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Spectra Logic Expands Tape Offering — Adds IBM TS1150 Drive Technology to Library Offerings

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Management Summary

The *Lego Brick* is an amazing toy – you can start with a set as small as you need to determine if a child has any interest in the construction toy. Then, when the smile appears, you can return to the store and buy more bricks to add to the set and to the child's imagination. As time goes by and more and more bricks are added, you can expand that child's imagination in almost unlimited ways. In fact, there is an exhibit by a professional artist touring the U.S. with over 1 million colorful bricks used to create a show that has transformed this this popular toy into a large-scale art form.

The ability to start small and scale up is nothing new to the CIO of any enterprise data center. No one wants to buy a piece of IT hardware and have it go obsolete when the enterprise outgrows the capacity or functionality. Nor does anyone want to pay more for something that they most likely would not consume fully during its useful life. The ideal situation is created when you can take the "bricks" that you have and add as few or as many new bricks as you might need to the existing collection, thus expanding the capacity and functionality to support a growing enterprise demand – not only for today and tomorrow, but well into the future.

Take the tape library, for example. A typical library consists of tape drives, tape slots, tape cartridges, robotics, and power supplies, all integrated into a frame to create an expandable data storage collection. When required by the growth of storage, the data center can add capacity to the basic frame, replace it with a larger frame, or add additional frames (depending on the product installed), with these changes adding only modestly to the original investment. In fact, one company, Spectra Logic, has done just that.

Spectra Logic has developed a scalable set of tape libraries (the *T-Series*) with a technology called *TranScale* that can grow within the frame and also by adding frames when you grow beyond the capacity of the existing frame. In addition, you can replace one or more frames while retaining all of its existing drives, cartridges, robotics, and power supplies for use in new frames – typically with higher slot capacities and/or capabilities. To learn more about Spectra Logic and its introduction of the new *IBM TS1150* tape drive across their broad library offerings, how this new drive can protect your investment in existing data center infrastructure, and also how it can lower the total cost of ownership of that infrastructure, please read on.

The Role of Tape in the Enterprise Data Center

In an era of *Big Data*, more information is being collected, preserved, and used for many purposes. One example is the heavy use of analytics within many different industries, much of which was not being done just a year ago. Because of the expanding (seemingly ever-growing) collection of more and more data and the rapidly expanding uses of data, the requirement to keep (and make available) more data for much longer continues to scale

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with no end in sight. The need to preserve, protect and be able to quickly deliver that data persists now and demands will only grow. As a result, for many larger enterprises the requirement for additional storage is doubling every 12-to-18 months. Unfortunately, the budget to support that increase remains about the same or may even be less.

When determining the correct solution for the enterprise data center, four factors are most important: reliability, performance, capacity, and roadmap. First, the storage solution selected must have the highest, enterprise-class reliability to provide data integrity for data on the media and to ensure 24x7 availability. Second, it has to perform in terms of being able to meet data throughput and access time requirements. Next, it needs to be able to scale to enable the data center to deploy the densest architecture possible, while also lowering acquisition and media costs. Finally, in order to protect the investment being made, the storage solution must have a roadmap into the foreseeable future that will satisfy future enterprise requirements. Budget restrictions almost always will be a significant factor.

The two main media for the preservation of data (typically as part of an archiving solution) are disk and tape. Of the two, tape – both *enterprise* (a.k.a. *proprietary tape*) and *LTO* tape (a.k.a. *open systems tape* sold under the *Ultrium* brand) – meets more of these requirements and also continues to improve faster in terms of capacity and functionality, thus increasing its value to the enterprise. In fact, the capacity of a tape cartridge has increased more than two-fold in recent years while disk has struggled to grow 50% in the same time frame.

Which media is best for the preservation of files and long-term data is a question that has been given significant coverage in The Clipper Group's bulletins over the years. In the past two years alone, we have looked at many aspects of using tape in the enterprise data center.

- In March 2013, we explored the competitive advantages of enterprise tape versus the newest version of open systems tape (*LTO-6*) and drew the conclusion that enterprise tape has a clear advantage over LTO-6 in terms of capacity and performance and is very competitive with the LTO solution in terms of TCO.[1]
- In May 2013, we published an extensive total cost of ownership (TCO) study comparing disk and tape solutions for archiving, which showed many resounding advantages for tape.[2]
- In July of this year, we looked again at the advantages of using tape and reiterated our conclusions based upon the rapid advancements being made in tape technology.[3]

Despite what you may have heard from any number of tape-deprived disk vendors, tape is far from dead. From a usage and reliability standpoint, enterprise tape was and has continued to be a clear best choice for the long-term preservation of files and archives. Disk and flash continue to retain a prominent place in the enterprise data center for the immediate retrieval of mission-critical information, let's say in less than one second. TCO concerns dictate for many the need to deploy tape when retrieval time is not that critical. **Thus, the question is no longer *"Should we use tape?"* but *"Which tape should we use?***

