

Lab Validation Report

IBM Storwize V7000 Disk System

Enterprise-class Function in a Midrange Storage Package

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ESG Lab Reports

The goal of ESG Lab reports is to educate IT professionals about emerging technologies and products in the storage, data management and information security industries. ESG Lab reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies. Our objective is to go over some of the more valuable feature/functions of products, show how they can be used to solve real customer problems and identify any areas needing improvement. ESG Lab's expert third-party perspective is based on our own hands-on testing as well as on interviews with customers who use these products in production environments. Although this report may utilize publicly available material from various vendors, including IBM, it does not necessarily reflect the positions of such vendors on the issues addressed in this report. This ESG Lab report was developed with IBM funding.

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Introduction

This report documents the results of ESG Lab hands-on testing of the [IBM Storwize V7000 Midrange Disk System](#) with a focus on the powerful enterprise-class features and functionality offered by the platform, including heterogeneous storage virtualization, thin provisioning, data mobility, and capacity-efficient point-in-time snapshots. Testing was designed to confirm IBM's claims that the V7000 has built-in efficiency with exceptional ease of use and performance.

Background

ESG conducted an in-depth survey of senior IT professionals concerning their organizations' IT spending plans and priorities for 2011. Survey participants represented midmarket (100 to 999 employees) and enterprise-class (1,000 employees or more) organizations in North America and Western Europe. The top ten responses are shown in Figure 1. Priorities were fairly evenly distributed with every listed priority getting at least one response. The top two priorities for organizations were increasing the use of server virtualization and managing data growth.¹

Figure 1. Data Storage Infrastructure Spending Plans



Source: Enterprise Strategy Group, 2011.

In another recent study, ESG found that server virtualization is becoming ubiquitous in IT organizations of all sizes. Of 1,602 survey respondents, nearly three-quarters (74%) said their organization currently uses server virtualization. An additional 19% of organizations are in the evaluation or planning phase, leaving just 7% of the midmarket and enterprise organizations surveyed by ESG not currently using server virtualization and having no plans to do so.²

IT professionals who have experience with server virtualization know that like server virtualization, storage virtualization enables consolidation, which reduces complexity and cost. Storage and server virtualization are also similar in their ability to provide increased availability, fault tolerance, and mobility. Given the similarities, it's not surprising that, in an earlier study, ESG learned that an increasing number of organizations are deploying server and

¹ Source: ESG Research Report, *2011 IT Spending Intentions Survey*, January 2011.

² Source: ESG Research Report, [The Evolution of Server Virtualization](#), November 2010.

