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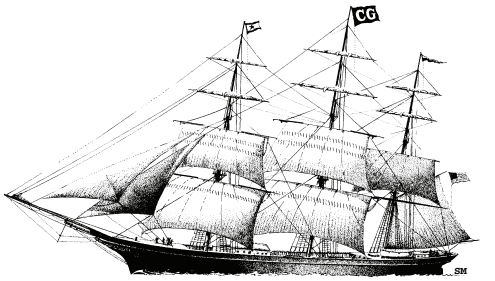

Navigating Information Technology Horizons℠

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A Tape Solution for Every Size Enterprise — IBM Adds LTO-4 to Tape Family

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Management Summary

There are few products as competitive or as volatile as the personal computer (PC). The PC industry has its top tier vendors such as Dell, HP (Compaq), and Lenovo (formerly IBM) and any number of secondary manufacturers such as Acer, eMachines, and Gateway. In fact, there are neighborhood storefronts everywhere where you can go in and configure a "white box", an un-branded chassis, to your specific configuration. You can even order parts on the Internet and build your own PC. The technology is constantly changing, by either turning up the processor clock speed, or moving from a 32-bit CPU to a 64-bit processor, or, the latest trend, putting more cores onto the CPU. If each of these systems used a proprietary technology, then purchasing a PC would become an impossible task. How would you know if the system that you were buying would run your operating system and your application set? By using commodity technologies, however, all of the PC vendors can utilize a common application interface and a common user interface, eliminating your doubts about program compatibility. Whenever you look for a new PC, all you have to do is look for the logo that says "Intel Inside" or the logo identifying an AMD-based processor. You know that no matter which vendor you choose, you can run Microsoft's *Windows* or the *Linux* operating system. The only question that you need to ask is: What is the CPU-surround environment? This includes the type and amount of memory, disk storage, etc. It comes down to how much value-add the vendor has incorporated, and at what price. The same scenario is true today in the data center of every enterprise, especially that of the SMB, when considering the acquisition of a tape backup and archiving solution.

There is any number of tape formats available in the open market, from *DDS* to *DAT*, from *AIT* to *Mammoth*, from *Super Digital Linear Tape (SDLT)* to *Linear Tape Open (LTO)*, all of which work well with the standard backup applications from Legato, Tivoli, and Veritas, among others. Since 2000, however, open systems servers have gravitated to either SDLT or LTO, with LTO from the LTO Consortium, consisting of IBM, HP, and Quantum, viewed as the more "open" option. Recently, Quantum, which acquired *DLT* from Digital in 1994, has quietly conceded the market to LTO, with *SDLT-600* and *DLT-S4A* as the last iterations. With "LTO inside", the data center can be sure of compatibility, reliability, and a future, no matter which iteration of LTO they deploy. Capacity and throughput are another question, however, with each generation supporting a higher capacity and more performance. How each vendor surrounds the drive with autoloader or library technology is still another variable. To learn how IBM is deploying *LTO-4*, please read on.

IN THIS ISSUE

LTO's History in the Data Center

It is clear to all that there is an information explosion in process in the data center of every enterprise, both large and SMB. Data storage is doubling in less than two years, putting a strain on the IT staff to complete both weekly and intermediate backups in a timely fashion. In addition, senior management is putting the onus on that same staff to protect the assets of the enterprise by securing that expanding information, especially whenever it leaves the "secure" environment of the "glasshouse". **Backup tapes may be lost or stolen; the information on them cannot**!

The need for rapid recovery of data in case of a disk failure or human error has influenced some enterprises to move to a disk-to-disk (D2D) architecture. However, the cost to implement a D2D solution can be prohibitive due to total cost of ownership (TCO) issues, notably the costs of the controller infrastructure, disk management, and the energy required to keep the devices spinning[1]. The "imminent demise of tape" that has been floated by many in the disk industry is nothing more than a self-fulfilling prophecy that has encouraged the generation of a plethora of myths about tape. These erroneous myths include everything from tape is dead, tapes fail, to tape is too slow[2].

Some iterations of tape, while not quite dead, are on life support. Vendors continue to manufacture and support older technologies, but stop short of continuing research and development. They are what they are, and will continue to be so. Over the past two decades, *DLT/SDLT* has been one of the most popular options for open systems servers. With an initial capacity of 2.6GB, DLT grew over a decade to a capacity of 40GB. In 2003, DLT experienced a mid-life kicker with the release of SDLT with a native capacity of 110GB and a throughput of 11MB/s.

