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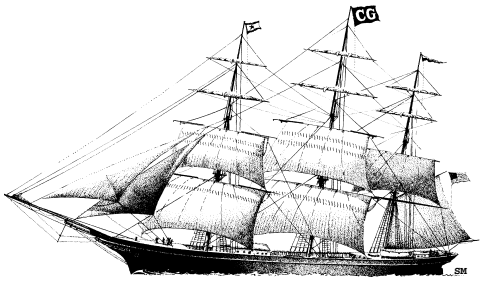

Navigating Information Technology Horizons℠

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Lowering the TCO of the Data Center — IBM Innovates Tape Architecture … Again!

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Management Summary

I had the opportunity to test drive a new car recently and I was most impressed with a feature that I did not know the car had and did not intend to test. Unbelievably, this feature activated itself and operated as it was designed, automatically. While I was driving, **the windshield wipers came on automatically!** I thought that I had hit the wiper switch by accident, as it did not appear to be raining, but while I was searching for the wiper control, they stopped, again by themselves. A few moments later, they came on again. This time I noticed that it had begun to rain. As I observed the wipers, I realized that they were operating at a faster rate as the rain became heavier. **In fact, these were rain-sensing, variable speed windshield wipers**. With these rain-sensing wipers, the driver does not have to worry about controlling their speed; they take care of that for you. Apparently, there is a small sensor in the windshield that detects when it is raining, and identifies how much water is obstructing your vision. Moreover, since Mother Nature can change her mind quickly, these wipers adjust their speed automatically. I was very impressed by this innovative technology because I am easily distracted while driving and I hate to "fiddle" with the variable speed control in my car trying to compensate for the changes in rain intensity. There is a parallel for this technology in the data center of every enterprise.

Over the past few years, data has been growing at a rate that has never been seen before. In fact, data has been doubling every 12 to 18 months, creating a storage nightmare as IT administrators try to maintain performance while securing an expanding volume of data, and deploying, installing, and managing primary and secondary storage devices in the data center. It was bad enough when the IT staff had to manage and secure the viability and integrity of a multi-terabyte storage architecture. Now, they must try to manage the petabyte storage area networks (SANs) that proliferate the enterprise environment in 2008. Many data centers have implemented a disk-to-disk (D2D) backup architecture in order to be able to satisfy the recovery service level agreements (SLAs) that they establish with their client base. Unfortunately, the high costs associated with the deployment and operation of an all-disk environment demand that every CIO with an eye on the bottom line implement a disk-to-disk-to tape (D2D2T) environment for archive and long-term storage requirements. Unfortunately, not all tape systems are created equal, especially in terms of capacity and operating in concert with disk drives and SANs. **In fact, many tape drives have to stop entirely while they wait for the network to transfer data into their available buffer space**.

IBM has just announced a new version of their enterprise tape drive, the **1TB** *TS1130 Tape Drive*, which not only encrypts your data to secure it from prying eyes, but **it also receives data at six different speeds, dynamically, to ensure that all of your drives are operating at the optimum speed**. To learn more about the high-capacity TS1130, please read on.

IN THIS ISSUE

The Trouble with Terabytes

Enterprise storage requirements are growing, and they are growing at a rate never seen before in the data center. In fact, the most vivid comparison that comes to mind would be Episode #44 of the original *Star Trek* series, entitled *The Trouble with Tribbles*. The problem with Tribbles was that they reproduced indiscriminately and they consumed all edible contents available to them. They also physically interfered with essential ship systems (infrastructure), causing havoc with, would you believe, a starship named *Enterprise*.

This massive growth in data is due to several factors changing the traditional storage paradigm in the data center and is reflected in the fact that storage requirements are doubling every 12-18 months at most enterprises. The IT staff tries to meet the *mission-critical* demands of their application set, while, at the same time, attempting to adhere to budget constraints. Government regulations and best practices policies require the preservation of an increasing store of historical email and financial data that previously was merely a nuisance, but now is required to keep executives out of trouble and out of jail. This compliance data adds to the category of *business-critical* data.

