

Comparison of Native Fibre Channel Tape and SAS Tape Connected to a Fibre Channel to SAS Bridge

White Paper



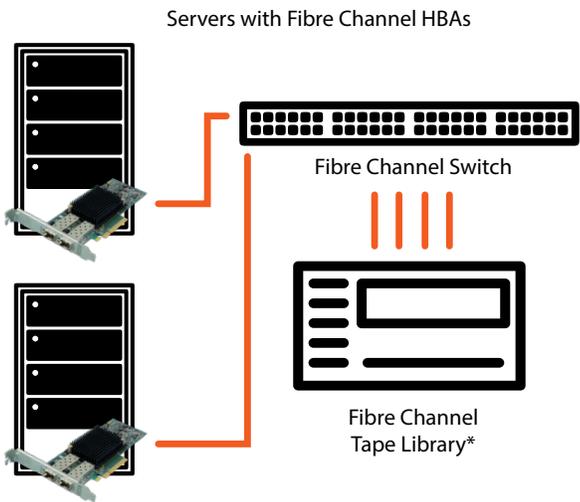
The Power Behind the Storage

Introduction

IT Managers may approach backing up Storage Area Networks (SANs) with the idea of purchasing native Fibre Channel tape drives or libraries. This paper examines the technical and economic considerations of implementing an alternative solution for SAN backup and archive; a Fibre Channel-to-SAS Bridge powering SAS Tape drives or libraries. Considerations of which solution to implement will be identified and the benefits of each will be compared on the basis of performance, availability, connectivity, manageability, intelligence and cost.

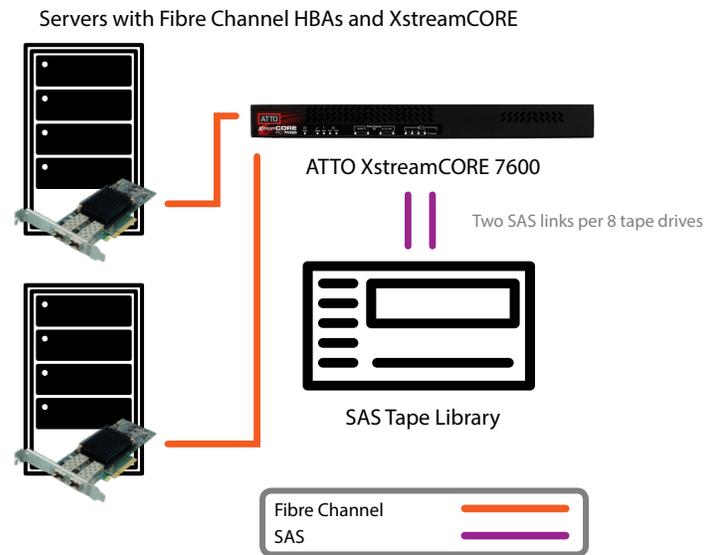
Although the native Fibre Channel tape options may appear to be less complicated, bridging devices utilizing SAS tape drives, such as an ATTO XstreamCORE® FC 7600, provides significant advantages.

