EMC Takes The Next Step —
Moves Multi-Tiering Inside Symmetrix

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Management Summary

Establishing a price for a product is not easy. Putting a value on a service may be even harder. Therefore, you have to admire the entertainment industry for its ability to not only establish a price to view a performance, but to be able to place different prices on a ticket depending upon where the seat is located. When a theatergoer buys a ticket for a Broadway play in a theater that holds an audience of only 2,000, he may pay $200 for an orchestra seat or $60 for a balcony view. You watch the same performance no matter where the seat is located, but a higher value is placed on the seats closer to the stage.

As the football season draws near, the average fan goes to the ticket office to buy seats for the coming season. It will cost more to sit on the sidelines of a stadium that holds 60,000 people than the end zone - more to sit on the 50-yard line than the goal line. The average fan pays more to be closer to the action! Unfortunately, unlike the theater, the stage at a football game is always moving, and the field is 100 yards long. The action could be at mid-field or at the goal line, depending on the flow of the game. Some fans are willing to pay more for a seat closer to the action – all of the time. Wouldn't it be nice if that fan could move his seat during the game, dynamically, to always be near to the next play (*a virtual view*), or pay less when the action was further away?

A similar problem exists in the largest enterprises: **getting true value for the investment in information storage**. The enterprise may install different tiers of storage throughout the organization, but the data center's where mission-critical applications require the highest level of performance possible, tier-one arrays are mandated. In the past, these storage arrays had one level of performance, one level of service – the highest possible of each. This would imply 2Gbps Fibre Channel connections, the fastest Fibre Channel drives available, and the highest performance storage infrastructure that technology can provide. If EMC is your storage vendor, then that implies a *Symmetrix DMX* array. Unfortunately, the value of most data diminishes over time and does not always require the fastest access. Best practices would dictate that multiple tiers of storage be implemented. With the recently announced DMX-3, EMC provides increased capacity and performance, and for the first time in high-end arrays, lower cost, slower, very high capacity drives within the same system. To learn if EMC's newest array, the DMX-3, can reduce the total cost of ownership for your data center while assisting you in the implementation of an ILM plan, please read on.

The Enterprise Data Center Problem

Today, the largest enterprises in the world share similar problems in their data centers: a complex architecture, limited budget, and rapid growth in data that must be stored and protected on disk. They also share a common mandate from management: **to improve data center efficiency and to reduce the total cost of ownership (TCO) of the Information Technology (IT) infrastructure**.

The EMC Solution

Consolidation is not a new concept. Enterprises have been consolidating their servers and storage for decades. However, in the enterprise data center, this has been mostly a homogeneous activity, with IT staff upgrading multiple mainframe systems into newer, larger models of the same architecture. With the advent of open systems, we have seen enterprise departments sharing mainframe storage and building heterogeneous environments based on standard operating systems and standard communications protocols in order to reduce the cost of accessing non-critical information. The IT community has also gained from the introduction of virtualization to the storage network, enabling applications to access data no matter where it resides.

One of the winners in this paradigm shift has been EMC, which has complemented their high-end *Symmetrix* platform with a broad-ranging family of storage arrays under the *CLARiiON* and Centera brands. Whereas Symmetrix *DMX* could be looked at as a homogeneous silo with hundreds of replicated devices, supporting terabytes of storage, with the fastest response time and the highest levels of reliability, the CLARiiON systems have evolved into highly efficient ILM platforms for the small-to-midsized enterprise (SME) and tiered platforms for the larger enterprise. The CLARiiON *CX* family, for example, supports FC, ATA and SATA drives, via both FC and iSCSI protocols. This enables the SME to allocate *tier 1 data* to higher performing FC drives, with less urgent files being relegated to slower devices within the same chassis, under control of the same storage management software (*Navisphere*).