Enterprises place mission-critical data on high-performance disk arrays to respond instantly to the queries of everyone from corporate executives to customers and partners. Enterprise databases have to be accessible, 24x7, to place orders and process invoices. System outages are simply unacceptable when the enterprise measures downtime in thousands of dollars per minute rather than just minutes and hours. *Backup* and *recovery* data has similar urgency, although, as the information ages, it carries less significance to the everyday data center operation. Due to the requirement for immediate recovery from a failure, some of this data is now being captured on high-capacity drives with slightly less performance capability in a D2D environment. *Archived* data and long-term storage of backups is another matter. That must be saved and managed, but is rarely accessed. For this third-tier data, tape often proves to be the price/performance leader.

Another advantage of tape is that it is portable and the IT staff can transport it to a remote vault to satisfy disaster recovery and compliance best practices. One concern with data in transit is that it must be protected beyond the secure walls of the data center. In order to resolve this dilemma, all tape cartridges that leave the data center should be encrypted to protect the enterprise from embarrassing headlines and costly programs to protect those whose personal data may have been lost or stolen.

In order to meet their SLAs, many data centers implement a D2D backup architecture. By using disk as a target for backup, the data center quickly can recover any lost data. Unfortunately, the floor space and the cost of energy to keep these devices spinning is itself spiraling out of control. The cost of electricity is tied to the cost of oil, and that is now in excess of $145 per barrel. In order to control the total cost of ownership (TCO) for the data center infrastructure, the IT staff is returning to the legacy environment of tape for long-term storage and archiving[1]. The IT staff is taking advantage of both the performance of disk in a D2D environment and the long-term cost advantages and archive data protection attributes of tape by designing a D2D2T environment. Which tape architecture to use, however, is another question.

IBM Enterprise Tape Drives

IBM is not only viewed as a leader in tape technology, they have been *the leader* for over 55 years. Starting with the IBM 726 Tape Drive in 1952, IBM has been at the forefront of almost every new tape innovation. Their latest family of enterprise tape drives has its genesis in the introduction of the enterprise-level IBM *TotalStorage 3590 Tape Drive* in 1995. IBM has continued to innovate with this technology, first with the IBM *TotalStorage 3592 Tape Drive* in 2003, and then with the IBM *System Storage TS1120 Tape Drive*[2] in 2005. IBM has always been first in tape: the first tape cartridge in 1964, first to deliver LTO in 2000, the first with automatic tape encryption. Now IBM is taking the next giant leap forward in tape functionality with the new IBM *System Storage TS1130* Tape Drive.

The IBM TS1130 Tape Drive

The TS1130 is the fastest 1TB tape drive in the world. It is the third generation of IBM's *3592* enterprise tape technology, and using the existing 3592 *Extended Data Cartridge (JB/JX)*, can store 1TB of uncompressed data at up to 160MB/s. IBM accomplished this, in part, by employing its *Giant Magneto Resistive* (*GMR*) head technology, previously in use only for disk drives. IBM has been working in their Almaden Research Center, along with the Fuji Photo Film Company, in the development of GMR technology for tape, announcing a high-density tape demonstration in 2006 that could lead to 8TB tape cartridges[3]. GMR heads can detect

[1] See the issue of Clipper Notes dated February 13, 2008, entitled *Disk and Tape Square Off Again – Tape Remains King of the Hill with LTO-4*, and available at http://www.clipper.com/research/TCG2008009.pdf.

[2] See **The Clipper Group Navigator** dated November 29, 2005, entitled *Sun Challenges IBM for Enterprise Tape Drive Supremacy – T10000's Improvements Fall Short*, available at http://www.clipper.com/research/TCG2005077.pdf.