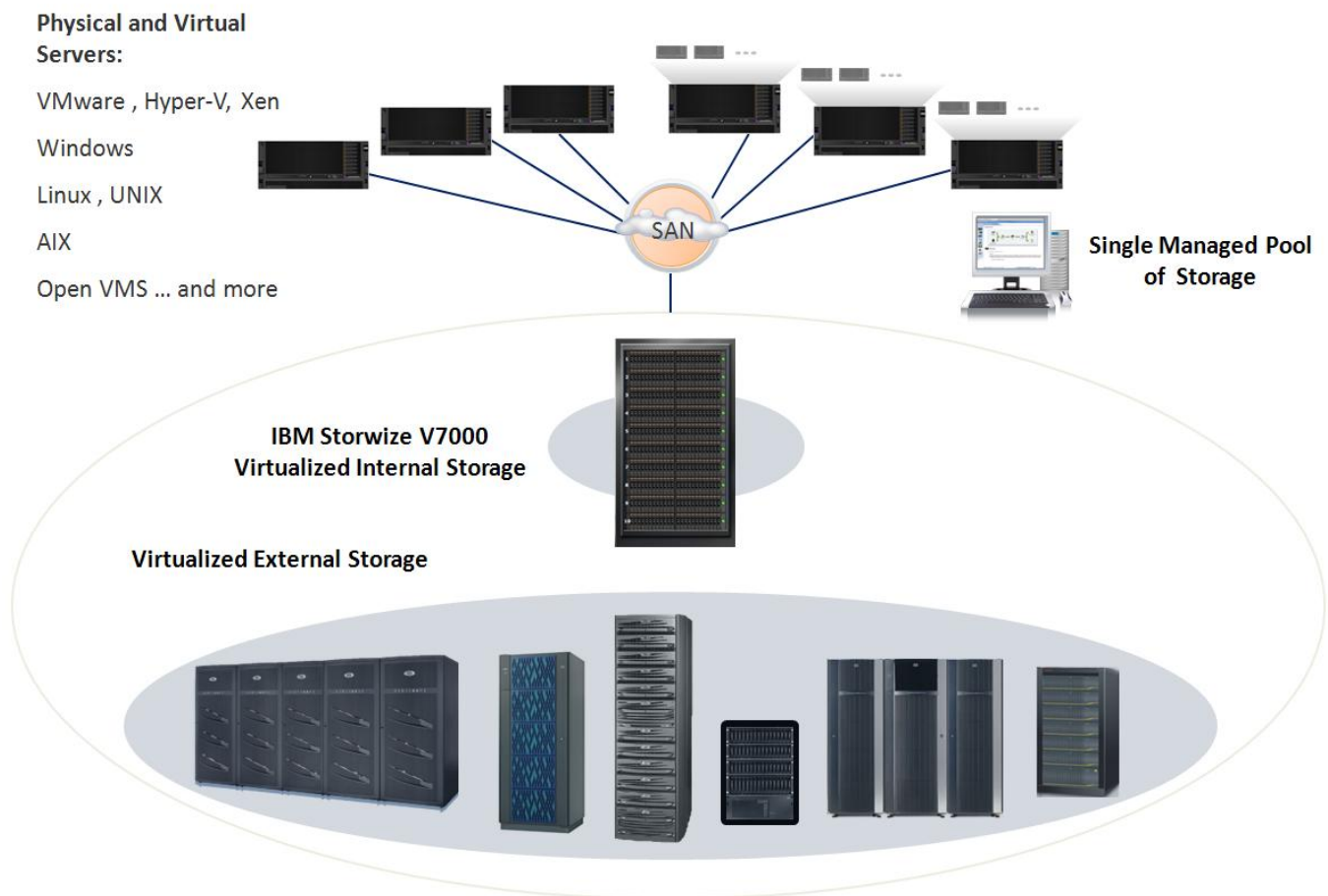
storage virtualization together. Fifty-seven percent had either already deployed storage virtualization in conjunction with server virtualization or planned on doing so within the next 24 months at the time of that survey.³

One of the most significant findings involved the substantial economic benefit of deploying an intelligent storage virtualization solution in conjunction with server virtualization. As an example, 79% of early adopters with a large SAN believe they have reduced their annual storage hardware spending to some degree, with a reported mean annual savings of 19.7%. Storage hardware savings were the most significant due to the ability to reclaim and re-use existing storage (the least expensive storage is the storage you already have). Consolidating storage software that previously ran on multiple servers or storage systems onto a centrally managed infrastructure also helped reduce storage software spending and storage administration costs.

IBM Storwize V7000

The IBM Storwize V7000 is a midrange disk system that has been designed to be easy to use and manage, enabling rapid deployment with minimal resources. Storwize V7000 is virtual storage that offers efficiency and flexibility through built-in SSD optimization and “thin provisioning” technologies while enabling users to virtualize and re-use existing disk systems, as shown in Figure 2.

Figure 2. The IBM Storwize V7000 Midrange Disk System



Storwize V7000 advanced functionality also enables non-disruptive migration of data from existing storage, simplifying implementation and minimizing disruption to users.

³ Source: ESG Research Report, [The Impact of Server Virtualization on Storage](#), December 2007, N=332.

IBM Storwize V7000 can be deployed in a data center to provide:

- Dramatic performance improvement with IBM System Storage Easy Tier functionality, providing automatic storage tiering between hard disk drives and solid state drives (SSD)
- Optimized capacity utilization and availability
- Significantly improved storage management ease-of-use
- A centralized platform for the management of SAN-attached storage capacity
- Heterogeneous interoperability between a wide variety of hosts, operating systems, and storage systems
- Online data migration services
- Remote replication and disaster avoidance services
- Space efficient provisioning and copy services