Now, EMC has adopted what they have learned in the mid-range arena to the enterprise data center. They have announced DMX-3, the third generation of their Symmetrix DMX architecture. DMX-3 not only continues EMC's drive for the highest-performing high-end storage system, receiving that baton from *DMX-2*, but DMX-3 lays the groundwork to more than double the capacity of the DMX-2, creating a new tier, as EMC continues to offer DMX-2 where it satisfies the data center needs. In addition, EMC has enabled the inclusion of lower-cost (and slower-performing) disk devices in the same system. During 1H06, the DMX-3 will be qualified to scale to 1920 drives, with a 2000+ device capacity on tap for the end of 2006. In addition to the standard high-performance FC drives already available with Symmetrix, the DMX-3 will support new higher capacity low-cost Fibre Channel (LC-FC) devices during 1Q06. Running at 7200 RPM, these drives will be introduced with capacities of 400 and 500GB, enabling previously unreachable levels of scalability. These LC-FC drives will add another tier of storage for ILM within the DMX-3. These new LC-FC drives will be available on all DMX platforms. Data centers with DMX-1 and DMX-2 solutions installed will be able to install these drives into any available bays as long as the IT staff upgrades the Enginuity operating environment to the correct rev level. This could be a significant advantage for the enterprise as EMC has protected the investment made in earlier Symmetrix platforms. **This can lower the TCO and simplify the management of the enterprise data center through a reduced, simplified infrastructure**.

Applying EMC's network-based virtualization utility, *Invista[1]*, to the SAN, further facilitates the dynamic flow of enterprise data between tiers as well as between heterogeneous devices. A clear example is how one goes about migrating all of this data into one place.

The DMX-3

The DMX-3 is not replacing the DMX-2 –

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[1] See **The Clipper Group Navigator** dated May 31,, 2005, entitled *EMC Announces The Big "V" – Invista Storage Virtualization Platform* at http://www.clipper.com/research/TCG2005032.pdf.

it is complementing the DMX-2 at the high-end, the very high-end. Second, the DMX-3 announcement has been made in conjunction with some significant data migration software announcements, as well.

DMX-3 Hardware

The DMX-3 has been introduced with the capability of scaling to over 2000 devices by the end of 2006 with up to eight storage bays and over 1PB (as in Petabyte) of disk capacity, more than twice the capability of the *DMX3000*, which has a maximum of 576 drives. In fact, at first shipment in September, the DMX-3 will support from 360 to 960 FC drives, with drive capacities scaling from 73GB to 300GB, at speeds of 10,000 and 15,000 RPM, enabling implementation of an ILM strategy with drives of differing performance and price. Drives are separated into groups of 120 devices, with each group supported by a pair of channel directors, and each storage bay supporting one or two groups. All of this scalability makes the DMX-3 ideal for consolidation of storage in the enterprise data center with access from both mainframe and open systems[2] servers. The Enginuity operating environment, the heart of the DMX-3, will support up to 255 hosts per FC port or 512 hosts per iSCSI port. It will also support up to 64,000 Symmetrix volumes or up to 255 parallel access volumes.

Using the next generation of their *Direct Matrix Architecture* to provide the highest levels of throughput, bandwidth, scalability, and response time, EMC has doubled the throughput of DMX-2[3], with internal bandwidth of up to 128 GB/s. With 128 direct connections between channel directors and 512GB of global memory[4], the DMX-3 can meet the demands of the most taxing applications. EMC has complemented the basic infrastructure of the DMX-3 system bay with new, higher-performing channel directors. Implemented using four dual 1.3GHz *Power-*

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[2] The DMX-3 provides open systems support for AIX, HP/UX, Linux, Solaris, and Windows.

[3] See **The Clipper Group Captain's Log** dated March 3, 2004, entitled *EMC Builds to the Future – Part 1: Enhanced and New Storage Platforms* and available at http://www.clipper.com/research/TCG2004017.pdf.

[4] Global memory is configured in mirrored pairs of up to 256GB of DDR memory, to permit higher density memory configurations and compensate for the lack of dual porting.

PC processors from IBM, these new DMX-3 directors have up to 2.6 times the I/O processing power of the DMX-2. These channel directors provide 8-port support for 2Gb FC and ESCON interfaces and 4-port support for 2Gb FICON, GigE, and iSCSI. A DMX-3 System Bay can support up to eight or ten channel directors, depending upon configuration. The DMX-3 also supports up to 8 Disk Directors, with up to 240 drives connected to each[5]. As additional drives are added to the configuration, additional disk directors may be added with no disruption to mission-critical activity.

