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## Highlights

- Help lower archiving and long-term retention costs by moving data to IBM tape solutions
  - Leverage the IBM strategy for tape media quality to provide enterprise-level reliability and stability
  - Rely on IBM leadership to drive ongoing tape innovation and improvement
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# Defining the future of tape

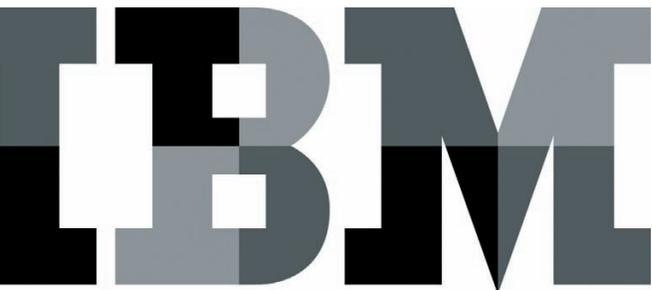
*The IBM strategy for tape media quality has resulted in decades of marketplace success*

Perhaps more than for any other data storage solutions, the quality of the basic tape media is crucially important.

There are a number of reasons why this is so. Because they are often used in the real-time operations of business-critical applications, mechanical disk storage and now NAND flash systems employ multiple layers of data protection such as RAID. Even if a flash page or an entire hard drive platter fails, data should never be lost or corrupted.

Tape is often used for various data backup and archiving. For these workloads, other data protection schemes are utilized to avoid or correct errors resulting from storage media failures. The responsibility for fidelity of the tape data storage medium itself is an extremely important factor with these workloads, especially over long retention time periods.

With more than half a century of tape storage experience, IBM is keenly aware of the importance of tape media quality. IBM, together with media manufacturers such as Fujifilm, has implemented a number of quality-control standards and ongoing innovations to help ensure that no matter when customers access their data stored on IBM tape systems—whether in minutes, months, years or decades—they can experience far fewer errors than with other digital media, along with maximum accuracy.





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Linear Tape-Open Ultrium 7 cartridge

## The vital roles of tape

In past decades, many IT industry analysts predicted the demise of tape-based data storage, but the opposite has come true. IT industry analyst Enterprise Strategy Group (ESG) notes: “Contrary to misconceptions that tape is an unreliable, slow, and antiquated storage technology, ESG is pleased to report that Linear Tape-Open (LTO) tape is thriving and has a bright future in organizations of all sizes, including some of the largest public cloud providers on the planet.”<sup>1</sup>

Tape, as a result, provides an outstanding data storage option to address a number of common enterprise IT challenges or “pain points”:

- Compliance with regulations governing the types of documents that require retention and the length of time organizations must keep them can become a significant cost burden. Tape can change this equation, helping drive archiving and compliance costs down to manageable levels.
- Like compliance, backup and disaster-recovery solutions are mandatory in today’s business world. And they can be expensive. Tape can significantly help lower backup and disaster-recovery solution costs.
- Data volumes are increasing explosively, while IT budgets remain essentially flat. The very low cost and high capacity of tape storage offers one of the most effective solutions to this challenge.

In fact, tape:

- Is used by the majority of the world’s large organizations<sup>2</sup>
- Is significantly less expensive than disk storage<sup>3</sup>
- Is orders-of-magnitude more reliable than disk<sup>1</sup>
- Can be used in production IT environments to lower costs in combination with new software-defined storage and flash-based architectures

In data archiving and long-term preservation use cases, tape offers many benefits over disk storage, as shown in Table 1.

	<b>Tape</b>	<b>Hard disk drives</b>
Media life	30+ years on all new tape media	Approximately 4 - 5 years for most disk drives before upgrade or replacement
Portability	Media completely removable and easily transported	Disks are difficult to remove and safely transport
Ease of movement in case of natural disasters	Tape cartridges can easily be moved with/without electricity	Difficult to move disks to remote disaster recovery sites without electricity
Power consumption for inactive data	No power consumption for inactive data. This is becoming a goal for most data centers—if data isn't being used, it shouldn't consume electricity	Disk requires power even with inactive data, except in the cases of MAID or "spin-up/spin-down" disks
Encryption for highest levels of security	Encryption is available on essentially all tape drives, with highest demand in mainframe and mission-critical environments	Becoming available on selected disk products, PCs and personal appliances

*Table 1.* A comparison of tape to hard disk drives

### **The IBM strategy: Quality**

IBM is the leading tape storage vendor on the planet, with twice the market share of any other vendor.<sup>4</sup> This success is the result of a more than six decades-long commitment to the technology; the adoption and execution of a product strategy based on innovation, continuous improvement and constant communication with business partners and customers; and a focus on component quality, especially the basic tape media.