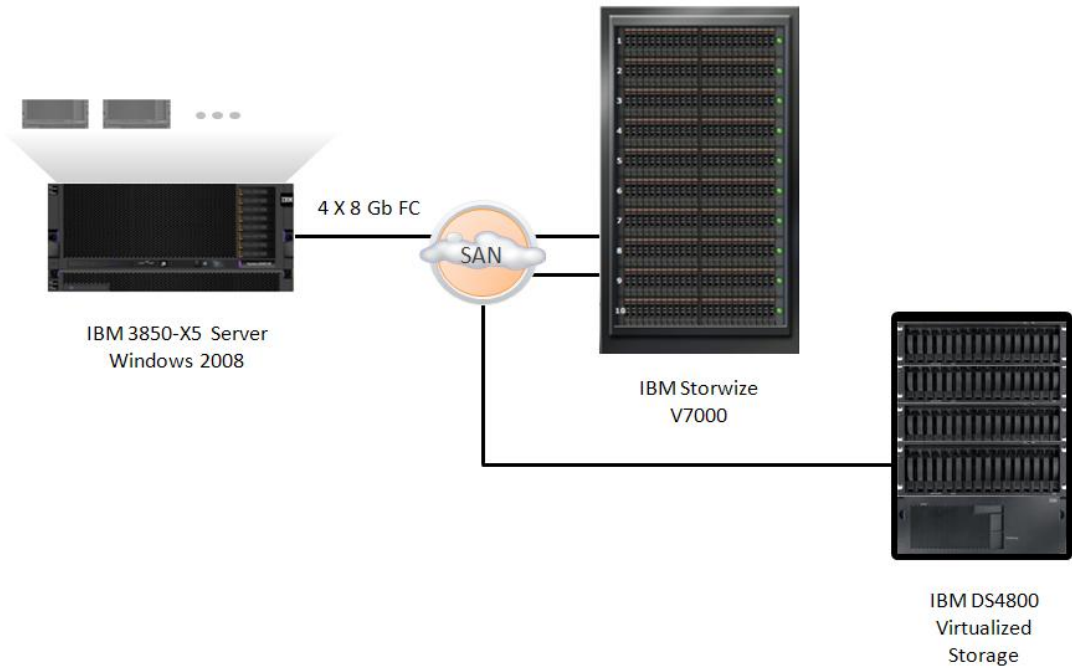
Storwize V7000 may be used to provide all these functions to enhance existing installed storage or as part of a new storage deployment.

The goal of ESG Lab's testing of the IBM Storwize V7000 was to validate enterprise-class features and functionality including ease of use, non-disruptive virtualization, automated tiering, data mobility, and copy services. The performance benefits of IBM System Storage Easy Tier were also explored.

ESG Lab Validation

ESG Lab performed hands-on evaluation and testing of the IBM Storwize V7000 at an IBM facility located in Tucson, Arizona. A SAN-attached IBM 3850-X5 server was used during testing as shown in Figure 3 and documented in the Appendix. An IBM DS4800 storage array was used to validate the ability to virtualize and manage external storage.

Figure 3. IBM Storwize V7000 Test Bed



Ease of Use

ESG Lab testing began with a high level examination of the Storwize V7000 user interface shown in Figure 4.

Figure 4. Getting Started GUI View



The Storwize V7000 graphical user interface is a browser-based, easy to navigate intuitive GUI. The home screen shown in this screen shot provides an excellent graphical flow chart of the system components and steps required to provision storage to host systems. The getting started view also provides e-learning and information center links that can be leveraged to provide detailed information on each component in the storage provisioning process.

ESG Lab Testing

ESG Lab leveraged the getting started view to confirm physical system components and resources as well as a gateway to configuring more advanced system features. The flow diagram and component detail information was repeatedly referenced during the configuration of many storage components including managed disks, pool, and volume creation to host provisioning and external device imports.

The Storwize V7000 GUI provides an intuitive view of the system components organized on the left side of each pane in column format, allowing the administrator to scroll from component to component with ease. Hovering over an individual component will provide drilldown options of the administration tasks that can be performed for that component. Figure 5 shows the administration options available for the Storwize V7000 volumes.