Many advocates of tape have been impressed with the open systems qualities, capacity, performance, and reliability of *LTO* tape drives and media. However, **in a growing number of enterprise data centers, LTO tape does not have the scalability, throughput, and reliability needed. These qualities are offered by enterprise tape.**

The newest ("latest and greatest") enterprise tape drive is from IBM, which has persevered for decades to climb steadily through what had been perceived to be capacity ceilings. Its newest offering, the *IBM TS1150 Tape Drive*[4], has a native (uncompressed) capacity of 10 TBs. IBM only offers this drive in its largest tape libraries, the IBM *TS3500* and the *IBM TS4500*, currently offering a maximum capacity of 35.5 PBs in a single, multi-frame library. While these IBM libraries may be satisfactory for many enterprise data centers, they have a relatively high entry price, compared to smaller members of Spectra Logic's *T-Series Enterprise Library*, which allows smaller enterprises to take advantage of IBM's

[1] See *The Clipper Group Captain's Log* entitled *Enterprise Tape for Archival Storage? – Why This Just Might Make Sense* dated March 31, 2013, and available online at http://www.clipper.com/research/TCG2013005.pdf.

[2] See the issue of *The Clipper Group Calculator* dated May 13, 2013, entitled *Revisiting the Search for Long-Term Storage – A TCO Analysis of Tape and Disk*, and available at http://www.clipper.com/research/TCG2013009.pdf.

[3] See the issue of *Clipper Notes* dated July 5, 2014, entitled *Is Tape the Best Low-Cost Technology for the Preservation of Data?* and is available at http://www.clipper.com/research/TCG2014015.pdf.

[4] See **The Clipper Group Navigator** dated October 30, 2014, entitled *IBM Plays Leap-Frog with Oracle – IBM's TS1150 Captures the Tape Capacity Crown*, available at http://www.clipper.com/research/TCG2014019.pdf.

new high-capacity tape drive and cartridge technology in an enterprise library with a smaller footprint.

Spectra Logic Library Technology

With IBM's TS1150 (which will be described in detail below), Spectra Logic has a tape drive with the highest capacity – 10TBs – and the fastest throughput, 360MBs/second. Spectra Logic also can satisfy the storage requirements of the largest enterprise data center, including those that IBM cannot satisfy with its new TS4500 library.

However, what about the smaller enterprise with a smaller data center that does not have the floor space, or the need, to accommodate a behemoth capable of storing literally hundreds of PBs of data? *Why must the TS1150 be limited to only the largest data centers*? Spectra Logic has responded to these questions with a full range of tape libraries, taking advantage of its *TranScale* architecture to accommodate a maximum amount of storage in a minimal amount of floor space, while preserving the investment that many enterprises have made in their existing Spectra Logic library.

There are many requirements, most notably, archiving – across many industries – that need maximum cartridge capacity and maximum throughput without having the necessity of a tape library sized for the largest requirements. Spectra Logic already has established itself as a leader in the long-term storage of historical data with its *T-Finity* library family and *BlackPearl* archiving software[5]. Now, Spectra Logic has increased the capability of a wide-range of enterprises to take advantage of IBM's new tape drive technology. They have qualified the IBM TS1150 in multiple Spectra Logic tape libraries, from a rack-mounted *T380* with a 28U profile, to the *T950* with a base frame occupying less than 10 sq. ft., to the T-Finity, which, indeed, can fill a data center, if that is what is needed.

Spectra Logic T380

The rack-mounted, enterprise-class Spectra T380 is the ideal entry-level tape library for applications designed to process a high-volume of data, and it is the only rack-mounted library that supports the IBM TS1150 drive. With a minimum configuration of 45 TS1150 slots for up to 450 TBs of data (without compression), the T380 can scale to a maximum configuration of 261 slots, capable of supporting 2.61 PBs (also without compression). The T380 can support up to 12 TS1150 drives with a maximum uncompressed throughput of 15.6 TBs/hour. The combination of many high-capacity drives in a single footprint enables the T380 to pack a big wallop without overwhelming the data center or its budget.

Spectra Logic T950

With a single-base frame, the T950 can support up to 594 cartridges with up to 24 TS1150 drives. A T950 with only four drives could support up to 738 slots and 7.38 PBs (uncompressed). This means that a single cabinet can support up to 5.94 PBs of data, in less than ten square feet (about a square meter) of floor space with uncompressed throughput of 31.1 TBs/hour. A fully-configured T950, with a total of eight frames, can support up to 7,614 cartridges and 120 drives, for a maximum capacity of 76PBs and uncompressed throughput of 155 TBs/hour.

