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IBM Upgrades SVC with Solid State Drives — Achieves Better Storage Utilization

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Management Summary

With the football season in full swing, the baseball season heading into the playoffs, and the hockey season just starting, it is time to raid the refrigerator for snacks, head for the most comfortable chair in the family room, and settle in for a full day of viewing sports. Unfortunately, it is not always easy to turn on the myriad number of devices required to watch a game broadcast over cable, on that wide-screen hi-def TV, with the wrap-around sound from the latest audio system available. There is the remote for the cable system; there is a remote for the TV; there is one for the satellite dish; there is another for the sound system. There are so many remote controls on the coffee table that there is hardly room for the snacks! What you need is a universal remote; a single, simplified command center that can control all of the hi-tech equipment in the family room. Unfortunately, even that universal remote will not do the job for any device released after the remote was manufactured. What is required is a universal remote with a learning capability to take the complexity out of turning on the TV, one than can reprogram itself from the remote that comes with every new device.

Similar problems confront the data center storage administrator. How can he manage a dozen different disk arrays and virtual tape libraries (VTLs) from any number of different vendors, improving storage utilization? How can he manage multiple SANs and multiple NAS arrays without having to learn a dozen different command sets? How can the administrator deploy multiple tiers of storage across these arrays efficiently and economically, to ensure that the storage is being properly utilized? How can the administrator ensure that the HPC application is assigned to the highest performing (and most expensive) solid-state disk device (SSD), while mission-critical applications write to the fastest Fibre Channel (FC) devices, and the backup application to the highest capacity (and lowest cost) SATA disk? When confronted with similar issues, the server administrator has resorted to the consolidation and virtualization of under-utilized platforms. The solution is the same for the storage administrator.

Virtualization of the storage architecture can ensure that the data center gets the maximum value out of its storage resources, maintaining the lowest possible total cost of ownership (TCO) of the enterprise storage infrastructure. By deploying a storage virtualization appliance, the IT staff can achieve the highest possible utilization of its storage capacity, while simplifying management control. It can manage FC and iSCSI from the one GUI. It can deploy SSDs for those applications that demand the highest possible IOPS, while assigning the most reliable HDDs to those mission-critical applications that require them, and the least expensive devices to archive applications. The question that remains: *Which virtualization engine to deploy?* To date, the most successful storage virtualization system has been IBM's *SAN Volume Controller* (*SVC*). Is it the right engine for your enterprise? To find out, please read on.

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Storage Utilization in the Data Center

The typical data center is in the midst of radical change, consolidating under-utilized server sprawl onto fewer, more efficient multi-core platforms, which have been virtualized to improve processor utilization, simplify server administration, and lower the TCO of the data center. This lower cost encompasses more efficient energy consumption and better utilization of floor space, enabling the enterprise to conserve natural resources and prolong the lifecycle of the existing data center facilities. Along the way, these faster, multi-socket, multi-core platforms improve application performance and raise service levels, enabling the enterprise to react faster to changing business conditions. However, it has done nothing to improve the utilization of storage resources and **it also has resulted in a significant increase in the complexity of the storage architecture, with potential performance penalties for every I/O issued**. As the number of virtual machines on any given server increases, the ability of the I/O subsystem to predict the next read or write becomes increasingly difficult.

With a dual-socket, quad-core server, the IT staff can consolidate 10, 20, or more, applications on a single platform. Unfortunately, this does not improve the utilization of storage within the data center. Similarly to the server farm, disk devices on the SAN are seriously under-utilized, with space being reserved for future use which may or may not ever be utilized. The data center is only using about 30% of the typical disk drive, with the remainder sitting idle. Improvements must be made in the provisioning of disk storage which has rapidly become, along with application software, the biggest drain on the enterprise IT budget.

Server virtualization has also changed the fundamental nature of I/O generation, as each virtual machine, every application, can issue an I/O request to the same I/O controller, minimizing the ability of the controller to predict what the next I/O might be. In essence this makes every I/O random, even for applications which might be issuing sequential I/Os in a non-virtualized environment. This limits the capability of the controller to do a prefetch, bundle writes, or even utilize a read cache. In effect, the data center loses all of the performance gains achieved over the past few years in the area of predictive analysis, affecting the performance of every application moved to a virtualized server environment.

Exhibit 1 – SSD Functionality

NAND Flash is a special form of flash memory that can be electrically erased and reprogrammed. Flash memory is a memory technology that keeps data even when the power supply is cut off. This is known as non-volatile memory. Flash memory costs far less than byte-programmable EEPROM and therefore has become the dominant technology wherever a significant amount of SSD storage is needed.

Flash memory does not have the mechanical limitations and latencies of hard drives, so the idea of solid state storage is attractive when there is a requirement for very high IOPS speed and very low power consumption. Flash memory offers very fast read access times. In order to counteract a limited number of write-cycles, manufacturers have implemented a number of wear-leveling techniques to prolong SSD life. Manufacturers typically specify something in the area of 100,000 write-erase cycles per block, for the lifetime of the device.

In order to reverse this negative trend in I/O performance, the IT staff must change the data access paradigm in the data center, moving to an automated, virtualized storage environment, with multiple tiers of storage available to assign applications to disk space with the most appropriate value for the enterprise. The data center needs to improve storage utilization, the performance of an increasingly random I/O engine, and also lower the TCO of the storage environment in the same vein as the server network.

In order to eliminate storage sprawl, the data center must unify their existing storage, virtualizing the front end with a common interface to more fully utilize existing arrays. They need the capability to manage multiple tiers of storage, including high-performance Tier-1 FC drives for mission-critical applications, high-capacity, low-cost Tier-2 SATA drives for business-critical and archiving applications, and, most importantly, the premium Tier-0 Flash SSDs for those applications with the highest IOPS requirements (See Exhibit 1, above). They must have the ability to assign applications dynamically to the devices that can

deliver the *right amount of value* through performance and capacity to meet the service levels agreed to with the data center's users. The IT staff needs an environment that can reduce the complexity of storage management with the flexibility that will enable the data center to adapt to a changing business climate.