Figure 5. Volume Administration View

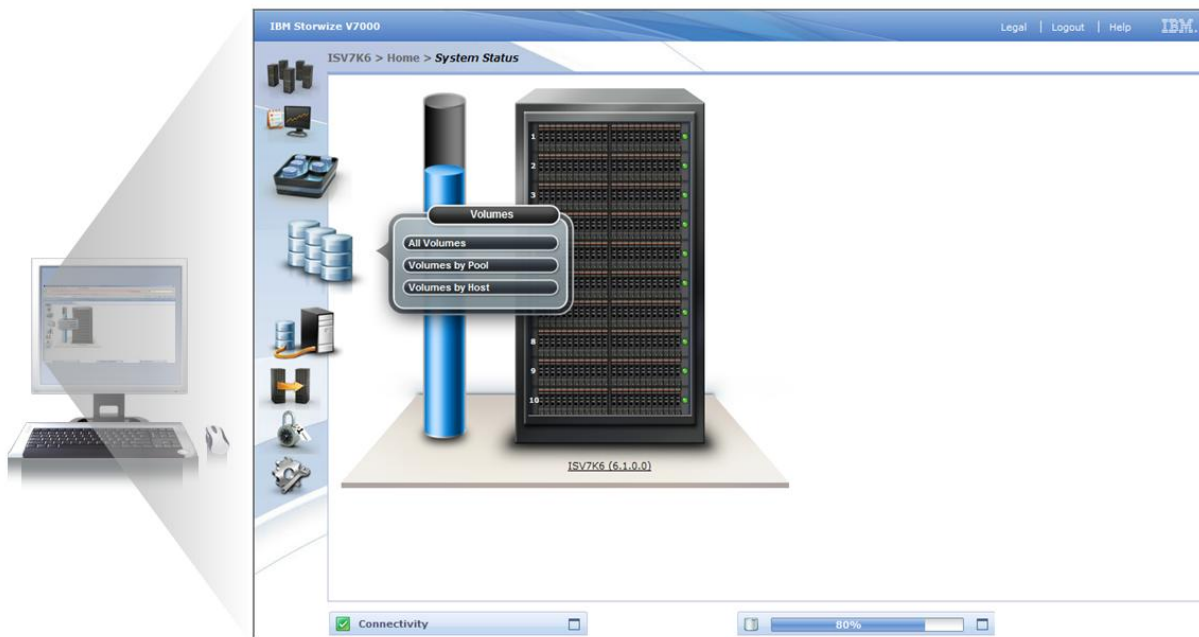
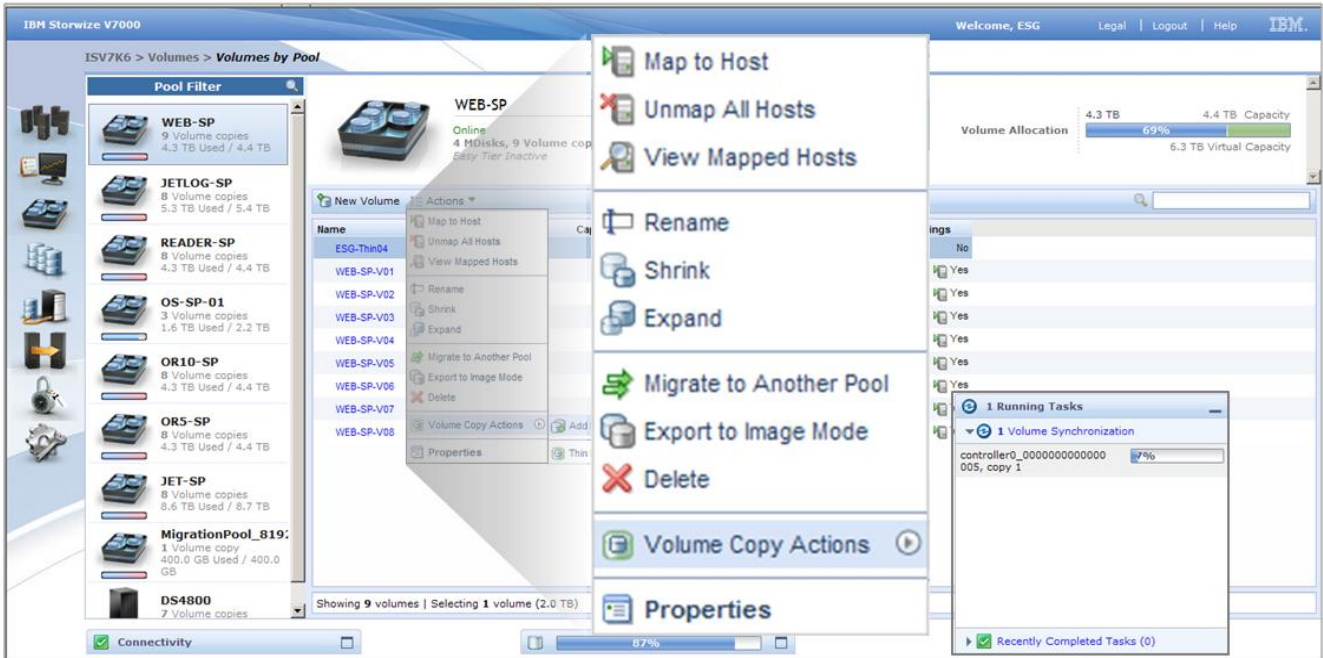