The IBM tape media strategy consists of two complementary approaches. First, IBM prioritizes tape media quality. Second, IBM cultivates close communication and feedback from tape media vendors such as Fujifilm, which in turn drives innovation and ongoing product improvement. This partnership with media vendors has resulted in several technology demonstrations that confirm the great strength in IBM tape research as well as the extraordinary field quality of IBM tape solutions. One of the overriding features of the IBM strategy involves the stringent quality control of products being shipped with the IBM logo.

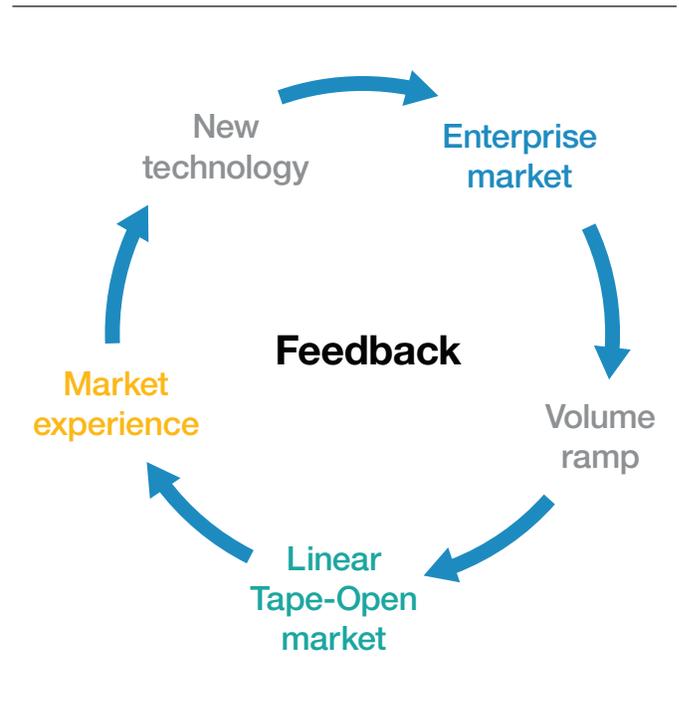
Not all tape solutions are created equal, and one of the most basic and powerful differences lies in the quality of the tape media itself. In fact, IBM designs tape drives specifically to maximize archive stability and the long-term reliability of the media.

It's important to keep in mind that LTO Consortium certification does not ensure media quality, only compatibility. "Interchangeable" does not mean "equal." IBM has implemented its own tape media quality control and processes, driven by quality specifications that go well beyond industry standards. For LTO Ultrium Generation 3 and higher tape drives, the IBM quality specification includes:

- 300 full-file passes (FFP), write or read
- 20,000 short section durability passes at all environments
- 20,000 load/unload cycles

IBM tape quality standards also involve continuous testing of new media with drives, new drives with media, and media in several environments.

The other component of the IBM tape strategy revolves around the connections between the enterprise tape market and the LTO tape market. Both dovetail nicely to provide long-term consistency and especially continuous improvement. The IBM strategy is to release new technology in the enterprise market space first. Releasing Barium-Ferrite (BaFe) tape developed in conjunction with Fujifilm into the enterprise market, followed by a release into the LTO market, is a great example.



The IBM tape quality strategy

The enterprise tape market tends to consist of larger customers who have good communication routes to IBM, which means that IBM can quickly get feedback and make any necessary adjustments in an agile fashion. When ready, the technology can then be released into the LTO market, which has much greater volumes. This provides more statistical data on how the technology performs and further drives quality improvements in both market segments. Once feedback is received, IBM can then create another turn in technology and start the cycle over again. This cycle of improvement provides differentiation for IBM tape solutions and is a key capability.