Using their technological leadership in the data center, IBM developed the *SAN Volume Controller* (*SVC*) to meet these requirements. By virtualizing the front-end of the SAN, the data center can improve the utilization and performance of their existing storage platforms, regardless of the vendor source. The SVC has been delivering the reliability and the tools necessary to create just the right balance of performance and capacity to enable the data center to reduce their TCO for the storage infrastructure while improving operating efficiency. In fact, IBM has reported better than five "9s" reliability across the entire SVC installed base.

Last year, IBM introduced a new entry-level version of the SVC for the SMB and departmental customers, simplifying configuration and pricing, and enhancing it with thin provisioning and snapshots, enabling these functions on storage platforms that did not come with these advanced capabilities. SVC also supports a wide variety of server virtualization hypervisors, including the most popular open products, *VMware*, *Hyper-V*, and *Citrix Xen*, as well as IBM's own *PowerVM* and *zLPAR*. This is extremely valuable for any data center with a mixed server virtualization environment looking for quick provisioning and scalability. SVC facilitates load balancing across a heterogeneous mix of storage arrays behind it. In fact, IBM has been so successful with the SVC that in 2008 they shipped their 15,000th SVC engine.

However, technology does not stand still; and, apparently, neither does IBM! IBM has now announced added capabilities for SVC 5 to include innovative support for SSDs along with a new Version 5 of the SVC software. In an era where server virtualization has changed the way servers interface with storage, the SVC is changing its role in the data center, also.

IBM's SAN Volume Controller 5

IBM's SVC is a storage virtualization system designed to help customers improve storage utilization, control storage growth, and reduce their TCO for SAN storage by up to 30%, for IBM and non-IBM arrays. The SVC enables the data center to combine storage capacity from multiple, heterogeneous disk systems into a single pool of storage, increasing flexibility while reducing the complexity of storage management. Improved remote mirror functionality, through *VMware vCenter Site Recovery Manager with Metro Mirror and Global Mirror*, provides the enterprise with a single, consolidated data center for a simplified, multi-site disaster recovery capability.

The SVC enables the data center to share multiple tiers of storage between multiple servers, physical or virtual. Moreover, with Version 5 of the SVC, IBM becomes the first vendor to deliver fully integrated support for solid-state drives, from one to four 146GB drives per SVC engine, to improve performance and energy efficiency. IBM has enabled virtual disk mirroring to protect against SSD or storage engine failure, with up to 584GBs of mirrored capacity per I/O group, or up to 2.4TBs per cluster. Replication, data movement, and management operate identically as they would on HDDs. Furthermore, the IT staff can move data to and from SSDs without disruption, including making copies of SSD data on HDD drives, preserving these more valuable assets for high IOPS activities. IBM's *Tivoli Storage Productivity Center Performance Optimizer* can be used to help identify the data that is the highest candidate for SSD storage. This enables scale-out ultra-high throughput and response time for hard-to-tune I/O intensive workloads, with up to 50,000 read IOPS per SSD, up to 200,000 per SVC I/O group, and up to 800,000 read IOPS per SVC cluster.

Along with Version 5 of the SVC software, IBM is introducing a new high end engine for increased performance, based upon the IBM quad-core *System x3550M2* server. Configured with 24GB of cache, three times the previous model, and with four 8Gbps FC ports, SVC 5 improves bandwidth by up to two times the previous version. SVC 5 also supports iSCSI, for lower cost server attachment to all SVC-supported disk systems. This new engine can be intermixed with older engines in an SVC cluster and provides support for multiple remote mirror locations with increased remote mirror capacity.

This innovation and configurability enables a significant improvement in SVC's price/per-

formance ratio. It also enables support for more demanding, larger configurations, with fewer SVC engines. With an eight-node configuration, IBM estimates that SVC 5.0 will return a projected SPC-1 benchmark rating 65% higher than the current SVC engine, with a projected rating that is more than double the posted benchmark from HDS.

SVC Software Version 5 is available as a non-disruptive upgrade for all existing customers with a current subscription, providing software support for the following.

- iSCSI server attachment, with two 1Gbps Ethernet ports per engine;
- Replication enhancements via Metro Mirror and Global Mirror to enable the data center to copy from several remote sites to a single SVC cluster at a disaster recovery site;
- Copy services for *Multi-Target Reverse FlashCopy* to enable FlashCopy targets to become restore points for the source; and
- Improved cache management, improving throughput by up to 15%.

SVC 5.0 supports all SVC engines available since 2005.

Conclusion

With the availability of solid-state storage within Version 5 of its SAN Volume Controller, IBM once again delivers outstanding technological innovation to the data center. SVC 5 provides the IT staff with multiple tiers of storage, topped by the 800,000 read IOPS capability of an integrated SSD capability. This functionality does come with a higher cost, but it also *delivers significantly higher value* as demonstrated by the increased performance from industry standard benchmarks, making its ROI very attractive to the enterprise.

Additional functionality, such as iSCSI connections for added flexibility to attach low-cost servers, and FlashCopy Manager to help reduce backup windows provide even more value to the data center. Furthermore, the new Multiple Cluster Mirror functionality to support consolidated disaster recovery helps to simplify data center management at a lower cost.

If you have a heterogeneous storage architecture in your data center that is under-utilized and costing the enterprise on the bottom line, IBM SVC 5 may be the solution that you have been seeking to consolidate and virtualize storage operations, improve performance, and reduce the budget drain by to the costs associated with rapidly expanding data.

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