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Magnetic Tape Makes a Comeback October 2017

When I started using computers at Bell Telephone Laboratories in the early 1960s, computers didn't have hard disks. The only means for storage was magnetic tape. And back then, magnetic tape didn't come in small convenient cartridges. It came in big reels that were handled by even bigger tape drives.



To prevent damage to tapes, the tape was moved past the read/write head via air columns. Tape from both the source reel and the take-up reel dropped into air column compartments. When the air column in the take-up compartment sensed that the tape was reaching its bottom, the take-up reel would be put into motion to wind the tape until it reached an upper level in the take-up compartment while the source reel would unwind more tape into the source compartment.



Economist

Tape is the oldest computer storage media still in use. It was introduced in 1951 in Univac computers. With the advent of high capacity hard disks and innovations such as cloud storage, tape sales began to fall in 2008. But in 2012, they started rising again. With so much data being created by mobile devices and sensors, there grew a need for an economic and efficient way to archive all of this data. Magnetic tape fills that need. A recent study showed that 77% of all companies use tape for backup and archival.

The Data Explosion

Data from digital sources is growing at a rapid rate. It is doubling every two years. This data needs to be stored, and this is reviving a technology – magnetic tape – that was deemed dead just a few years ago due to the falling prices of high capacity disk drives..

But now firms are reevaluating their move away from tape. Tape shipments are growing at a robust rate. Tape storage is seeing a resurgence as organizations grapple with the regulatory requirement for backing up big data. In addition, it is the ideal storage device for long-term archival of data. Tape storage libraries are still one of the most common methods used by companies to store massive amounts of this data.

Approximately 76,000 petabytes of compressed data was stored on tape in 2015, a 17.5% increase over that stored in 2014 (a petabyte is one million billion bytes!). Cloud vendors are looking at tape to provide the capacity they need for archival and backup. Many firms are transporting archival data to the cloud via tape as networks are too slow to handle the high volume.

LTFS – The Linear Tape File System

The Linear Tape File System (LTFS) is a recently adopted specification that allows files to be stored on magnetic tape and to be accessed in a similar fashion as those on disk drives by providing an index of files stored on the tape. With LTFS, files and objects can be stored on tape with no need for backup software.

While LTFS can make a tape appear to behave like a disk, it does not change the fundamentally sequential nature of tape. Files are always appended to the end of the tape. If a file is modified and overwritten or removed from the volume, the associated tape blocks used are not freed up. They are simply marked as being unavailable.

In spite of these disadvantages, there are several cases where LTFS formatted tape is superior to disk. While seek times range in the seconds, the streaming data transfer rate can exceed disk transfer rates. Additionally, tape cartridges are easily transportable. The ability to copy a large selection of files (up to 2.5 terabytes) to an LTFS formatted tape allows easy exchange of data or the archiving of large files.

Does Tape Have Advantages Over Disk?

Tape has several advantages over disks for the long-term preservation of data:

1. Speed – Reading from tape is about four times faster than reading from a hard disk. Writing to tape is significantly faster than writing to disk.
2. Reliability – When a tape snaps (which hardly ever occurs), it can be spliced back together, perhaps losing a few hundred megabytes of data at most. When a terabyte hard disk fails, all data is lost.
3. Power - Tapes do not need power to preserve the data held on them. Stopping a hard disk increases the chances that it will fail.
4. Security – Hackers can't break into tapes that are not mounted. Hacking of data on disks is an all-too-frequent occurrence.
5. Spinning disks require over 200 times more energy than tape drives.
6. Hard disks cost about fifteen times more than tape.

The majority of problems with tape backup systems are caused by human operators. Backup software is often too complex for many system operators. In those cases where a backup could not be restored, it was seldom due to the tapes. It was often because someone used damaged tapes or because the tape drives had not been properly maintained.

Sony's Technique to Substantially Expand the Capacity of Magnetic Tape

Back in 2010, the record for how much tape could store was 29.5 GB per square inch. A Blu-ray optical disk can hold about 25 GB per layer (up to four layers are available).

Although cloud storage and hard disks are convenient, Sony's new tape can store 145 GB per square inch. This leads to a capacity of 185 TB on a single tape cartridge, equivalent to 3,700 50 GB Blu-ray disks. This is 74 times the amount of storage available on a standard tape cartridge.

Sony achieves this high capacity via a process it calls 'sputter deposition.' A uniform distribution of nanosized magnetic particles is created on tape which also has a magnetic under layer. The average size of a nanosized magnetic particle is about 7.7 nanometers. Sony creates the nanosized magnetic particles by firing argon ions at a polymer film substrate.

Future data centers will probably use a mix of these new supercharged tapes and disks.

HPE's Tape System

HP StoreEver Storage delivers LTO-6 (Linear Tape Open) innovations that meet 'big data' protection and retention requirements more efficiently than disk. The HP StoreEver solution tape portfolio features sixth generation LTO-6 technology that delivers twice the capacity and 44% more performance than LTO-5 in the same footprint.

An HP cartridge can store 6.25 TB of data when using 2.5:1 compression. It delivers a transfer rate of 1.44 TB per hour.

HP's tape library accommodates more than 44 petabytes of data.

Summary

It was not too long ago that magnetic tape as a storage device was thought to be dying out. With today's current needs for backing up and archiving massive amounts of data, tape has found a new life. It will be with us for the foreseeable future.

Acknowledgements

Information for this article was taken from the following sources:

Magnetic tape to the rescue, *Economist*, November 28, 2013.

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Sony develops tech for 185TB tapes: 3,700 times more storage than a Blu-ray disk, *Extremetech*; May 5, 2014.

Tape Makes a Comeback, *Prosys*; undated.

Tape backup systems experience resurgence due to LTFS, big data, *Tech Target*; undated.

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Tape Data Storage Makes a Comeback, *Tech 60 Second Webinar*.