For the continued assurance of availability, EMC has engineered, in addition to standard RAID implementations, enhancements at two different levels of protection into the DMX-3:

- **Memory protection**: Provided through a new vaulting approach that writes global memory to the first 32 drives on each disk director, reducing the power required for any failure event and allowing for faster restart regardless of the number of devices installed or the size of global memory.

- **Environmental protection**: EMC has redesigned this newest Symmetrix chassis with front-to-top cooling to provide maximum airflow to control the temperature within the DMX-3 cabinets.

DMX-3 Software

The operating environment that drives the DMX-3, as well as the rest of the Symmetrix family, is *Enginuity,* the industry's most robust, open, and proven storage operating environment. It delivers optimized performance, availability, data integrity, and functionality to the most complex IT infrastructures and demanding enterprises. Enginuity is the foundation for a wide variety of storage applications, such as the *Symmetrix Remote Data Facility* (*SRDF*) and *Time-Finder*, part of the *ControlCenter* family of storage resource management software. It also provides application compatibility with all existing Symmetrix environments, eliminating the need to retrain staff, rewrite applications, or do any new integration. This

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[5] The DMX-3 Disk Director will support 480 drives in 1H06.

includes the ability to connect simultaneously with virtually all mainframes as well as a wide variety of open platforms, including Linux, UNIX, and Windows.

EMC is now adding to that a pair of server-based data migration applications that enable customers to easily move information within and between storage systems without losing access to the data. This is a capability necessary for any serious ILM implementation. The two applications are *Open Migrator/ LM*, a homegrown tool to provide automated online data migration between heterogeneous storage systems in Windows and UNIX environments, and *Logical Data Migration Facility* (*LDMF*), the first migration utility that enables non-disruptive online relocation of mainframe data at the dataset level. EMC and Softek developed LDMF jointly. Combined with Invista, EMC's networked storage virtualization solution, along with *Centera* and *Documentum*, the data center can employ a complete ILM strategy.

Open Migrator/LM

Open Migrator/LM moves Unix or Windows-based data from a source to a target – either within a storage system or between two heterogeneous storage systems – while that specific information remains available to the application. Typically, these migrations require extensive periods of downtime. This new EMC software is easy to use and is an ideal fit for moving application data, migrating internal storage to an external storage system, migrating data between heterogeneous storage systems and from direct-attached storage to a storage area network (SAN).

Logical Data Migration Facility

LDMF transparently moves mainframe datasets – while online - from one volume to another in background and automatically updates catalog information to reflect the change in location. It is the only on-line alternative to making manual copies or using other utilities that require lengthy application downtime. LDMF software enables mainframe administrators to relocate information more efficiently onto new storage or storage tiers, to optimize volume utilization and performance, and to consolidate datasets into fewer volumes to minimize resource consumption. Specifically, it enables them to

consolidate smaller volumes onto larger ones, such as Mod 3's to Mod 9's, or Mod 9's to Mod 27's. In particular, salvaging the valuable and limited UCBs allotted to a given mainframe. This helps to exploit the larger drives and multiple tiers available in the DMX-3.

Conclusion

Quite clearly, the DMX-3 represents a major effort on the part of EMC to retain its hold on the enterprise data center, complementing the full-court press for SME business that EMC and other storage providers have adopted of late. From a hardware standpoint alone, DMX-3 provides significant advantages to the largest enterprises with significantly improved scalability, higher capacity, faster throughput, and investment protection. Improvements to the Direct Matrix Architecture, implementation of mirrored memory with vaulting, and redesign of the cooling system all contribute to the overall improved availability of data. **However, it may be the software enhancements that will prove to be of the greatest value to the enterprise data center**.

Lowering TCO, while improving scalability in a non-disruptive fashion, is the admirable stretch goal of any consolidation project. EMC may have turned this stretch into reality with a set of migration applications that enable the consolidation of both mainframe and open systems storage into a single, resilient platform. DMX-3 is not for everyone. You must be in need of a lot of storage (and you probably know how many zeroes there are in a petabyte) with the highest reliability requirements and you must be prepared to pay for it. If you are, you need to look at the DMX-3; it may be the answer you seek.

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