True Enterprise Storage for On-Demand Data Centers
— IBM Introduces TotalStorage DS8000

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Management Summary

The need for flexibility comes in many sizes, from personal needs to the enterprise requirement. If your daughter is about to be married, there is a lot of planning to be done: flowers, a band, catering, a guest list, a ballroom, and much more. *How big is the ballroom that you are going to need depends upon the number of guests. Will there be a big crowd?* Maybe, you are not sure. If you invite 1000 of your closest friends, maybe 200 will reply, maybe all 1000. *Is there a ballroom that is flexible enough to fit your needs and your time frame?* **After all, we have seen that one size may accommodate everyone if it is large enough, but one size clearly doesn't always fit all – correctly**. Your hotel of choice informs you that they have a series of ballrooms that can be combined into a single room, simply by removing a temporary wall or two, enabling the flexibility that you desire. **However, you will have to reserve, and pay for, the largest space that you might need.** You cannot take the small one and expand, on-demand, as replies come in.

The executives of the National Football League or World Cup Soccer would love to have a stadium that could be expanded on-demand for an event like the Super Bowl or the World Cup. With the largest stadiums capable of supporting only 100,000 fans, even higher numbers would attend, if there were more seats. *Can you imagine the opportunities if there was a stadium built with 100,000 seats, at an appropriate cost, that could be expanded on-demand by 10,000, 20,000, or even 100,000 more; especially if you did not have to pay for the additional capacity until you actually used it, and then after the game, you could reconfigure the stadium back to 100,000 for normal use and lower cost?*

In the world of Information Technology (IT) storage, however, that is exactly what you can do. With four separate and distinct storage families, IBM has introduced the capability to respond to the storage requirements of any enterprise, from entry-level to mainframe, with an appropriate storage solution.

With the introduction of the TotalStorage family of storage devices, IBM has announced the capability to support the entire range of enterprise requirements, from entry level to mainframe. With the recent introduction of the DS8000 series, IBM has expanded their storage capability from one TB to over 192TB of capacity. To learn more about the DS8000 series and the rest of IBM's offering, please read on.

The Enterprise Environment

Despite the efforts of some vendors who try to convince the data center management of every enterprise, no matter how large or how small, that their top-of-the-line data storage device will solve all of their Information Lifecycle Management (ILM) problems, we have seen that one size really does not fit all enterprises. IBM has apparently accepted that fact as truth with their latest series of storage announcements. Starting with the requirements of the smallest enterprises, often referred to as SMBs, or small and medium businesses, **IBM announced the *TotalStorage DS300* and *DS400*[1] to provide entry-level businesses and departments with storage area networking (SAN) solution technology**. With the re-naming of its *FAStT* family of disk arrays to the *TotalStorage DS4000*, IBM has positioned a set of mid-level arrays, with an installed base of 25,000, **to support the expanding requirements of workgroups and departments in the open system storage arena**.

As we advance up the through the organizational chain of enterprises, we reach the middle-tier with their own unique storage problems, and, therefore, demanding unique requirements. The solution for this tier is **the *TotalStorage DS6000* series, which we classify as *upper class storage for middle class budgets*[2], bringing enterprise class features to the mid-range market space.** The DS6000 series uses POWER servers, Linux, and high-availability to bring enterprise-class innovation to the open systems community.

This brings us to the largest enterprises that reside at the highest-end of the storage solution food chain. Here, massive scale-up remains a vital need in the storage marketplace. *How do we define the storage needs of these enterprises? How do we define the challenges facing these enterprises?* Exhibit 1, at the right, defines the challenges confronting IT staffs across the country and around the world.

At the same time, the data center staff is trying

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[1] See **The Clipper Group Navigator** dated October 9, 2004, entitled *IBM Introduces SAN Storage for the Entry SMB – A Storage Strategy Appears* at http://www.clipper.com/research/TCG2004084.pdf.

[2] See **The Clipper Group Navigator** dated October 12, 2004, entitled *IBM TotalStorage DS6000 – Upper Class Storage for Middle Class Budgets* at http://www.clipper.com/research/TCG2004085R.pdf.