[3] See The Clipper Group Captain's Log dated May 24, 2006, entitled *Tape Density Evolution? No Revolution!*, available at http://www.clipper.com/research/TCG2006042.pdf

weaker and smaller signals, enabling them to increase areal density, thereby increasing capacity and performance. They are less subject to noise and interference because of increased sensitivity to improve reliability. A GMR read/write head provides fewer data read errors and improved robustness over the life of the drive, due in part to an alumina-based head coating, introduced on IBM's tape technology for the first time, which improves head reliability, reduces wear on media, providing a longer life for both the drive and the media. GMR technology helps to lower the TCO of the TS1130 environment.

IBM has implemented several significant changes in the overall architecture of the TS1130 to improve its competitive position, resulting in:

- **Enhanced TCO –** With a 1TB cartridge, the TS1130 has 43% more capacity than the TS1120 with the same media. This is a 100% improvement over the capacity available on the Sun *T10000* cartridge[4]. (See Exhibit 1, on the next page, for a more complete comparison IBM's and Sun's new drives and those of the previous generation.) In addition, **the TS1130 lowers power consumption, with a reduction from 46W to 17W in standby mode. The drive automatically reduces fan speed when idle to lower energy dissipation and reduce the risk of unnecessary airborne debris contamination over extended idle periods.**
- **Improved Productivity** – With a native throughput of up to 160MB/s, as compared with 104MB/s for the TS1120, the TS1130 has almost a 60% higher data rate[5]. This is also 33% faster than the Sun T10000A or the new B drive. The TS1130 also has a 24% improvement in high-speed space/locate, as compared to the TS1120.
- **Improved Streaming Capability** – The TS1130 has a 2x improvement in the size of its internal data buffer, 1GB versus 512MB for the TS1120. The T10000A and B only have a 256MB buffer.
- **Improved Speed Matching** – With the ability to match six data-streaming rates automatically, the TS1130 can keep its drive spinning to eliminate the stop/start phenomenon common in other architectures. This helps to improve job performance and increase the life of the drive and media. The T10000A and B drives only support two speeds.
- **Enhanced Virtual Backhitch** – Virtual Backhitch can also help keep tape streaming to improve job performance. With the TS1130, it has a 100% improvement in performance as compared to the TS1120[6], and the TS1130 enjoys an 80% improvement for large files with the new *SkipSync* feature.
- **Enhanced Reliability –** The replacement of standard AMR technology with GMR technology improves the density and reliability of the drive head compared to the TS1120. In addition, an improved *Statistical Analysis Reporting System* (*SARS*) to help report and monitor media health and drive usage is included.

The TS1130 Tape Drive comes with a dual-ported, native 4-Gbps Fibre Channel interface for attachment to host systems, or a switched fabric environment. As with the TS1120, the TS1130 can read WORM[7] cartridges and has an automatic drive-based encryption feature included as standard on every drive[8], which works with IBM's *Encryption Key Manager*. This new model, the TS1130 model E06, has a list price of $39,050, with a one-year warranty. It supports all existing 3592 cartridges, protecting the investment that the enterprise has made in existing media, one of the largest capital costs in a growing tape architecture. The data center can also reformat existing cartridges from 700GB to 1TB, deferring the need to buy new cartridges, helping to reduce data center TCO. In fact, reformatting will provide more than a 40% increase in uncompressed data center tape capacity, as compared to the TS1120 with 700GB tape cartridges. These improvements are possible because the TS1130 has 1152 tracks, as compared to the TS1120 with 896 tracks. The TS1130 writes data 16 tracks at a time, at a tape speed of 8.6 m/s versus 6.2 m/s for the TS1120, an improvement of almost 40%, with a 14% increase in linear density.

IBM is also delivering an upgrade, the *TS1130 Model EU6*, to fit into existing *TS1120 Model E05* canisters. At $19,500, this model is functionally equivalent to the TS1130 Model E06, helping to protect the investment made in the second-generation drives, but the E06 will not be upgradeable further, if and when IBM comes out with the next generation drive.