IBM prioritizes features that result in the longer life of entire tape systems, working with the tape media technology to select the best components for features such as trans-dimensional stability (TDS). This feature enables writing data to tapes in one environment such as hot and wet, then reading the data potentially years later in a different environment such as cold and dry. The IBM enterprise tape drive JD cartridge, for example, utilizes a substrate technology that minimizes media stretching or shrinking between environments, resulting in a more stable long-term tape archive.

The IBM strategy does not focus on point-in-time design. Tape-quality data measured at any one time is interesting, but good archive practitioners recognize that long-term consistency and a commitment to continuous improvement is a better strategy. IBM monitors many different characteristics of tape media—such as long-length durability testing, short-length durability testing, and green media testing—as well as the particular characteristics of media such as smoothness and electrical resistivity. A specific measurement will provide a snapshot of a current lot of tape media, but these tests don't give the whole story of a tape experience. Customers typically buy many lots of media and purchase tapes over different periods of time. A long-term consistency and continuous improvement philosophy is required to satisfy experienced tape customers.

### Tests confirm IBM strategy

Figure 1 provides another example, this time using green media testing, which involves running many brand new tapes in a single drive. This diagram shows test results from cartridges of two different vendors, with one of them (vendor A) starting to show problems around 200 cycles into the test. The tape drive was degraded by the new tapes so that it could no longer write the correct amount of data on tape cartridges, with the degradation commencing more clearly around 400 cycles into the test. This diagram shows data taken before the release of LTO Ultrium 7 products. Data was given to the media manufacturer, and again corrective action was taken.

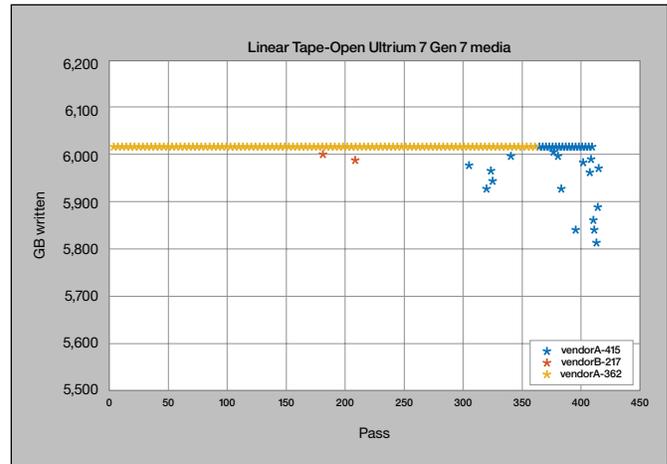


Figure 1. Green media test: Two vendors

The last two charts in Figure 2 show the latest status of IBM brand cartridges on the media manufacturing line running green media tests. The chart showing the amount of data written by the tape drive is boring—the tape drive consistently is able to write full capacity to brand new tape cartridges. The “head wear” chart is more interesting and shows an estimate of tape drive head wear resulting from continuously running new tape cartridges on a drive. Note that new tape cartridges are rougher and tend to get smoother with use, so a green media test is very effective at determining worst-case drive wear-out characteristics with media.

The diagram has a logarithmic axis for the number of cartridges, showing results for the first 350+ cycles and making a projection on head wear for future cartridges. The test results data points fall well below the performance threshold, indicating that media coming off the manufacturing line have good characteristics for the life of a tape system. Although the data is good, again, this is a point-in-time measurement and just a snapshot, not the whole story. IBM continues to monitor the quality of its products to ensure the best user experience possible.

