IBM Brings Enterprise Functionality to Mid-Range Storage

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Management Summary

Was it really that long ago when mobile phones were introduced to enable us to make and receive calls outside our home: in our city, in our state, or even anywhere in the country? The ability to stay in touch with everyone no matter where we were was simply great, especially when your teenage daughter was running late or if you were caught in traffic, etc. Now, however, technology has taken us one giant step forward with the *iPhone 4*, enabling us to see whom we are talking to while they can see us.[1] The iPhone 4 not only makes video calling a reality with a front-facing camera, but it enable us to listen to music while we talk and even helps us find out where we are going via a built-in GPS function. With 512MB of memory and up to 32GB of storage, along with Wi-Fi radio and hundreds of apps, it enables us to do multi-tasking in the palm of our hand. *It even allows us to make a phone call!* The iPhone 4 brings integration to our everyday life, eliminating devices we no longer need. The age of integration is not unique to the cell phone, however.

The enterprise datacenter has seen its share of servers that were designed to accomplish one task very well, but were not as adept when asked to perform another function or multiple functions. Today's IT staff has taken servers based on the latest quad-core architecture and used them to consolidate and virtualize multiple applications onto a single integrated platform successfully. Now, that staff is looking for a highly-scalable, highly-functional disk system that can scale dynamically to support hundreds of storage devices: *high-speed* for performance-sensitive, mission-critical applications and *high-capacity* for business-critical and web-facing applications. This *unified solution* requires enterprise-level functionality to provide for thin provisioning, performance optimization, dynamic-migration of data between tiers, and sophisticated replication applications to ensure the availability of the mission- and business-critical data. For the largest enterprises, there are many vendors eager to provide high-value solutions to cure their pain. *However, what about the mid-sized datacenter?* They have the same needs as their larger brethren, without the same capacities. In fact, with a smaller IT staff and, certainly, a smaller budget for IT infrastructure, the mid-sized datacenter is in desperate need for a mid-range storage solution that can support both high-capacity disks and high-performance devices with enterprise-level functionality, without breaking their budget. So, where can they look for a storage system that can handle all of its needs at a reasonable price, but has the simplified data management features required by a more limited staff? *How about one of the leaders in storage and storage services? How about IBM!*

IBM has just announced their newest mid-range disk system, designed to meet the capacity and functionality requirements of any mid-sized data-center and also should find many uses in larger datacenters. With six decades of storage experience and the innovation from newly acquired technology, IBM has delivered the finest unified storage available. To learn more about IBM's *Storwize V7000*, please read on.

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[1] Did I say *forward*? Do you remember *Dick Tracy* and his 2-way wrist radio that was upgraded to a 2-way wrist TV in 1964?

Mid-Range Pain in the Datacenter

One fact is indisputable: storage is on an inexorable rampage through your IT infrastructure budget, determined to consume every dollar it can find. It does not matter if you are an enterprise datacenter, mid-sized datacenter, or SME, your data store is growing at a pace that we have not seen before. With datacenter storage requirements doubling about every 18 months, the IT staff has to find a means to get a handle on it. Mission-critical applications are looking for more high-performance, Tier-1 storage every day, while business-critical applications, such as email and backup, are taking longer to accomplish their tasks, often exceeding the timeframe allocated in the backup window, filling every high-capacity, Tier-2 drive provisioned to their LUN. Islands of high-performance Fibre Channel (FC) arrays are competing with islands of high-capacity SATA arrays in the storage area network (SAN) for attention, consuming increasingly expensive administrator time to ensure that all applications have the resources that they need.

Application consolidation and server virtualization have enabled the IT staff to reduce the total cost of ownership (TCO) attributable to the server infrastructure, but *what is being done to reduce the TCO for storage?* **With multiple applications sharing the same server resources, the datacenter has to look toward upgrading their storage requirements to support multiple tiers, dynamic scalability, and a virtualized environment demanding higher throughput.** For many enterprise datacenters, this means, upgrading their SAN to a high-availability, 8Gbps FC path. For others, there is a requirement to deploy a fast serial-attached SCSI (SAS) bus, in order to unify and simplify the I/O path and to avoid the high acquisition costs and even higher administrative costs associated with FC. SAS enables high-performance and high-capacity storage to share a common bus and lower the TCO of the IT infrastructure.

