before.

TS7700 systems also offer Secure Data Erase to manage the security of old data. To help support the long-term retention of reference data and meet requirements of regulatory bodies worldwide, microcode capabilities enable TS7700 solutions to support a virtual equivalent of write-once-read-many (WORM) functionality. Of course, tape offers the advantage of portability,

which allows for a physical “air gap” between data and online hackers, providing a uniquely effective safeguard against cyber attacks.

Simplified storage management

TS7700 systems are designed with automated tools and an easy-to-use, web-based user interface for management simplification. TS7700 allows users to store data according to how valuable it is to the organization and how quickly it needs to be accessed, resulting in significant operational cost savings compared to traditional disk-only solutions while improving overall tape processing performance.³

TS7700 systems incorporate extensive self-management capabilities to help reduce the complexity of business continuity/disaster recovery procedures. The systems can improve storage efficiency by providing tape operations at disk speeds, enabling optional policy-managed hierarchical use of cost-effective physical tape – and now the ability to leverage public cloud-based resources as well. Tape and cloud workloads running at disk speeds can meet the most demanding recovery point objectives and times (RPO/RPT), allowing workloads traditionally retained in primary mainframe-attached disk to move to tape, which can significantly reduce overall costs. And TS7700 enables efficiencies such as impressive zero recovery point objectives, thanks to its synchronous copy capabilities. These combined benefits make TS7700 an attractive repository for all workload and data types, as well as for demanding RPO/RPT requirements.

A web-based graphical user interface (GUI), based on the interface used in several other IBM storage solutions is provided to configure and monitor TS7700 systems. The GUI can be used to access information such as the current system status and resource usage statistics. This interface has been designed to make configuring and managing TS7700 solutions more efficient while also helping reduce the time needed to train new administrators.

Dynamic Disk Pools & Multi-Pool support

TS7700 Dynamic Disk Pools improve data availability by minimizing the rebuild time after a disk drive failure. By distributing the rebuild workload across a pool of drives, the impact of the process is greatly reduced. The Dynamic Disk Pool feature distributes data, parity information, and spare capacity across the drives, while its intelligent algorithm defines which drives are used for segment placement – making sure data is fully protected.

TS7700 now can define multiple pools in the cloud. Each pool can be a unique bucket/vault/provider/location. Using policy management to direct a workload to a pool, this capability is excellent for multi-tenancy.

Optimized data compression

IBM has optimized data compression for TS7700 systems, which can significantly reduce storage requirements and network bandwidth, improve overall system performance, and of course reduce operating expenses. Also, TS7700 supports 16 Gb FICON connectivity, enabling IBM customers to exploit their most current FICON infrastructure and maximize FICON throughput to IBM Z.

In addition to the standard compression built into the FICON adapters used in TS7700 systems, two enhanced compression options are available to balance performance demands with storage requirements – LZ4 compression and ZSTD compression algorithms. Now, the maximum TS7700 usable disk capacity of 3.94 PB can hold over 19 PB using 5:1 compression, depending on which compression method is used.

Up to 20 GB/sec of throughput and over 19 PB of compression-enhanced storage capacity, allowing mainframes to send more data faster while reducing the CPU utilization associated with data management.

Improving compression, IBM DS8900F has added the capability to compress data prior to transfer across TCP/IP connections to TS7770/60 systems configured as Object Storage targets. This new feature offers multiple benefits. The compression engine – and in fact TCT itself – does not affect overall system IOPS. No additional servers or gateways are needed. After compression, less network bandwidth is required to move data, which can increase performance across multicloud environments. And essentially three times more data can be stored at the target system while potentially reducing CAPEX by 55% and OPEX over 3-year period by 44%.

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On-going innovation

IBM TS7770 is the latest member of the TS7700 family. It is designed to provide higher performance for active data while reducing the expenses associated with archive, data

retention, and backup operations behind IBM Z servers. Built with the most advanced POWER9 processors, it benefits from years of trailblazing research and deep collaboration between the IBM Storage and IBM Z teams to deliver unique business value for mainframe deployments.

The new TS7770 virtual tape systems combines all the family capabilities while offering several enhancements over previous models, including:

- Dual control security authentication with a “maker” and “checker” approach designed for multi-tenancy environments protecting cloud retention pools and expire/hold and duration enablement. It is deal for customers looking for an additional security level.
- Automated Grid Cloud Failover capabilities that help ensure data is available from anywhere at any time. This leading-edge technology provides nearly zero seconds failover across up to eight grid-linked TS7770 systems.
- Increased performance with new data offload functionality to supported DS8900F platforms
- 20% higher disk density thanks to new disk technology that also provides much longer data retention

Innovation drives competitive advantage. The new TS7770 demonstrates that innovation is alive and well within the IBM TS7700 family.