Native Fibre Channel Tape Implementation



* One Fibre Link Per Tape Drive

Fibre-to-SAS Tape Implementation



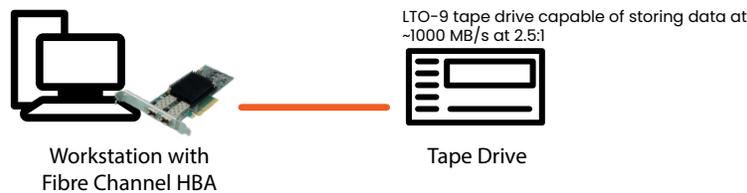
Two SAS links per 8 tape drives

Data Center Ready

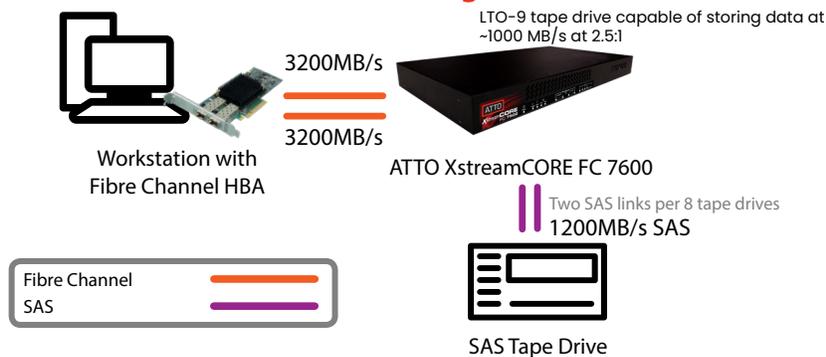
The explosion of Big Data and the need to store critical digital content at the petabyte level and beyond are forcing organizations to look beyond traditional storage solutions. By 2024, the amount of stored data is projected to reach 8.9 ZB worldwide. As tape capacities grow, new tape technologies are continuing to emerge to help solve today's growing data needs. Tape is quickly becoming the de facto standard for Big Data storage solutions, and new tape drive densities are pushing the archive in new directions. According to Gartner tape is in heavy use for enterprise backup with 78% of companies polled use tape in their data center. Data rates are doubling every two years and enterprises expect to manage 50x more data and files and expect growth to be over 75x more data in the next decade.

The tape industry has successfully re-architected itself delivering compelling technologies and functionality including steady LTO capacity increases with 2.5x compression, the lowest TCO, a higher ROI, a much longer replacement timeframe than HDDs and faster data transfer rates than any previous tape or HDD, making it the ideal medium for backup and archival of data for corporate or regulatory compliance purposes. Technology improvements over the past decade have vaulted LTO tape into the top reliability spot with a BER (Bit Error Rate) of 1×10^{20} , four orders of magnitude more reliable than HDDs at 1×10^{16} . Media life for LTO is rated at 30 years or more making it well suited for long-term archival storage applications. Tape capacity and data rates have soared reaching reached 18 TBs native capacity (45 TB compressed) on the latest LTO-9 drives delivering faster data rates than any HDDs. Robotic tape library capacities have surpassed one exabyte (1×10^{18}) becoming the first exascale storage system.