Figure 5 highlights the drilldown options for volume operations, but it should also be noted that the middle of the screen displays system status information in this view. The system status pane provides a high level detailed view of system information moving from left to right. Figure 5 displays a physical view of system capacity via the bar graph to the left and a component view in the middle of the pane. From the system status screen, users can hover over each object and display detailed system information. The blue section of the bar chart will display used capacity while the black section will show total system physical capacity. A click on the link below the physical display will present a table of system statistics to the right or users can click on a disk shelf to display detailed information on the drives in each enclosure.

The Storwize V7000 disk system presents storage as volumes. Volumes are virtual containers, abstracted from physical disk drives by the concepts of managed disks and pools presented to host servers. The volume by pool view allows the administrator to see detailed information for each Storwize V7000 volume, including its pool association. Figure 6 shows the volume details and administration options available for volumes in pool WEB-SP.

Figure 6. Volumes by Pool View



ESG Lab Testing

ESG Lab validated the ease of executing typical storage administration tasks with the Storwize V7000 by creating a thin provisioned volume copy in an existing storage pool. Figure 6 shows the volume copy creation steps as well as the percentage completed. Volume copies can be assigned to hosts and used for a number of operations (e.g., off-host backups, test/dev, or data migration).

Why This Matters

ESG Lab found that getting started with the Storwize V7000 disk system was intuitive and straightforward. The user interface provided a high level flow chart diagram clearly describing the storage provisioning process. Common administration tasks were wizard-driven with easy to follow, step by step setup and configuration instructions. Included in the user interface for reference are e-learning modules and information center links.

ESG Lab believes the ease of use and intuitive approach of the Storwize V7000 GUI can shorten the time spent training and refreshing staff while greatly reducing the time and number of calls to support for administration issues.

Efficient Data Management

With the Storwize V7000, the storage administrator has the ability to deploy enterprise-class management features to improve storage efficiencies. Thin provisioning and snapshot technology are included in the Storwize V7000 code.

Thin provisioning employs an abstraction layer between the physical disk drive and the storage presented to the host system. With the Storwize V7000, physical disks are configured in RAID sets as managed disks, or MDisks. The MDisks are then assigned to storage pools. Virtualized volumes are created from pool storage and presented to hosts. The volumes can be created larger than the physical storage as shown in Figure 7. Because the volume is abstracted from the physical storage layer, capacity can be dynamically managed transparently to the host operating system as requirements change.