¹ IBM Institute for Business Value: [Assembling Your Cloud Orchestra](#), October 2018

² IBM: [2018 Annual Report](#)

³ IBM Systems Solution Brief: [IBM TS7700 grid solutions for business continuity](#), May 2016

⁴ *Results are based on internal IBM data measurements on an EC12 when migrating large data sets*

⁵ [Data Mobility solution factoid](#)

IBM TS7770 at a glance

Offering	TS7700 Base Frame (Racked solution, Single cluster configuration)	TS7700 Expansion Frame (One or two, Racked solution, per cluster configuration)	TS7770 Rack Mounted Client Supplied Rack Singles cluster configuration	TS7770 Racked solution 8-cluster grid Max configuration
Usable disk cache*	Up to 780 TB	Up to 3.94 PB	Up to 780 TB	Up to 31.52 PB
Tape Attach Support †	Up to 100 PB	Up to 100 PB	Up to 100 PB	Up to 100 PB
Cloud Attach Support †	Up to 100 PB	Up to 100 PB	Up to 100 PB	Up to 100 PB
Virtual Volumes ‡	Up to 4,000,000	Up to 4,000,000	Up to 4,000,000	Up to 4,000,000
Virtual drives	256 to 496	256 to 496	256 to 496	2,048 to 3,968
TS1100 (3592) tape drives §	4 to 16	-	4 to 16	4 to 128
16 Gbps FICON channels	Up to 8	-	Up to 8	Up to 64
Maximum logical paths	Up to 4,096	-	Up to 4,096	Up to 32,768
Warranty	One-year on-site repair			
Supported Environments**	IBM z/OS, IBM z/VM, IBM z/VSE, IBM z/TPF			

Physical specifications

Offering	TS7700 Base Frame (Racked solution, Single cluster configuration)	TS7700 Expansion Frame (One or two, Racked solution, per cluster configuration)	TS7770 Rack Mounted Client Supplied Rack Single cluster configuration (min config. / max config.)
Width	616 mm (24.25 in.)	616 mm (24.25 in.)	483 mm (19.0 in.) of each component
Depth	1,425 mm (56.1 in)	1,425 mm (56.1 in.)	Depth of the deepest component 3757-VED (p9 pSeries) from front to back of the cable management arm & cables in the arm 38.9 inches (98.8 cm)
Height	1,930.4 mm (76.0 in.)	1,930.4 mm (76.0 in)	2 disk module config. 18U in height Minimum configuration
			4 disk module config. 22U in height
			6 disk module config. 26U in height
			8 disk module config. 30U in height
			10 disk module config. 34U in height Maximum configuration
Weight	Max 735.3 Kg (1,621 lbs)	Max 929.3 Kg (2,049 lbs)	Min weight of components for configuration with 2 disk cache drawers is 243 kg (536.4 lbs)
			Max weight of components for configuration with 10 disk cache drawers is 456 kg (1,006 lbs)
Power consumption	Max 3480 watts	Max 4400 watts	Max 3480 watts
Power phase options	Single phase (240 V AC) or three phase (400 V AC)		Single phase only (240 V AC)
Power frequency	50 Hz - 60 Hz (+/- 3 Hz)		
Dry bulb temperature (recommended operating per range)	20°C to 25°C (68°F to 77°F)		
Relative humidity (recommended operating per range)	40% to 55%		

* Not all array cache capacity is usable. Cache capacities vary with grid configurations, including a combination of TS7720, TS7740, TS7760 and TS7770 models

† Maximum support is provided for EITHER Tape and/or Cloud attach

‡ 1,000,000 default Virtual Volumes

§ Tape support is optional

** Refer to [IBM Knowledge Center](#) for minimum software-level requirements and specific function or feature support

Why IBM

TS7700 virtual tape solutions enable multicloud architectures that help lower storage costs and increase overall system performance. And TS7700 offers powerful advantages in IBM Z environments. This success is the result of more than six decades of commitment to the technology and the adoption and execution of a product strategy based on innovation, continual improvement, and constant communication with business partners and customers. IBM TS7700 leverages these advantages, providing even more reasons for mainframe-powered enterprises to choose IBM tape solutions.

For more information

To learn more about IBM TS7700, please contact your IBM representative or IBM Business Partner, or visit:

ibm.com/products/ts7700

Additionally, IBM Global Financing provides numerous payment options to help you acquire the technology you need to grow your business. We provide full lifecycle management of IT products and services, from acquisition to disposition. For more information, visit:

<https://www.ibm.com/financing>

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