Exhibit 1 – Enterprise Storage Challenges

- Complex storage/systems infrastructures;
- The need to maximize return on investment;
- Lower total cost of ownership;
- Tighter budget controls;
- Multiple management processes across storage sub-systems;
- A requirement for efficient workload balancing;
- Increased utilization of recovery site assets;
- Better resource utilization and retention; and
- Improved service level attainment.

to improve:

- Performance
- Scalability,
- Solution integration,
- Flexibility,
- Storage Management,
- Availability, and
- Resiliency

In fact, **the enterprise data center is looking for the next generation of storage servers to be able to provide unlimited, on-demand capacity expansion in a performance-intensive environment.** The new arrays must be able to support multiple tiers of storage with each tier providing unique cost/ performance efficiencies. The next generation system must provide consolidation solutions to simplify the storage infrastructure, resiliency features to enhance business continuity, and advanced ILM capabilities to improve information management. In addition this new generation must be able to not only replace existing generations of storage arrays, it must also be able to coexist with them in a mission-critical, high-performance virtual storage environment. This includes the largest arrays from storage suppliers such as EMC and Hitachi, as well as tier one vendors such as HP and IBM.

IBM, for one, has decided to meet this challenge head-on with the introduction of the *TotalStorage DS8000 series*, **a new concept in**

storage server design that it expects to revo-lutionize the economics of storage scalability and lower the total cost of ownership (TCO) through the sharing of microprocessor tech-nology with its *iSeries* and *pSeries* servers.

TotalStorage DS8000 Series Design

Based upon the *POWER5[3]* microprocessor technology that has provided industry-leading performance for IBM iSeries and pSeries ser-vers, and *AIX 5L*, with all of its resiliency fea-tures, IBM has created an integration of server and storage that takes advantage of years of ap-plication server innovation to introduce a stor-age server that leverages IBM's technological advances. **By using POWER5, IBM can take advantage of its *Virtualization Engine* with *Logical Partitioning* (LPARs) to enable mult-iple storage partitions with hard boundaries for the execution of production applications in a resource shared with development and test facilities**. By reusing POWER5 microcode in a storage environment, IBM brings stability to an architecture undergoing the introduction of new technologies. Most significantly, due to the increased scalability of the DS8000 series and the proven performance of the POWER5 architecture, IBM feels so confident in the extended life of the DS8000 series that **they have extended the warranty on the system to four years, creating a new financial para-digm and lowering the TCO for the DS8000 family**. This sends a clear message to the storage community as to IBM's self-assurance regarding the life of the DS8000 series.

By incorporating an *eServer pSeries p570* server into the DS8000 series, IBM's storage designers can exploit the technological enhancements made for the server products without incurring additional development costs, thus lowering the TCO for the data center. By including the storage designers as a part of the server team, the resulting server products are, by their very nature, designed and tuned for storage requirements. This also provides a stable platform from which to implement the new functionality required to achieve the throughput improvements of the DS8000 series, including new cache optimization algorithms to improve workflow.

The DS8000 series also moves away from the proprietary SSA architecture found in the ESS 800 to a more open switched Fibre Channel fabric and a higher-bandwidth, fault-tolerant system interconnect. **The DS8000 series highlights IBM's TotalStorage DS family, which offers a continuous array of storage products from the entry level right through the largest enterprise, designed to leverage a common management platform and a suite of copy services to provide con-sistent field support and customer service.**

DS8000 Series Configurability

The DS8000 series takes advantage of the resiliency features designed for and inherent in the basic architecture of the POWER5-based p570. The DS8000 may be configured with a pair of dual-processor servers (*Model 8100*) or a pair of quad-processor servers (*Model 8300*), with on-demand expandability and built-in intelligent RAID adaptors. With support for up to 128GB of battery-backed cache memory and up to 32 ESCON or 64 2Gb FC/FICON ports, the 8100 can manage 384 Fibre Channel disk drives, either 73, 143, or 300GB, with up to 115TB of on-demand capacity. The Model 8300 can support up to 256GB of cache mem-ory with 64 ESCON or 128 2Gb FC/FICON ports and up to 640 disk drives. The 8300 can manage 192TB of disk, initially, in a footprint of less than 30 sq. ft, 20% less than previous generations. In fact, **the DS8000 series inter-nal addressing architecture has been created to support up to 96PB of disk, virtually an unlimited supply of storage for 99% of the enterprise community**. When compared to the ESS800 with a capability of 55.9TB, we can see that the DS8300 has almost 3.5 times the capacity and, as we will see, six times the performance. The DS8000 series is designed to have an MTBF of almost 100 years, based upon a service level design of six 9s reliability. No wonder IBM is so confident; it is offering a four-year warranty.