Figure 7. Thin Provisioning

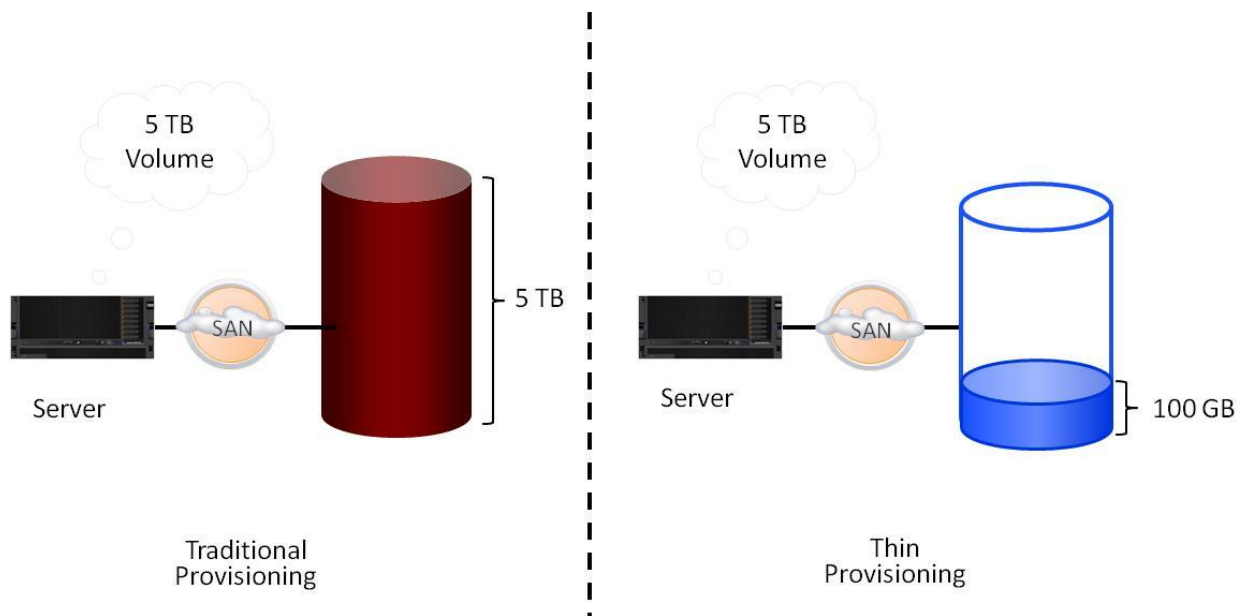
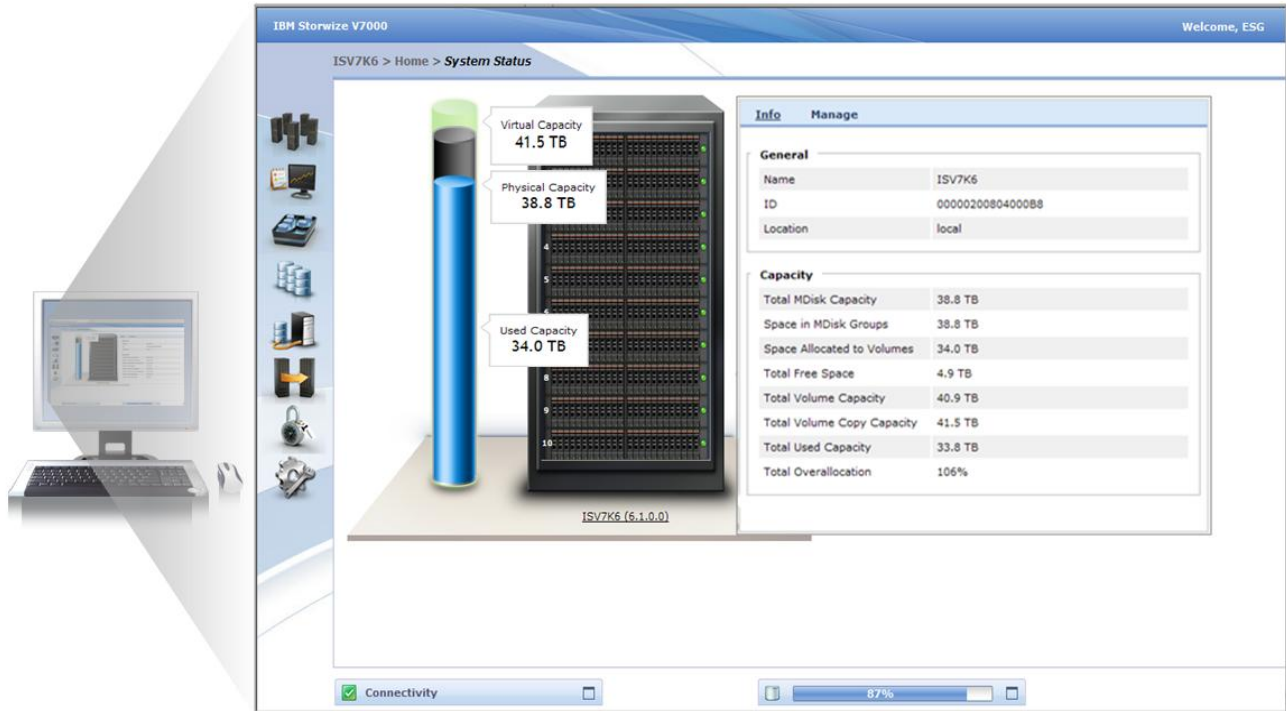


Figure 7 shows thin provisioned storage as compared to traditionally provisioned storage. The left side of the figure shows the one to one relationship of a traditional volume with a 5 TB volume presented to a host server consuming 5 TB of physical space. The right side of the figure shows a 5 TB virtual container being presented to a host server using only 100 GB of physical space.

ESG Lab Testing

ESG Lab tested thin provisioning on the Storwize V7000 by over-subscribing the storage array. Thin provisioned volumes were created with more capacity than the physical array as shown in Figure 8. The Storwize V7000 had a physical capacity of 38.8 TB and a used capacity 34.0 TB. ESG Lab created thin provisioned volumes to present a virtual capacity of 41.5 TB.