Larger datacenters, with higher budgets, have resources available to them that do not exist for the mid-range datacenter. Their IT staffs are larger, with a broader range of experiences, and often carry a significantly higher salary. However, functionally, their needs are very similar. **The mid-sized datacenter needs solutions that are integrated with all, or at least most, of the hardware and software functionality found on enterprise-level storage arrays.**

In terms of hardware, the mid-sized datacenter is looking for a multi-tiered storage solution that includes most, if not all, of the following:

- **Solid State Drives** (SSD) for their highest performing database applications, with very high IOPS;
- **High-performance SAS** drives to satisfy mission-critical Tier-1 application requirements;
- **High-capacity SATA** drives to fulfill the rapidly growing needs of Tier-2 business-critical applications, such as email and other web-facing requirements; and
- **Virtualization** capabilities to improve the utilization rates of storage devices, in much the same way that the datacenter has consolidated and virtualized their server infrastructure to improve the TCO of the IT environment.

The technology roadmap for storage software for the mid-sized datacenter includes the same functionality provided to many of their bigger brothers – in terms of:

- Block and file replication;
- Asynchronous remote block mirroring;
- Thin provisioning;
- Storage performance monitoring;
- Capacity planning and forecasting; and
- Record/document management.

Many storage vendors have a limited range of products that they try to force-fit into every solution. With an extremely broad range of storage solutions available, from the *DS8000*[2] for the largest enterprise datacenter with the highest functionality requirements, to the *DS3000*[3], for the SME with more basic demands and limited scalability, to the *XIV*[4] line for enterprises looking to scale and have high-performance, to the *ProtecTIER*[5] line of data deduplication engines, IBM has solutions that can be tailored to meet the specific needs of any datacenter. Nonetheless,

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[2] See **The Clipper Group Navigator** entitled *Maximizing the Business Value of Information and Lowering Energy Consumption with IBM's DS8700* dated April 13, 2010, at http://www.clipper.com/research/TCG2010018.pdf.

[3] See **The Clipper Group Navigator** entitled *Delivering Enterprise Features for the Mid-Range – IBM Introduces DS3500 with TPC MRE* dated June 7, 2010, and available at http://www.clipper.com/research/TCG2010027.pdf.

[4] See *The Clipper Group Captain's Log* dated January 15, 2008, entitled *A New Year Dawns for I.T. – IBM Adds New Paradigm to its Storage Architecture* and available at http://www.clipper.com/research/TCG2008003.pdf.

[5] See **The Clipper Group Navigator** entitled *Reversing the Requirement for Storage Growth – IBM Consolidates and Simplifies Tier-2 Storage* dated February 23, 2009, at http://www.clipper.com/research/TCG2009008.pdf.

IBM has now introduced *Storwize V7000,* specifically designed to meet the growing scalability requirements of the mid-sized datacenter, including functionality features usually only found only in the largest enterprises. IBM's range of storage solutions just got even better!

IBM's Storwize V7000 Solution

The new IBM Storwize V7000 is designed to satisfy an expanding mid-range datacenter community with new, more demanding requirements. These include delivering a storage solution that can deliver Tier-1 performance to a mid-sized customer looking at it for primary storage attributes, as well as Tier-2 capacity value for those looking to reduce the TCO of their IT infrastructure. This array can deliver the efficiency that mid-range IT staffs require to remove complexity from their administrative burden, simplifying the day-to-day operation of the datacenter.

IBM has developed a new, innovative unified storage architecture and combined it with hardware and software innovations from a number of sources, including the integration of RAID code from the DS8000, solid state disk drives[6] (SSDs) and a rich software stack from the *SAN Volume Controller*[7] (*SVC*), and the graphical user interface (GUI) from the XIV product line. They have developed a storage platform where the emphasis is on the value-add of a powerful set of software features, ease of use and rapid time to client value, and tighter application integration, rather than simply focusing on mid-range price/performance. IBM now is placing that emphasis on delivering enterprise features to the mid-range community to deploy RAS to their datacenter: reliability, availability, serviceability, and data resilience. Storwize V7000 may be new, but the mid-sized datacenter that deploys it will inherit a mature software stack that has evolved in SVCs since 2003.