The TS1130 attaches to all IBM systems, including IBM *System z* via the *TS1120 C06* or *3592 J70* controllers. It also attaches to selected HP and Sun systems, running with selected versions of Microsoft *Windows* and selected *Linux* editions. The TS1130 is supported in the IBM *System Storage TS3400*, *TS3500*, and *TotalStorage 3494* tape libraries, as well as the IBM *3592 C20* silo compatible frame, for attachment to the Sun *Powderhorn* tape libraries.

[4] The new Sun T10000B supports a 1TB cartridge, but at the same performance rates as the T10000.

[5] With a 3:1 compression ratio, the data center can increase this throughput to 350MB/s.

[6] This feature is not available on the Sun T10000.

[7] Write Once, Read Many.

[8] A feature that costs an extra $5,000 on the Sun *T10000* family.

Exhibit 1 – Comparison of Enterprise Tape Drives

Drive Feature	IBM TS1120	*IBM TS1130 (New)*	Sun T10000	*Sun T10000B (New)*
Max Native Cartridge Capacity	700GB	*1 TB*	500 GB	*1 TB*
Native Data Rate	104 MB/s	*160 MB/s*	120 MB/s	*120 MB/s*
System z Attachment	4Gb FICON or ESCON	*4Gb FICON or ESCON*	4Gb FICON	*4Gb FICON*
Open Systems Attachment	4-Gbps Fibre	*4-Gbps Fibre*	2 or 4-Gbps Fibre	*4-Gbps Fibre*
Virtual Backhitch (minimizes start/stop)	Yes	*Yes (Advanced)*	No	*No*
Tape Drive Buffer	512 MB	*1 GB*	256 MB	*256 MB*
Speed Matching Capability	6 speeds	*6 speeds*	2 speeds	*2 speeds*
Load Thread Time	13 seconds	*13 seconds*	16 seconds	*16 seconds*
Average File Access Time (includes load time)	58 seconds	*49 seconds*	62 seconds	*62 seconds*
Average Rewind time	47 seconds	*38 seconds*	48 seconds	*48 seconds*
Encryption	Included in price	*Included in price*	$5,000 additional	*$5,000 additional*
Power Consumption (Drive/Standby)	46 W/30 W	*46 W/17 W*	63 W/NA	*63 W/NA*
List Price-Fibre drive (USD)	$35,500	*$39,050*	$37,000	*$37,000*

Source: IBM and Sun web sites and spec sheets on 7/15/2008 and subject to change. User results may vary.

Conclusion

The TS1130 provides significantly increased value to the data center enabling the enterprise to reduce the number of tape drives, cartridges, and floor space. With an increased capacity of 1TB of native data and increased performance, at a comparable price as compared to the TS1120, the TS1130 enables the IT staff to decrease the backup window and reduce the number of cartridges required to complete any backup or archiving task. Fewer cartridges and increased storage density can result in fewer frames and less floor space, helping to reduce both capital and operational expenses. The fact that the TS1130 can use the same cartridges as the TS1120 means that IBM has protected the investment that the enterprise has made in its IT infrastructure, not to mention the fact that the data center can stretch their budget by reformatting their existing media and achieve a 43% improvement in library capacity.

With lower power consumption rates on every idle drive, the data center can also achieve significant savings in energy use, perhaps even helping to eliminate the necessity to build a new data center to cope with increased energy demands. Although not a new functionality, the inclusion of encryption as a standard feature helps to eliminate the need for additional encryption appliances and more cost.

At $39,050, the IBM TS1130 carries a 10% higher cost than the TS1120 but adds significantly more capacity, performance, and reliability. It is worth noting that the TS1130 is about $2,000 more expensive than Sun's new T10000B, with the same capacity. However, the TS1130 does have 33% more performance. When you incorporate Sun's encryption option to secure your data in transit, the TS1130 becomes almost $3,000 less expensive.

If you are looking to reduce the size of your tape architecture and, at the same time, improve your enterprise performance to warp speed, look at IBM's TS1130.

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