Spectra Logic T-Finity

The T-Finity, however, is a totally different design from those just mentioned. With a base frame capable of supporting up to 594 TS1150 cartridges (with a capacity of 5.94 PBs) and up to 24 TS1150 drives (with a throughput of 31.1 TBs/hour), the T-Finity can scale to almost infinite proportions. Each media expansion frame can support 990 additional slots while a drive expansion frame can support another 24 drives while also adding 810 slots. An entry level T-Finity consisting of three frames with 1,350 slots, supporting up to 13,500 TBs, which becomes 33.75 TBs with an average compression ratio of 2.5:1[6]. This entry-level configuration occupies only 27.33 square feet, with a remarkable density of 1,235 TBs/square foot.

A fully configured T-Finity library (with 40 frames) can hold up to 38,115 cartridges for a capacity of up to 381 PBs, uncompressed, or 952 PBs, when compressed at 2.5:1. This maximum configuration occupies only 347.58 square feet and delivers a compressed density of 2,741 TBs/square foot.

A T-Finity library complex, basically an amalgamation of eight adjacent libraries, can scale even further up to 320 frames and up to 304,920 slots – for an uncompressed capacity of more than 3 EBs. The maximum native throughput for a

[5] See **The Clipper Group Navigator** dated November 11, 2013, entitled *Simplifying the Long-Term Storage of Historical Data – Spectra Logic Introduces BlackPearl*, available at http://www.clipper.com/research/TCG2013022.pdf.

[6] This 2.5:1 average compression ratio is a good starting point but your average may be more or less, depending on the nature of the data being stored.

Exhibit 1 — Features of IBM TS1150 Drive Technology

- **Speed Matching** – The TS1150 has 12 read/write speeds to enable the drive to stream data from slower hosts, reducing start/stops, preventing drive wear, and improving throughput and reliability, from 112 to 365 MBs/second;
- **Load/Ready Time –** An improvement to 12 seconds from the previous 15 seconds;
- **Read Ahead** – The TS1150 has a larger buffer, An increase from 1 GB in the TS1140 to 2 GB in the TS1150 to read ahead and cache up to 2,000MB of compressed data for better performance in "short-hop" file locate operations, and reducing backhitches;
- **High Resolution Tape Directory and Virtual Backhitch** – This improves the performance of small file reads/writes while reducing wear on the tape media;
- **Backwards Compatibility** – This feature enables the TS1150 to read/write to a TS1140 cartridge and reformat that cartridge to a 7 TB capacity;
- **Linear Tape File System** (**LTFS**) – LTFS allows users to organize and search tape media with the same methodology as a hard disk, improving file access time.

Source: Spectra Logic

Spectra T-Finity library with IBM TS1150 drives is 155.5 TBs/hour with 120 IBM TS1150 drives. A T-Finity library complex can scale to 960 drives with a total native (uncompressed) throughput of 1.2 PBs/hour.

IBM TS1150 Characteristics

All of these Spectra Logic library offerings support multiple IBM TS1150 tape drives, the latest and most advanced tape drive technology available. These drives provide the data center with enterprise-class reliability with an MTBF of 237,000 hours and a *detectable* bit error rate of 10^{-20} that Spectra Logic claims is 1000 times more reliable than other technologies. To put this tape technology in its proper perspective, the data center may experience an *undetectable* single bit error for every $1.6x10^{33}$ bits read. This equates to one bit for about every 111,022 PBs (or 111 EBs) written, which is a lot of bytes before an unrecoverable single bit error.

The TS1150 protects investments that many enterprise data centers have made in earlier *TS1140* technology, because TS1150 drives can read and write TS1140 cartridges (without reformatting). By enabling the data center to store more data in less space and to retrieve it faster than with the TS1140 (details on next page), the TS1150 can support many high-performance data requirements and also can resolve many data management issues surrounding the increasing number of data cartridges required. The TS1150 technology has an outstanding set of features, as highlighted in Exhibit 1 above.

With a native capacity of 10TBs, the *IBM 3592 Advanced Data tape cartridge* provides up to 25% more capacity than the *Oracle T10000D* drive and cartridge (with a native capacity of 8 TBs uncompressed) and four times the capacity of an *LTO-6* cartridge (with 2.5 TBs of native capacity uncompressed). The same 10TB capacity applies to the *IBM 3592 Advanced WORM cartridge*[7], which becomes a necessity in any environment governed by regulations to guarantee the unaltered authenticity of the data in question. The IBM 3592 cartridge capacity expands to 25TBs when a 2.5:1 compression ratio can be achieved.

A prior-generation TS1140 JC cartridge can be reformatted from a current maximum capacity of 4 TBs to a new (reformatted) capacity of 7 TBs, a 75% increase for free; thus protecting the enterprise investment in existing technology by enabling the reuse of TS1140 media.[8]

The TS1150 cartridge also is available in a shorter, smaller capacity and this lower-cost format provides even faster average access time to up to 2 TBs of data. This is 25% more than the 1.6 TBs available on Oracle's T10000D "Sport" cartridge. The TS1140 short (economy) media also can be reformatted to the TS1150 format, thus increasing its capacity from 500GB to 900GB and providing faster access to stored data than with a full-length data cartridge.