Because the DS8000 series starts off with a base of an IBM *eServer p570,* the 8300 can also take advantage of the logical partitioning (LPARs) inherent in the architecture, to estab-lish two parallel but unique workloads, one in each partition, each receiving 50% of the re-source allocation. The data center can establish

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[3] See **The Clipper Group Navigator** dated July 22, 2004, entitled *Open Systems and Virtualization – IBM Takes Another Stride with POWER5* at http://www.clipper.com/research/TCG2004063.pdf.

two separate production workloads based upon operating system, application, or organizational boundaries. They can create an environment with a single production workload along with a full-scale development system within the same footprint, still ensuring business continuance by isolating the test database in the alternate partition. In the future, the DS8000 series will follow the POWER5 capabilities and offer increased granularity of resource allocation as well as offering additional partitions enabling the running of storage applications such as DB2 or Oracle, backup/ recovery, or an integrated file system, such as SFS, closer to the data.

In a series of performance comparisons based on IBM's estimates and projections using IBM performance models and preliminary measurements comparing the DS8000 series to the ESS 800 and ESS 800 Turbo, the DS8000 consistently outperforms its predecessors. Final tuning will continue until the DS8000 series is available in December, but IBM expects it will achieve at least the following results:

- A DS8300 4-way storage server should score minimally 77 KOPS/ second on the 70/30/50 Open benchmark, more than twice the score for the ESS 800 Turbo. This improvement can be attributed to the leverage of the latest POWER5 server technology, expanded and enhanced cache capabilities, the use of simultaneous multi-threading to enhance system performance, and faster switched Fibre Channel disks.
- A DS8100 dual processor is rated at 32 KOPS/second, showing roughly linear scalability.
- Similar proportions hold for the Cache Standard zSeries benchmark, where the DS8300 should achieve about 100 KOPS/second, with the ESS 800 Turbo at 32 KOPS, a three times improvement.

IBM expects that sequential throughput from disk for the DS8300 will exceed 3600 MB/second, which is more than six times the total sequential thruput of its predecessor, the ESS 800. This dimension of thruput improvement will allow customers to consider aggressive consolidation strategies from older IBM or other vendors' storage systems.

It should be noted that the DS8000 series shares a common library of software functionality with the DS6000 series to enhance product integration and support the multi-tier architecture of ILM. This includes *TotalStorage Flash Copy, Metro and Global Mirror,* and *z/OS* functionality for environments intermixed with ESS products.

Conclusion

At the high-end of the enterprise storage architecture, it all comes down to providing the customer with substantial value for their investment. **The DS8000 series has been designed for the most demanding, high performance applications with flexibility and performance key requirements**. The data center is looking for the ability to retrieve the right information at the right time and from the right place. The DS8000 series provides that capability through the dynamic allocation of resources and workload balancing between logical partitions, along with increased storage management.

With the integration of the POWER5 architecture, IBM has taken advantage of an investment in application servers to lower the TCO of storage servers, not only by lowering the costs, but also by improving the performance through POWER5 features, like logical partitioning and simultaneous multi-threading. IBM also gets to exploit future investments in the POWER architecture, such as more granular I/O allocation and more dynamic resource allocation capability for distributing CPUs to the dual partitions.

The DS8000 series provides TotalStorage DS with the ideal capstone for any enterprise storage architecture; it completes the continuum of selections available to the enterprise to best match the value of their data with the right tier of storage devices.[4]

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[4] See **The Clipper Group Navigator** dated August 29, 2002, entitled *Tiered Storage Classes Save Money – Getting the Most Out Of Your Storage Infrastructure,* at http://www.clipper.com/research/TCG2002030.pdf.

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