IBM has made an overt decision to include, at no extra charge, a significant portion of their SVC software stack, *without dumbing down* the functionality. (There is a charge for some optional features, as described below.) The IBM Storwize V7000 becomes the ideal mid-range solution for

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[6] See the issue of **Clipper Notes** dated January 26, 2009, entitled *A New Tier of Storage Appears – Faster, Solid-State Drives State Their Case,* and available at http://www.clipper.com/research/TCG2009006.pdf.

[7] See **The Clipper Group Navigator** entitled *IBM Upgrades SVC with Solid State Drives – Achieves Better Storage Utilization* dated October 14, 2009, and available at http://www.clipper.com/research/TCG2009046.pdf.

the datacenter looking to deploy storage virtualization capabilities. In fact, those virtualization features, both standard and optional, are there whether you want them or not; all you need to do is turn them on, since IBM already has integrated them into the stack, as delivered.

IBM Storwize V7000 Hardware

IBM's Storwize V7000 mid-range storage offering consists of a series of 2U building blocks (enclosures) configured for a standard 19" rack. (See Exhibits 1 and 2, on the next page.) Each control enclosure includes dual controllers, with the latest generation of Intel processors, in an active-active configuration, and up to twelve 3.5" drives or twenty-four 2.5" drives. Each controller supports up to four 8Gbps FC ports and two 1Gbps iSCSI ports, for a total of eight 8gbps FC ports and four 1Gbps iSCSI ports. The IT staff may attach up to nine expansion enclosures to a control enclosure, dynamically, for a total of up to 240 drives (using 2.5" drives), with a maximum system capacity of 240TB (using 3.5" 2TB drives).

The 2.5" drives come in a variety of SAS formats, both HDD and SSD. The HDDs are all 10,000-RPM devices with capacities ranging from 300GB to 450GB to 600GB, enabling the datacenter to deploy a maximum number of read/write heads to improve application performance for Tier-1 applications. Storwize V7000's 2.5" enclosure also supports any number of 300GB 2.5" SSD devices for the most demanding high performance applications. The datacenter may deploy an enclosure with a mix of drive types (HDD and SDD), as well as any mix of drive capacities.

The 3.5" devices are presently limited to 2TB nearline drives running at 7200 RPM for capacity optimization for Tier-2 applications. While you cannot mix 2.5" and 3.5" devices in the same enclosure, you can mix 2.5" enclosures with 3.5" enclosures in the same system.

While IBM made an overt decision to focus on software functionality, make no mistake: this is an extremely powerful high-performance and energy-efficient storage engine. With a full configuration of HDDs, Storwize V7000 can deliver up to 70,000 IOPS for disk reads with a throughput estimated at 6,000MB/s and up to 24,000 IOPS for disk writes with a throughput estimated at 4,000MB/s. Configured with just 32 SSDs, these numbers skyrocket to 320,000 IOPS for reads and 70,000 IOPS for writes. These values compare favorably with any competitive

Exhibit 1 — IBM's Modular Hardware Building Blocks

- Control enclosure: dual controllers and up to twelve 3.5" or twenty-four 2.5" drives in just 2U
- Expansion enclosure: drives only
- Up to nine expansion enclosures attach to one control enclosure
- Mix drives sizes and HDD/SSD in enclosure
- Eight 8Gbps FC ports plus four 1Gbps iSCSI ports per controller pair

Source: IBM

mid-range storage system.

Configured with 12 2TB drives, the 12-bay control enclosure consumes only 665W, or 27.67 Watts/TB. Configured with 24 600GB drives, the control enclosure consumes just 680W, or 47.2 Watts/TB, delivering double the number of read/write heads in the same energy envelope.

Storwize V7000 Software

Exhibit 2 – Building a Midrange Storage System

Source: IBM

And now, as Steve Jobs would say in introducing the iPhone 4, onto the *really big news*. IBM's Storwize V7000 hardware, with capacities, as we have seen, specifically designed for a growing mid-sized datacenter, comes with the richest set of storage optimization features – including an IBM software stack – that is currently available in mid-range storage. These are not features making their debut in your datacenter, these are features that have been tested, deployed, and in production in the largest datacenters around the globe, leveraging capabilities innovated by IBM for *SVC*, *DS8000*, and *XIV*. Let's take a look at the highlights of what you receive.