In 1998, however, three companies joined to provide a more open standard for tape. IBM, HP, and Seagate developed the *LTO* specification for a magnetic tape storage technology as an open alternative to the proprietary DLT. In 2000, with an initial native capacity of 100GB per cartridge and a throughput of 15MB/s, 36% faster than SDLT, LTO technology quickly developed a following as a reliable medium for backup and archiving. Over the next few years, Quantum improved the capacity of SDLT, first to 160GB and then to 300 GB and 600 GB, and the throughput, from 16MB/s to 36 MB/s and 60MB/s. Unfortunately for Quantum, LTO was typically outpacing SDLT in capacity and increasing its lead in throughput, with a 200 GB *LTO-2* cartridge with up to 35MB/s throughput, and then to 400GB in LTO-3 with a throughput of up to 80MB/s. In addition to mere speeds and feeds, LTO was also gaining new functionality with each new revision. *LTO-3*, for example, introduced Write Once, Read Many (WORM) technology to commodity tape. Installed in a variety of autoloaders and tape libraries, LTO-3 became so entrenched in the data center that Quantum has ceased new development activity on SDLT, although they continue to support the existing technology.

This year the LTO Consortium, now with Quantum in Seagate's place, announced the latest iteration of LTO, *LTO-4*, with a native capacity of 800GB, throughput up to 120MB/s, and a 256MB internal buffer for improved performance.[3] The first member of the Consortium to announce a product was IBM, with the *TS2340*. Equally significant, the next two generations of LTO are already under development, with LTO-5 expected for release in 2009 with a native capacity of 1.6TB and throughput rated at up to 180MB/s. LTO-6 is expected to arrive in 2011, with a native capacity of 3.2TB and

[1] See the issue of Clipper Notes dated February 1, 2007, entitled *Tape and Disk Costs - What it Really Costs to Power the Equipment,* and available at http://www.clipper.com/research/TCG2007014.pdf.

[2] See the issue of Clipper Notes dated February 21, 2007, entitled *The Truth about Tape – Nine Myths to Reconsider*, and available at http://www.clipper.com/research/TCG2007025.pdf.

[3] See the issue of Clipper Notes dated July 12, 2007, entitled *LTO-4 Pounces into the Data Center with New Life, Greater Capacity, and Higher Performance,* and available at http://www.clipper.com/research/TCG2007073.pdf.

throughput up to 270MB/s. IBM would seem well positioned to lead in this effort based upon their partnership with Fuji Photo Film Co. for the development of a new tape recording environment, with the capability of recording up to 8TB of data on a single cartridge[4].

The IBM TS2340 LTO Ultrium 4 Drive

One of the most valuable assets that any corporation has is its data, and this asset is expanding at a precipitous rate, with enterprise storage doubling every 18 to 24 months. The data center needs to be able to access and protect this information quickly and reliably, and it needs to be able to share and store this data in a secure manner. Magnetic tape has been, and continues to be, the least expensive method to share, backup, and archive enterprise data. However, the sheer volume of data and the requirement to retrieve it quickly and reliably has led some to look at D2D techniques for this role. With a compressed capacity of up to 1.6TB per cartridge with a throughput of up to 240 MB/s, IBM's *System Storage TS2340 LTO Ultrium 4 Drive* doubles the capacity of an LTO-3 cartridge and relieves the IT staff of their concerns to complete intermediate or full backups within their allotted timeframe. The TS2340 protects your current investment in LTO Ultrium 3 cartridges with full read/write capability, and read capability for LTO Ultrium 2 cartridges. The TS2340 also enhances some features that IBM implemented for LTO Ultrium 3, such as *digital speed matching* to reduce the number of backhitch repositions, *power management* to reduce energy consumption by the drive electronics, and an improved *data compression*[5] to determine the most efficient storage method.

Even more importantly, the TS2340 can protect the enterprise and its executive team from possible legal action, and potential embarrassment, whenever a tape is lost or stolen. The TS2340 is not theft-proof, but it is tamper proof. With the introduction of the TS2340, IBM brings the encryption security pioneered in the *TS1120 Tape Drive*[6] to the mid-range tape environment. The tape cartridge itself may be misplaced or stolen, but the information on it is secure; without the encryption key, the bits and bytes on the media are worthless. With the same WORM technology introduced with the full-height *TotalStorage 3580 LTO Ultrium 3 Tape Drive*[7], and continued with the half-height *TS2230 Tape Drive Express*[8], the TS2340 can also protect the executive team from charges of tampering with their historical data. The TS2340 is a standalone tape drive and is designed for an entry to a mid-sized requirement, but with an attractive price tag of only $5,170 with a SCSI Ultra160 LVD interface, or $5,681 with a 3Gbps SAS interface[9]. The cost of tape media must be included in any TCO analysis; IBM is offering LTO-4 cartridges at $514 for five, about $.13/GB. This is down from LTO-3 media pricing of $295 for five, or about $.15/GB.