With an average file access time of 40 seconds (on the standard cartridge), the TS1150 drive can locate and retrieve any desired file at the same

[7] WORM=Write Once Read Many. For more on WORM, see **The Clipper Group Navigator** entitled *IBM Adapts 3584 Tape Library for ILM - 3592 Drive adds WORM Option* dated May 9, 2004, and available at http://www.clipper.com/research/TCG2004048.pdf.

[8] However, the reformatting is destructive in that it writes over what was there before, so any resident data must be relocated prior to the reformatting process.

speed as the TS1140, even though more data can be stored on a TS1150-formatted cartridge. This is faster than the file access time for LTO-6 tape drives (at 47 seconds) or for Oracle's *T10000D* (50 seconds). With a native data transfer rate of up to 360MBps (uncompressed), the TS1150 can deliver data to/from tape faster than ever before using an 8Gb Fibre Channel interface, thus enabling a shorter backup window. The fastest throughput also is a great benefit for today's cloud, mobile, and social media users to provide timely data for critical business analyses. The faster TS1150 drive also can facilitate a quicker disaster recovery.

360MBps compares quite favorably over the data transfer rate of the previous-generation TS1140 enterprise drive, which maxed out at 250 MBps and also is similar to the Oracle *T10000D* enterprise drive at 252 MBps. In fact, the TS 1150 drive is 45% faster than the TS1140 and 125% faster than the throughput of LTO-6 at 160 MBps. This significant improvement in throughput likely will enable the data center to reduce the number of drives required to meet service levels while also reducing the energy consumption level two ways: first, when compared to the T10000D (50 watts compared to 90 watts)[9] and, second, by reducing the number of drives required. The TS1150 consumes about 10% less energy than the TS1140, 46 watts versus 51 watts.

The TS1150 provides the enterprise with a high-performance, flexible data storage device with information security provided by AES-256 bit encryption that helps every organization secure data on tape. Spectra Logic encryption offers a range of solutions to meet your individualized encryption requirements. *Spectra TKLM* (based on IBM's *Security Key Lifecycle Manager*) supports encryption for the TS1150 drive as well as LTO drives.

The TS1150 continues to support *LTFS* for direct, drag and drop simplicity for access to files stored on tape enabling a fast and easy way to gain access to the data center's growing (in number and volume) collection of files, thus helping to satisfy today's requirements for scalability in capacity and performance. Spectra Logic's *BlackPearl S3 Gateway* to tape is the primary method for writing to LTFS tape in Spectra Logic libraries. This provides organizations an easy way to use cost-effective TS1150 tape drives in libraries, within a tiered storage infrastructure, keeping track of which file is on which tape cartridge.

Conclusion

What does all of this mean to the enterprise data center? As presented earlier, in a fully configured Spectra T-Finity Tape Library, the T-Finity can support up to 38,115 enterprise cartridges, probably with fewer TS1150 drives (than TS1140 or other high-end drives) because it enables the data center to deploy fewer drives to achieve the same volume of data reads and writes with a higher throughput and also because of the 10GBs per cartridge native capacity. This helps to control infrastructure TCO, including floor space, energy requirement, and labor costs because of improved storage density.

Without knowing your existing configuration or requirements, all we can do is ask you to consider: *How many PBs can you deploy today per square foot? How much can you save in floor space charges? How much is it costing you to store a TB on tape (or disk)?* Given the new capacity and performance characteristics of the TS1150 drives and cartridges, it seems clear that moving up to TS1150s can lower the TCO of long-term storage infrastructure and reduce the fear that an expanding storage requirement will force you to build a new data center, no doubt at what would be a cost of additional millions to your IT budget. That, alone, makes the TS1150 worthy of further consideration.

As discussed herein and in referenced papers, **tape continues to be the best, low-cost answer for your long-term and large-scale storage needs.** Tape continues to provide the data center with the features and qualities needed for the data center staff to rein in the uncontrolled proliferation of storage costs within the enterprise. **Whatever you are doing with tape today or are considering, the TS1150 in a Spectra Logic library simply makes most situations better.**

With its broad range of libraries accepting the TS1150 drive, Spectra Logic offers the broadest range of solutions for storing data at very low costs per TB stored. Even if you currently are not using tape, it most likely is worthwhile to reconsider what the latest in high-capacity, high-performance enterprise tape from Spectra Logic can do for you and your enterprise. Check it out!

[9] It should be noted that LTO-6 has an energy consumption of only 27W. Tape solutions are very energy efficient when compared to spinning disks.

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