Native Fibre Channel Tape



Fibre to SAS Bridge



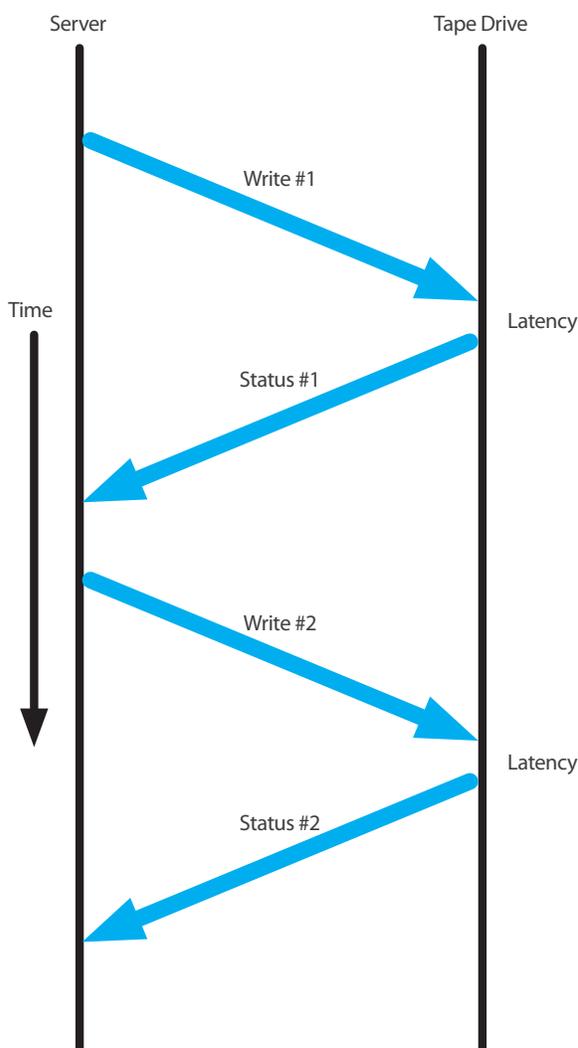
Performance

There is a common misconception that native Fibre Channel devices can outperform SAS drives. The reality is that the type of interface used by the drive does not change its ability to write or read data to tape. Tape performance is a function of how fast the drive can move data from its input buffers to the media, not the speed of the interface itself. So the fact that a 32Gb Fibre Channel LTO drive has a faster interface than a 12Gb SAS drive never comes into play.

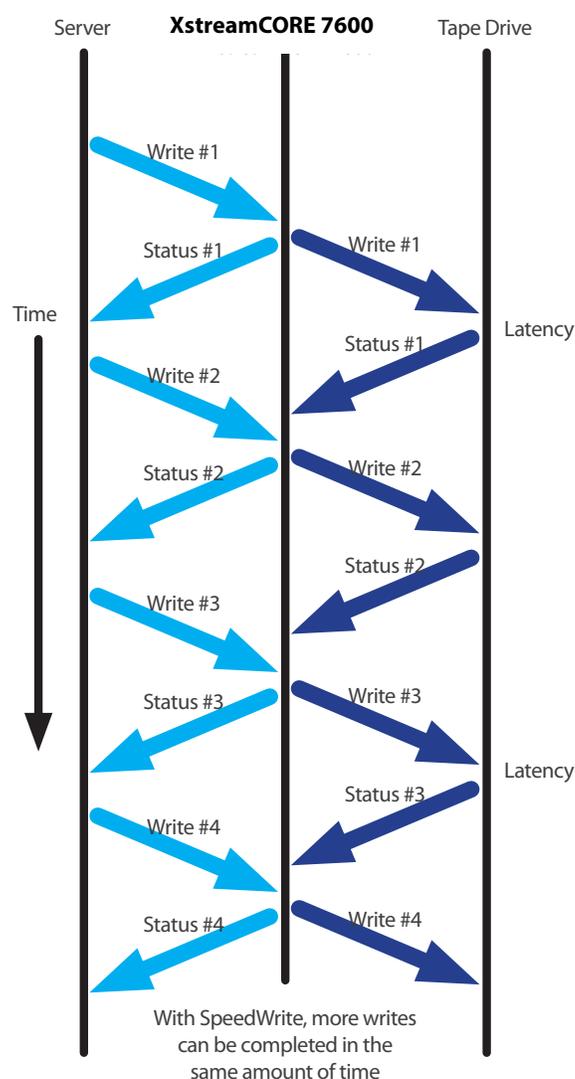
Regardless, the task of using a backup application to write a block of data to tape, even compressed, will not reach maximum performance. Most applications only use one outstanding command at a time and usually only send 64K of data in each block. ATTO XstreamCORE® FC 7600 actually increases performance by utilizing its SpeedWrite™ function. The bridge will buffer up write commands as well as data to effectively allow more than one command to be outstanding at any point in time. The result is that a host can issue new write commands to an XstreamCORE SAS target in faster succession than is possible with standard architecture. The path between the host and the controller is continuously filled with data, reducing the latency associated with pauses. This leads to 25% better performance over direct-attached tape drives.

The controller also provides value in that it can balance the performance to multiple drives concurrently.

Server to Native Fibre Channel or Ethernet Tape Commands



Tape Commands using SpeedWrite™ in the XstreamCORE® FC 7600



Availability

End users tend to lean toward native Fibre Channel tape drives because they feel they have the ability to design for multiple redundant paths into the drives which will increase the probability that unattended backups will complete overnight. Fibre Channel SANs do offer an easy way to allow multiple connections and redundant paths between servers and tape drives. Some native Fibre drives even come with two independent ports.