- **RAID 0, 1, 5, 6, and 10** (from the DS8000);
- **Storage virtualization** for local and external heterogeneous disks (from SVC);
- **Thin provisioning** and enterprise-class **replication** (from SVC);
- A simplified web-based **Graphical User Interface** (GUI) fro*m XIV*;
- *Easy Tier* to provide dynamic movement of sub-LUNs between HDDs and SSDs (from the DS8700);
- *IBM FlashCopy Manager* to provide replication integration with a wide variety of data base software; and
- **Tight integration** with *Tivoli Storage Productivity Center (TPC)* and *IBM Systems Director*.

Let's take a closer look into the features that come standard at no cost with Storwize V7000 and those that are optional.

Storwize V7000 Standard Software Features

Storwize V7000 comes with the following IBM features as standard.

- **Thin Provisioning** enables the datacenter to make more productive use of available storage, improving storage utilization. Without thin provisioning, pre-allocated space is reserved whether the application uses it or not. With thin provisioning, applications can grow *dynamically*, only consuming the space actually being used. This happens in a way that does not require any reconfiguring of the applications.
- **Easy Tier** performance management enables the datacenter to identify and automatically relocate the busiest data from HDD to the higher performing SDD drives in a hybrid storage pool. This enables the remaining data to take advantage of higher capacity, price-optimized storage.
- **RAID 0, 1, 5, 6, 10** – along with RAS services and diagnostics – to ensure against loss of data in the event of a device failure;
- **Data Migration** feature enables the IT staff to manage storage system upgrades and lease terminations more efficiently by installing Storwize V7000 into the SAN fabric as a new disk, transparently moving application data from legacy disk arrays, such as EMC *CLARiiON*, to Storwize V7000's internal disks. The Storwize V7000 system also can virtualize existing LUNs or entire storage systems for consolidated management. No data movement is required, but other arrays may now be managed as part of a virtual pool.
- **Local Mirror** feature allows ultra-high availability applications to mirror application data synchronously between two separate disk enclosures attached to the same Storwize V7000 system.
- **FlashCopy** creates instant application copies for backup or application testing. It enables the datacenter to make better utilization of storage space with incremental snapshots for up to 256 copies.
- **The Storwize V7000 GUI** provides a fresh, new user interface based upon the XIV GUI, which has received much praise for its simplicity. It hides system complexity with presets, but makes all capabilities of the system available for advanced users. It provides easier navigation between screens to guide staff personnel to the next step. It is browser-based to enable access from any platform. It enables the administrator to get the system up and running and shows a visualized task flow. It also provides an integrated video instruction set to guide the mid-range IT administrator through system operation. (See Exhibit 3, at the top of the next page.)

Storwize V7000 Optional Software Features

- **Performance optimization** through IBM Tivoli Storage Productivity Center enables the IT staff to visualize the physical topology and logical data path through the SAN to analyze system performance and throughput. It collects storage usage statistics and builds a database in order to recommend moving logical units between drawers to avoid hot spots and facilitate capacity management with policy-based alerts. It builds scripts to rearrange the data transparently to eliminate hot spots dynamically, balancing utilization of all devices. It also provides health and status monitoring and event management.
- *Metro and Global Mirror* enables the datacenter to create application-level consistency groups synchronously up to 300km (with *Metro Mirror*) and asynchronously over global distances.
- **Comprehensive Disaster Recovery** is provided by IBM Tivoli Productivity Center for Replication, which works in conjunction with the Storwize V7000 Metro and Global Mirror function to automate failover/failback in the event of a disaster, and also to freeze the mirror and take a consistent FlashCopy replica to enable disaster recovery testing for critical applications.
- **IBM Systems Director Storage Control** improves administrator productivity by providing consolidated single-pane-of-glass management of Storwize V7000 and IBM servers.
- *FlashCopy Manager* provides an integrated, instant copy for critical applications like *Oracle*, *DB2*, *SAP*, and Microsoft *SQLServer* and *Exchange*. It can almost eliminate backup windows as it rapidly creates clones for application testing.[8]

Optional features are pre-installed for ease of deployment, and can be enabled with the input of a license key.

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[8] It is similar to *Snap Manager* for the IBM *N Series* NAS storage.