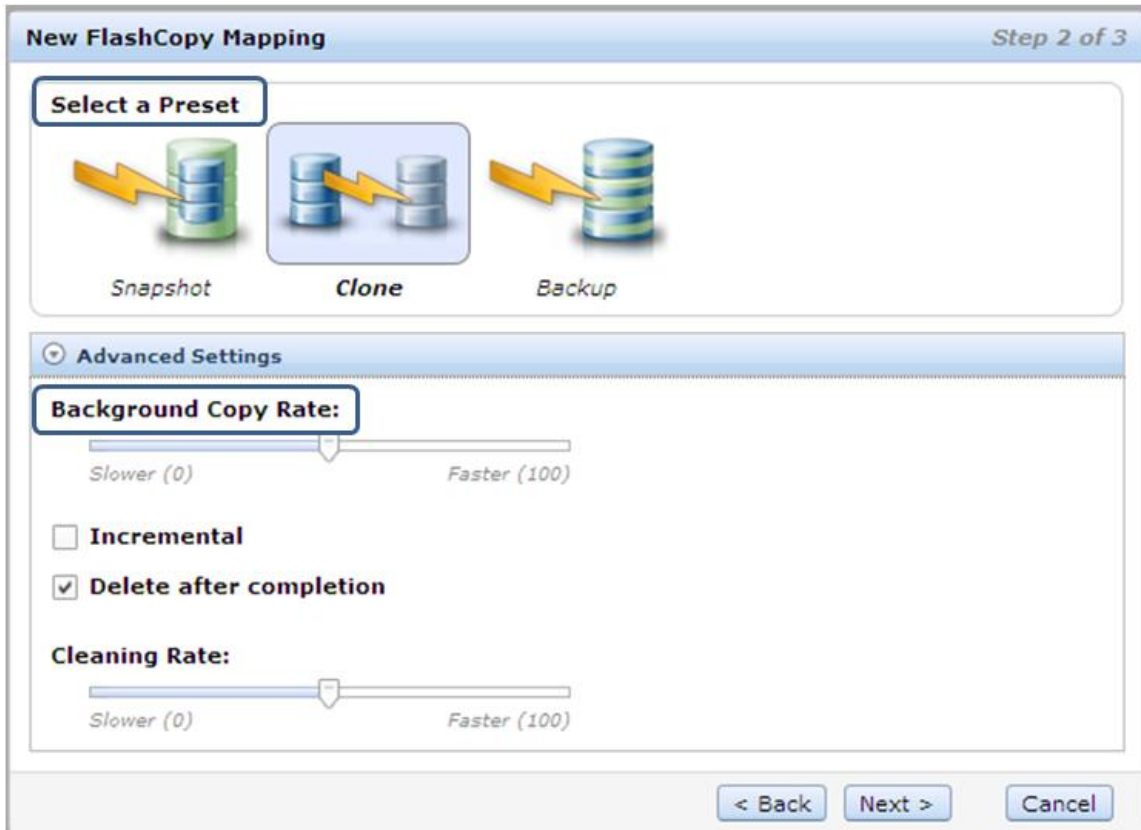
Figure 8. Thin Provisioning GUI View



The bar graph in Figure 8 shows the used capacity in blue, the physical capacity in black, and the virtual capacity in green. At this point in ESG Lab testing, the Storwize V7000 had presented more capacity to host servers than it physically contained, yet the used capacity was only 34.0 TB.

FlashCopy is a copy service provided with the Storwize V7000 disk system. There are three different FlashCopy options available in the Storwize V7000—Snapshot, Clone, and Backup—as shown in Figure 9. Implementing FlashCopy enables the instantaneous copy of data from a source volume to a target volume.