What customers do not realize is that they can get a similar level of redundant paths using an ATTO XstreamCORE® with SAS tape drives. The front end of the bridge has two or four independent Fibre Channel ports. Each SAS tape drive can be mapped to all ports providing two to four independent paths for each drive.

By assigning a standby port, the XstreamCORE FC 7600 increases data reliability through available redundant paths. Should an error occur with one of the active ports, data can be automatically re-routed to the standby port. This provides additional data redundancy and improved disaster recovery for backup systems.

The controller itself does present a single point of failure (as does a single Fibre Channel switch) but the failure rate of this device compared to the tape drives, media, cables, optical transceivers and everything else in the configuration is relatively low.

Manageability

Native Fibre drives do not provide very comprehensive management capabilities. In fact, most allow only limited capabilities in-band over the Fibre Channel link. Specialized management software packages need to be purchased to query the status of the drives. Since each drive is connected directly to the SAN, administrators need to manage each drive independently, again increasing equipment and management costs.

ATTO XstreamCORE products allow for consolidated management of all drives and the media changer in one place using the ATTO XstreamVIEW™ System Manager browser-based remote monitoring and management GUI. This tool is supplied with every bridge at no additional cost and includes such features as SNMP monitoring capabilities, extra-large advanced event and error logging with SNTP-based time stamp recording, link up/down monitoring; SAS drive health monitoring, temperature and voltage monitoring and many more easy-to-use configuration capabilities. In addition, XstreamCORE allows for in-field troubleshooting and diagnostics via a built-in trace log that provides bus analyzer-like capabilities. A key total cost of ownership factor to consider is how long it takes to identify and resolve an issue once a hardware failure occurs. The troubleshooting assist capabilities provided in XstreamCORE products can reduce down time considerably.

XstreamCORE can also communicate in-band over the Fibre Channel link to provide monitoring and management for customers who already have Fibre Channel SAN management tools in place.

Intelligence

SANs are one of the leading methods to implement cloud-based, virtualized server and other high-end enterprise server/storage based environments and customers need to use special purpose-built products to manage these installs. Adding intelligence is the key to adding value to the network.

XstreamCORE features a more efficient architecture that separates data traffic from services and features removing any non-data request from the data path to maintain a consistent level of latency and performance. ATTO xCORE Acceleration Engine was developed to handle the majority of I/O operations in a hardware processing pipeline without software intervention. xCORE manages all I/O, command routing and decoding, buffer allocation, reservations, access controls and provides real time data analytics. Any exception is off-ramped to the ATTO eCORE Control Engine to manage commands which do not require acceleration, enabling it to achieve 1.1M 4K IOPS or 6GB/s throughput per controller while adding a consistent two microseconds of latency.

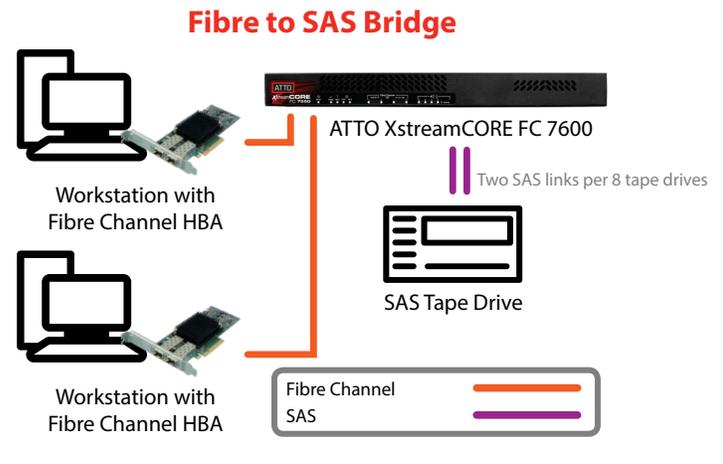
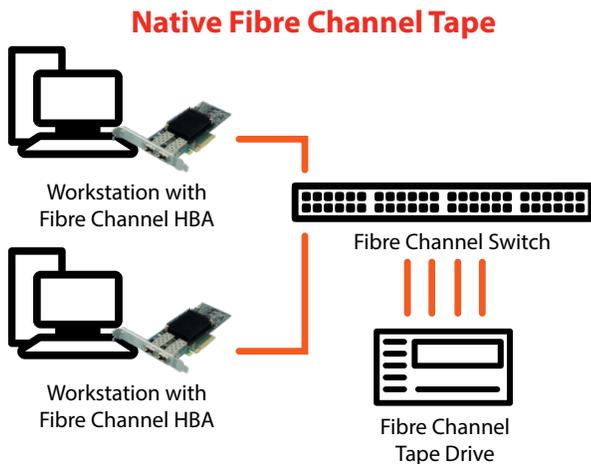
The intelligence ATTO XstreamCORE products add to managing the backup environment is one of the most significant benefits over native Fibre Channel tape. Some of the benefits provided by the bridge include:

- ATTO xCORE Data Acceleration manages the data path and assures that all reads and writes are processed as fast as possible.
- I/O Acceleration with ATTO xCORE technology featuring multiple hardware acceleration engines.
- ATTO eCORE virtualizes a common set of services and features
- ATTO Drive Map Director™ simplifies mapping and reduces maintenance costs for storage.
- ATTO Data Mover technology improves storage performance while reducing compute, memory and network utilization.
- Web based ATTO XstreamVIEW™ system manage.
- Persistent Event Log gathers at least 40,000 hardware, software and network events.
- SNMP, SNTP, Telnet, FTP, iCMP

Cost

System Administrators need to consider the entire cost of the solution when comparing native Fibre Tape to a Fibre Channel-to-SAS Bridge. On average, a native Fibre Channel tape drive costs around \$1200 more than the same drive with a SAS interface. Each native drive requires a dedicated Fibre Channel switch port. At approximately \$2000 per port this can add up quickly. The need for additional Fibre Channel cables and optical transceivers also results in a considerably higher native Fibre Tape solution cost.

Consider the following real life example. A user with a tape library that houses eight LTO-9 drives wants to create a managed backup solution that runs from two servers at the best possible performance.



Estimate Differential Cost Analysis Mid Range Tape Libraries		
Cost Component	Native FC Tape	ATTO XstreamCORE FC 7600 Solution
Tape library with media changer	Same	Same
Two (2) Servers	Same	Same
Two (2) Fibre Channel Adapters	Same	Same
Tape Drive Cost FH (4)	\$35,000	\$25,000
FC Switch	\$35,000	\$0
Additional Hardware/ Interconnects	6 @ \$500 = \$3,000	2 @ \$500 = \$1,000
XstreamCORE® FC 7600	\$0	\$12,000
Optical Fibre Channel Cables	6 @ \$90 = \$540	2 @ \$90 = \$180
SAS Cables	\$0	1 @ \$50 = \$50
Total on Differences:	\$73,540	\$38,230

Estimate Differential Cost Analysis Large Scale Tape Libraries		
Cost Component	Native FC Tape	ATTO XstreamCORE FC 7600 Solution
Tape library with media changer	Same	Same
Two (2) Servers	Same	Same
Two (2) Fibre Channel Adapters	Same	Same
LTO-9 Tape Drive Cost FH (8)	\$65,000	\$48,000
FC Switch	\$35,000	\$0
Additional Hardware/ Interconnects	10 @ \$500 = \$5,000	2 @ \$500 = \$1,000
XstreamCORE® FC 7600	\$0	\$12,000
Optical Fibre Channel Cables	10 @ \$90 = \$900	2 @ \$90 = \$180
SAS Cables	\$0	2 @ \$50 = \$100
Total on Differences:	\$105,900	\$61,280

It will cost approximately 70% more to implement a Fibre Channel Tape Backup solution using native Fibre Channel drives compared to using a Fibre Channel-to-SAS Bridge, such as the ATTO XstreamCORE® FC 7600.