Exhibit 3 — IBM Storwize V7000 Graphical User Interface
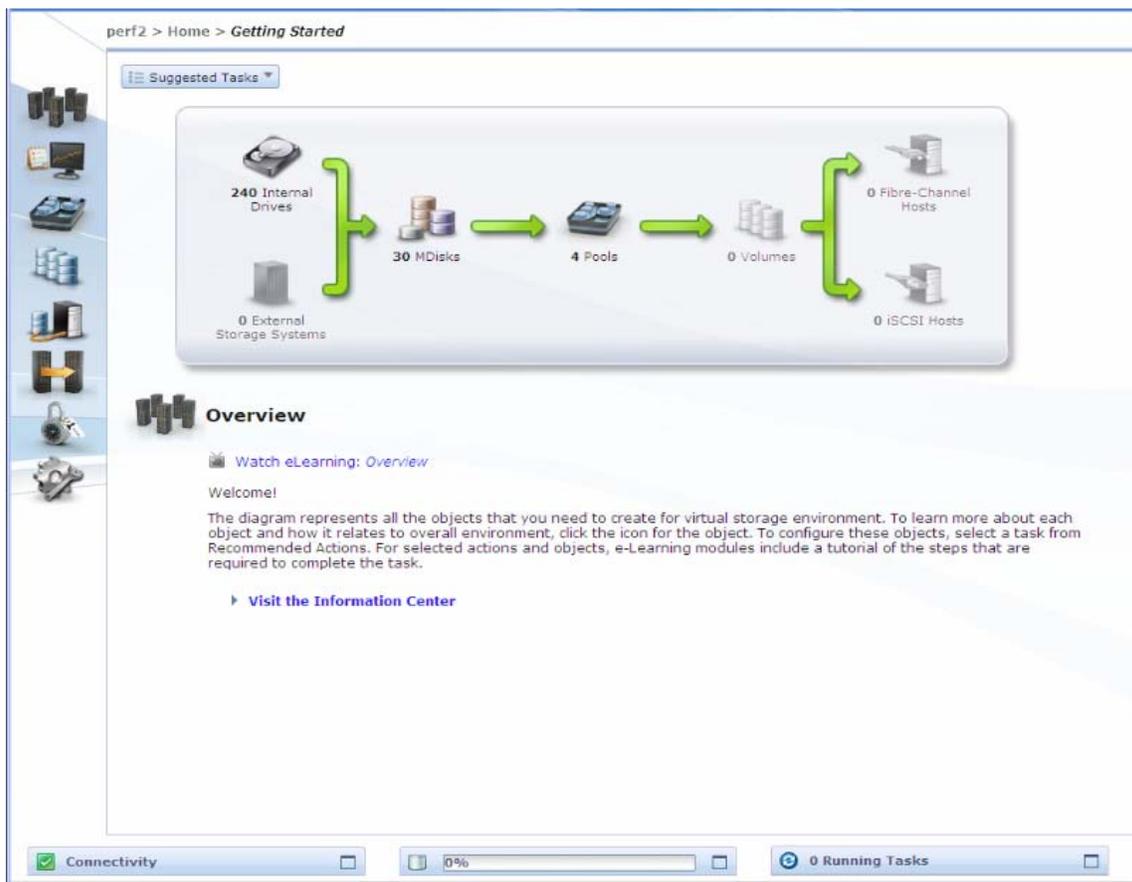
Source: IBM

Conclusion

Storwize V7000 provides the mid-range datacenter with the modular scalability previously reserved for enterprise datacenters, with a very compact packaging. It supports independent scaling of performance, capacity, and software, enabling the IT staff to start small and grow as business requirements change, up to 240 drives. It enables the datacenter to protect its investments without changing the base platform. With likely future enhancements, the datacenter can expect an even longer life span from this investment.

IBM Storwize V7000 empowers the datacenter with enterprise-class software capabilities, integrated into the basic platform, many of which are included in the basic price of the platform. With a completely new GUI from XIV, replication and virtualization capabilities normally found only in higher-priced enterprise arrays, and man-

agement capabilities that simplify complex tasks, IBM Storwize V7000 provides the IT staff with enterprise features at a mid-range price. With no-charge thin provisioning, no-charge Easy Tier, and non-disruptive migration, Storwize V7000 gives the mid-range datacenter an enterprise feel.

So, what does all of this mean? One thing is for sure, if you are managing a mid-sized datacenter with a rapidly expanding data store, and a not-so-rapidly expanding budget and administrative staff, you need to look at IBM's Storwize V7000, as one sure way to put a stop to a rising TCO.

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