IBM Tape Solutions

A superior tape drive, however, is merely a building block to a complete solution. Most enterprises will have a backup/recovery need that requires multiple drives to satisfy the data center requirements for capacity and performance. To appreciate fully the capabilities of IBM's LTO-4 tape drive technology, you must surround it with the proper components to build and manage an autoloader or library environment. This includes multiple drives and robotics, as well as storage management software.

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[4] 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.

[5] An implementation of a Lempel-Ziv class 1 (LZ-1) data compression algorithm.

[6] See **The Clipper Group Navigator** dated September 10, 2006, entitled *IBM Introduces the First Encrypting Tape Drive to the Data Center*, available at http://www.clipper.com/research/TCG2006080.pdf.

[7] See **The Clipper Group Navigator** dated February 18, 2005, entitled *IBM Restores Order to Data Center Storage – LTO Ultrium Generation 3 on Target*, available at http://www.clipper.com/research/TCG2005018.pdf.

[8] See **The Clipper Group Navigator** dated December 1, 2006, entitled *IBM Extends Its Tape Offerings – New Support for SMB and Enterprise*, available at http://www.clipper.com/research/TCG2006102.pdf.

[9] A SAS interface is required for encryption.

IBM offers a variety of library solutions that employ a full-height LTO Ultrium 4 automation tape drive and support LTO-4 encryption capabilities, including the *TS-3100 Tape Library Express* and the *TS3200 Tape Library Express* aimed at SMB accounts, and the *TS3310 Tape Library* and the *TS3500 Tape Library*, designed for larger enterprises. (See Exhibit 1, below) While a half-height LTO-4 drive has yet to be announced, IBM does have a half-height LTO Ultrium 3 drive that enables the SMB or departmental data center to double the number of LTO drives deployed in a TS3100 (1–2) or TS3200 (1–4) library. Please note, however, that the half-height LTO-3 drive has a native throughput of 60MB/s rather than the 80MB/s of the full-height drive, resulting in a total native throughput of 120 MB/s for two drives and 240MB/s for four.

IBM's library solutions work with most, if not all, of the popular backup/recovery storage management applications, including IBM *Tivoli Storage Manager*, Computer Associates *BrightStor*, HP *OpenView*, Legato *NetWorker*, and Symantec *NetBackup*. These applications run under a wide variety of operating environments, including *AIX*, *i5/OS*, *HP-UX*, *Linux*, *Solaris*, and *Windows*, and attach to all IBM *System i*, *System p*, *System x*, and *BladeCenter* servers, as well as a broad spectrum of non-IBM systems[10].

Conclusion

Life is constantly forcing us to make choices. Do you want the car with the souped-up, V-8 engine or the one with 40 MPG gas economy? Do you want the Townhouse in the city, or the Farmhouse in the country? Occasionally, you can find a beer that "tastes great" *and* "is less filling. With tape systems, the data center often has to choose between capacity and performance, with satisfying budget constraints another important factor.

With IBM, you do not have to choose between speed and capacity, or between brute strength and functionality. With the TS2340 LTO Ultrium 4 standalone tape drive and LTO-4 automation drives, IBM provides the data center with a reliable platform of drives that have more capacity **and** more performance than most any other midrange drive, and the LTO roadmap shows a doubling of capacity approximately every two years for at least two more generations. The TS2340 includes WORM **and** encryption functionality. The TS2340 uses a time-tested technology that has proven its value over the last seven years!

Exhibit 1 – Ultrium 4 Library Solutions

- **TS3100** – One Ultrium 4 drive with LVD SCSI, 4Gbps FC or 3Gbps SAS i/f and 24 tape cartridge slots;
- **TS3200** – Up to Two Ultrium 4 drives with LVD SCSI, 4Gbps FC, or 3Gbps SAS i/f and 48 tape cartridge slots;
- **TS3310** – Up to 18 Ultrium 4 drives with 4Gbps FC or 3Gbps SAS i/f and up to 396 tape cartridge positions; and
- **TS3500** – Up to 192 *TS1040* Ultrium 4 drives with a 4Gbps FC i/f and up to 6887 tape cartridge slots.

***Source**: IBM*

You could wait for the next backup to overflow the backup window or you could wait for the next unencrypted tape cartridge to be lost. Instead of that, you could take action today and examine the capabilities of IBM's latest preemptive strike to solve the backup/recovery and archive woes in the data center. The choice is yours!

[10] See IBM's Interoperability Matrix for the specifics.

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