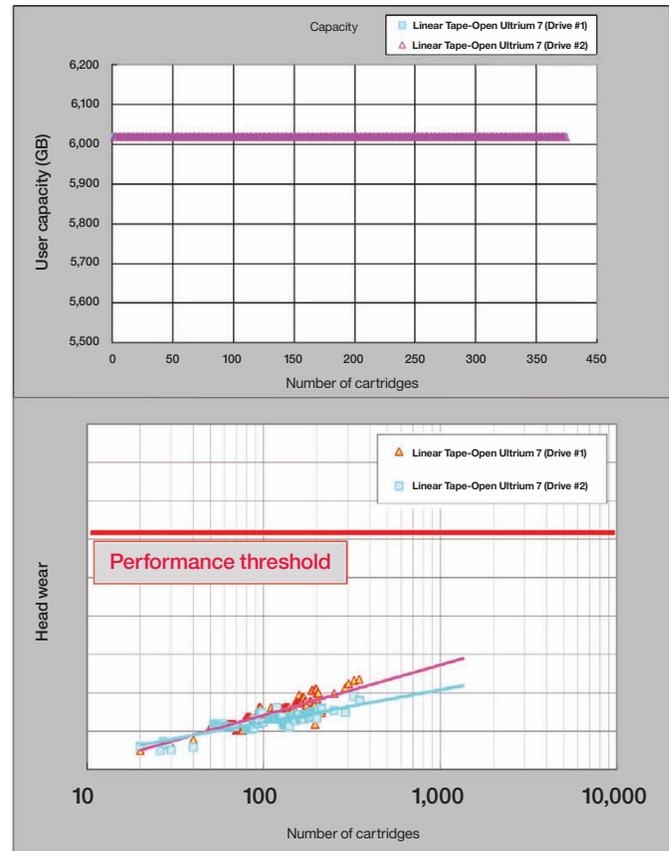


Figure 2. Green media test: The IBM brand

## Advantages of the IBM strategy

For IBM Business Partners and tape storage customers alike, the IBM approach to tape media quality provides a number of advantages:

- **Component optimization.** Deeply integrating and optimizing all components in the tape systems can result in lower risk of data loss, higher reliability, greater system stability, prolonged media life and optimal performance.
- **One hand to shake.** Because IBM supplies the complete tape solution, including drives, automation, media and software, customers benefit from a vendor that can provide an end-to-end solution for faster problem resolution.
- **Stringent quality control.** Constant testing of media and other tape system components helps increase the reliability and durability of IBM tape products—IBM brand tape media are tested against all IBM drive and library configurations.
- **Strong product warranty.** Warranties assure that IBM tape products will be free from manufacturing and materials defects for the life of the cartridge.
- **Confidence.** The IBM history with tape spans 65 years, so customers can have confidence in IBM experience and the IBM tape storage roadmap. Meanwhile the IBM knowledge base and media skills continue to grow.

## Quality matters

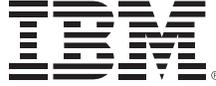
Industry analysts confirm that tape-based data storage solutions are, in fact, thriving in the 21st century. As ESG, in fact, notes: “Nothing is more cost-effective, reliable, or energy-efficient for long-term data retention than a tape in a library slot or on a shelf, and it continues to play a key role for organizations across the globe.”<sup>1</sup>

Decades of success in the tape storage marketplace and repeated cycles of innovation and improvement demonstrate that the IBM strategy for tape media quality has worked well—giving IBM a strong position in the industry. Customers who purchase IBM brand tape can take full advantage of the IBM strategy and its benefits to help reap the rewards for their own data centers and operations.

## For more information

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Actual available storage capacity may be reported for both uncompressed and compressed data and will vary and may be less than stated.

<sup>1</sup> Jason Buffington, “Analyzing the Economic Value of LTO Tape for Long-term Data Retention,” *ESG*, February 2016. [http://www.lto.org/wp-content/uploads/2014/06/ESG-WP-LTO-EVV-Feb\\_2016.pdf](http://www.lto.org/wp-content/uploads/2014/06/ESG-WP-LTO-EVV-Feb_2016.pdf)

<sup>2</sup> Drew Robb, “Ten reasons tape is better than disk,” *Infostor*, June 15, 2012. [http://www.infostor.com/backup-and\\_recovery/tape/10-reasons-tape-storage-is-better-than-disk.html](http://www.infostor.com/backup-and_recovery/tape/10-reasons-tape-storage-is-better-than-disk.html)

<sup>3</sup> “Tape and Disk Storage: What Do They Really Cost?,” *LTO.org BlogBytes*, March 3, 2017. <http://www.lto.org/2017/03/tape-and-disk-storage-what-do-they-really-cost/>

<sup>4</sup> Eric Herzog, “Tale of the tape: the lowest cost storage media,” *IBM Systems Blog: In the Making*, May 25, 2017. <https://www.ibm.com/blogs/systems/tale-of-the-tape-the-lowest-cost-storage-media/>



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