The Tape Renaissance

By: Fred Moore
President, Horison Information Strategies
www.horison.com
HORISON Information Strategies

The magnetic tape data storage industry has withstood numerous challenges from its own past performance, from the HDD industry, and mainly from those who are simply uninformed about the major transformation the tape industry has delivered. Early experience with non-mainframe tape technologies were troublesome and turned many data centers away from using tape in favor of HDDs. Mainframe tape technology was more robust. Many data centers still perceive tape as mired in the world of legacy tape as a result. However, this view is completely out of date.

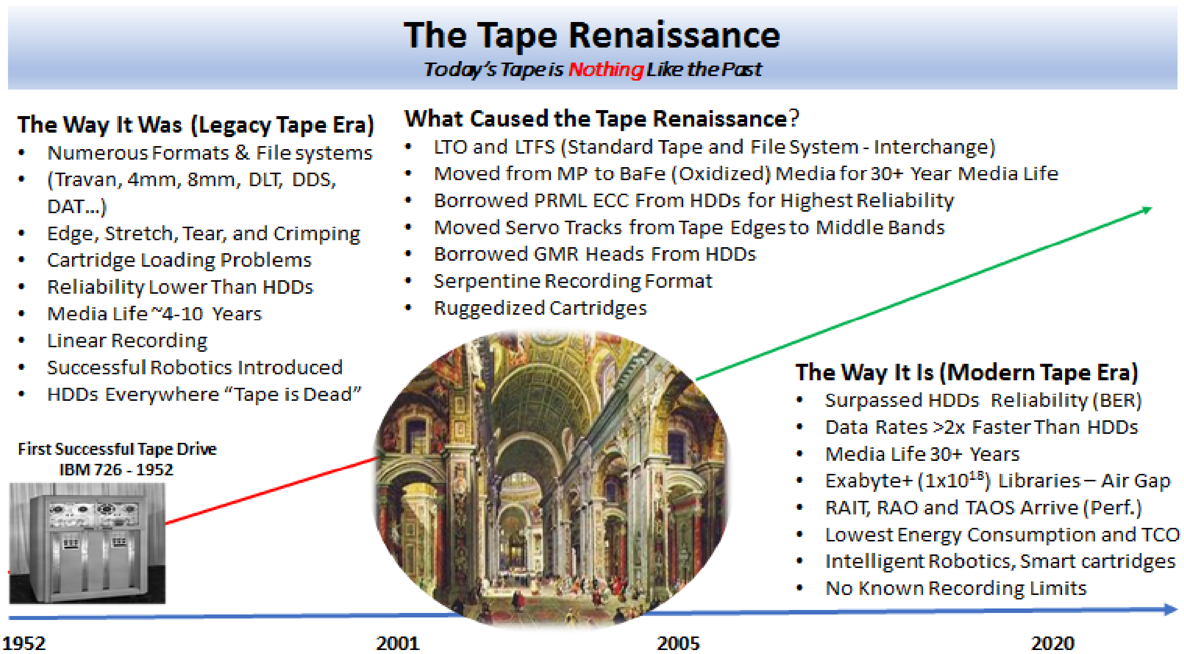
The Legacy Tape Era

The tape problems of the past were numerous and resulted in time-consuming reliability and management issues. Edge, stretch, tear, cartridge load problems and crimping were common. The servo tracks were written on the edge of the tape media and dropping a cartridge often meant damage to the servo leaving a non-readable tape. Metal particle (non-oxidized) media life was typically 4-10 years before concerns about re-readability arose. As the issues persisted, the HDD industry took advantage of these concerns and actively pronounced “tape is dead”.

The Tape Renaissance Changes the Game

The advent of LTO (Linear Tape Open) from the LTO consortium marked the beginning of the tape renaissance. LTO was originally developed in the late 1990s as an open standard alternative to the numerous proprietary magnetic tape formats that were available at the time. Today, Hewlett Packard Enterprise, IBM, and Quantum comprise the LTO Consortium, which directs development and manages licensing and certification of media and mechanism manufacturers. The standard form-factor of LTO technology is named Ultrium and the original LTO-1 version was released in 2000 with a 100 GB native cartridge capacity. The eighth generation of LTO Ultrium was announced in Oct. 2017 and can hold 12 TB native (30 TB compressed) in a cartridge the same physical size as LTO-1.

The LTO program borrowed many key technologies from the HDD industry and the renaissance was underway. Tape error recovery and reliability was greatly enhanced with PRML (Partial response maximum likelihood) ECC (Error-correcting code) which converts a weak signal from the head of a magnetic disk or tape drive into a much stronger digital signal. Servo tracks were moved to the middle of the tape from the edges improving track following while avoiding any potential damages to the servo if the cartridge was dropped. GMR (Giant Magneto Resistive) read/write heads, a mainstay with HDDs, were implemented in tape and were superior to conventional MP (Metal Particle) heads because they are more sensitive and can detect much weaker and smaller signals further improving reliability. Barium ferrite (BaFe) media arrived with LTO-6 and offered greater capacity, superior performance, and much longer archival life compared to legacy metal particle (MP) tape. Barium ferrite media is oxidized and has a media lifespan of 30 years or more and provided for much higher recording densities. Laboratory demonstrations using barium ferrite have indicated cartridge capacities of over 200 TBs are achievable. Beyond barium ferrite, strontium ferrite is in the labs promising even higher capacities. The modern tape era had arrived.



The Modern Tape Era

The reliability changes engineered from the tape renaissance vaulted tape into the top spot in storage device reliability with a BER (Bit Error Rate) of $1x10^{19}$, three orders of magnitude more reliable than HDDs at $1x10^{16}$. Tape data rates have soared and reached 400 MB/sec. on the latest TS1160 enterprise drive, more than twice the data rate of most HDDs. INSIC projects tape data rates to be as much as 5x greater than HDDs by 2025. Robotic tape library capacities have exceeded one exabyte ($1x10^{18}$) capacity levels.

Tape is a sequential access device however the access time to the first byte of a file and data rates have seen major improvements. Performance optimization techniques RAO (Recommended Access Order – enterprise tape) and TAOS (Tape Based Access Order System – LTO tape) generate the best access order to minimize physical tape movement times between files. RAIT (Redundant Arrays of Independent Tape) provide higher aggregate data rates by striping files across multiple drives for parallel data transfer while offering fault tolerance for higher availability. Tape continues to be the greenest (lowest energy cost) of all storage technologies and many industry studies indicate the HDD TCO to be 6-15x higher than tape.

Fighting the cybercrime epidemic has become a major problem for most data centers and tape can play a key role in its prevention. The Tape "Air Gap" is an electronically disconnected copy of data that prevents cybercrime disasters from getting to all your backup copies. You can take advantage of an electronic air gap between your backup server and backup tape storage by ensuring that backup copies are not accessible via any network or electronic connection. Most tape cartridges typically reside in library racks meaning they are offline well over 95% of the time and they are protected by the air gap and therefore are not electronically accessible to hackers.

Bottomline: Where is your perception of tape? If it is still mired in the out of date legacy era, it's time to update that perception and prepare to take advantage of the many benefits tape can bring to your storage infrastructure. BTW – the benefits of the renaissance are compelling - tape is not dead!