Figure 9. FlashCopy Mappings

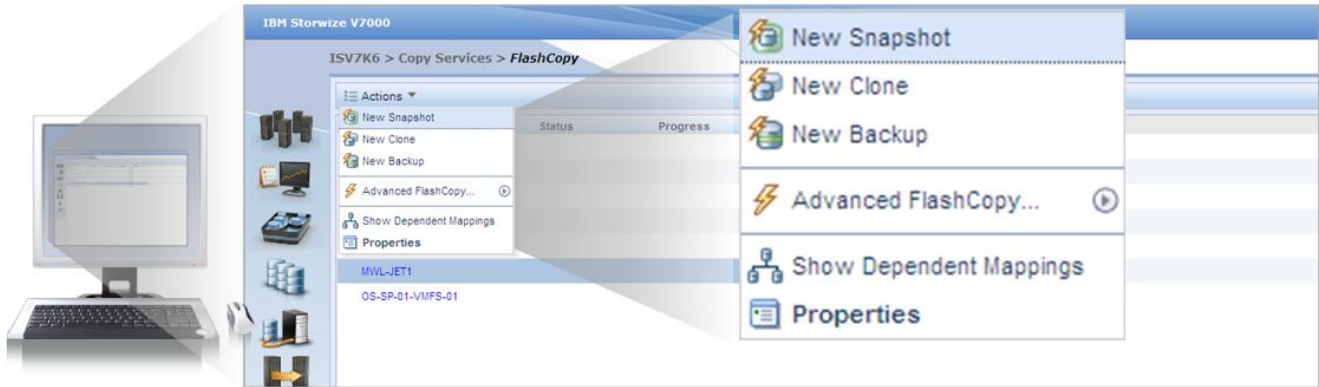


The FlashCopy Snapshot is a thin provisioned copy with the ability to automatically expand as necessary. The FlashCopy Clone option is a copy with the same properties as the source volume. FlashCopy Backup is a copy with the same properties as the source and the ability to create incremental copies.

ESG Lab Testing

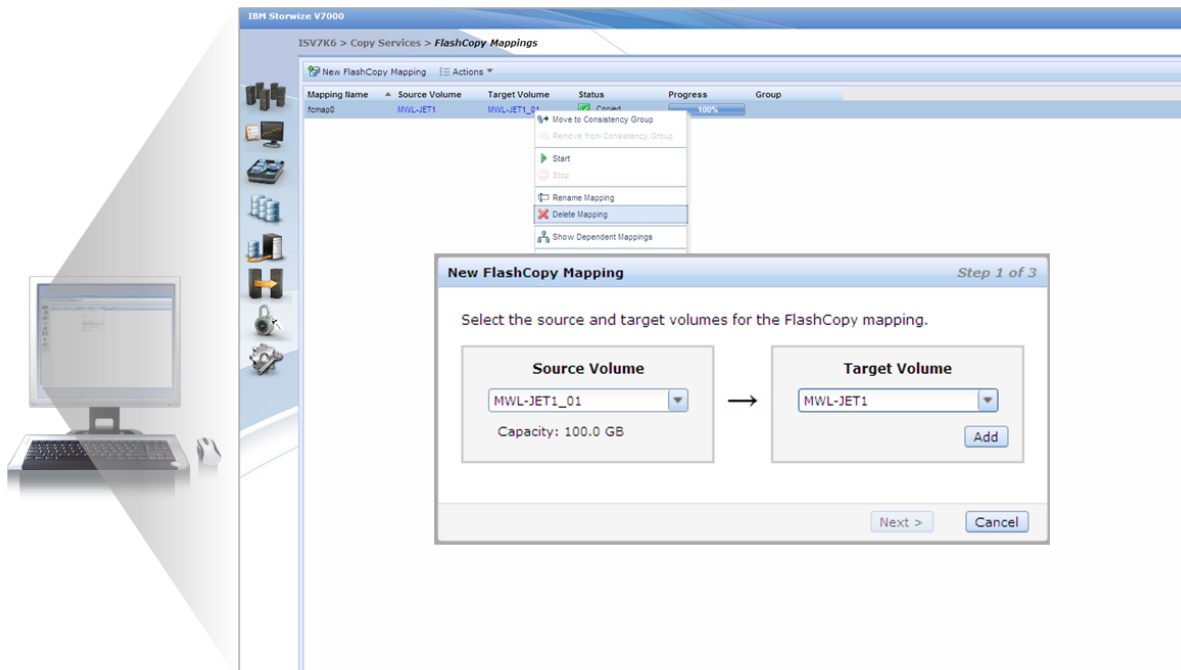
ESG Lab validated snapshot functionality on the Storwize V7000 by creating a FlashCopy Clone of an existing volume that was already presented to a Windows host with an 80 GB database file residing on it. Figure 10 show the first steps for creating a FlashCopy copy volume from the FlashCopy Actions menu.

Figure 10. FlashCopy Action Menu



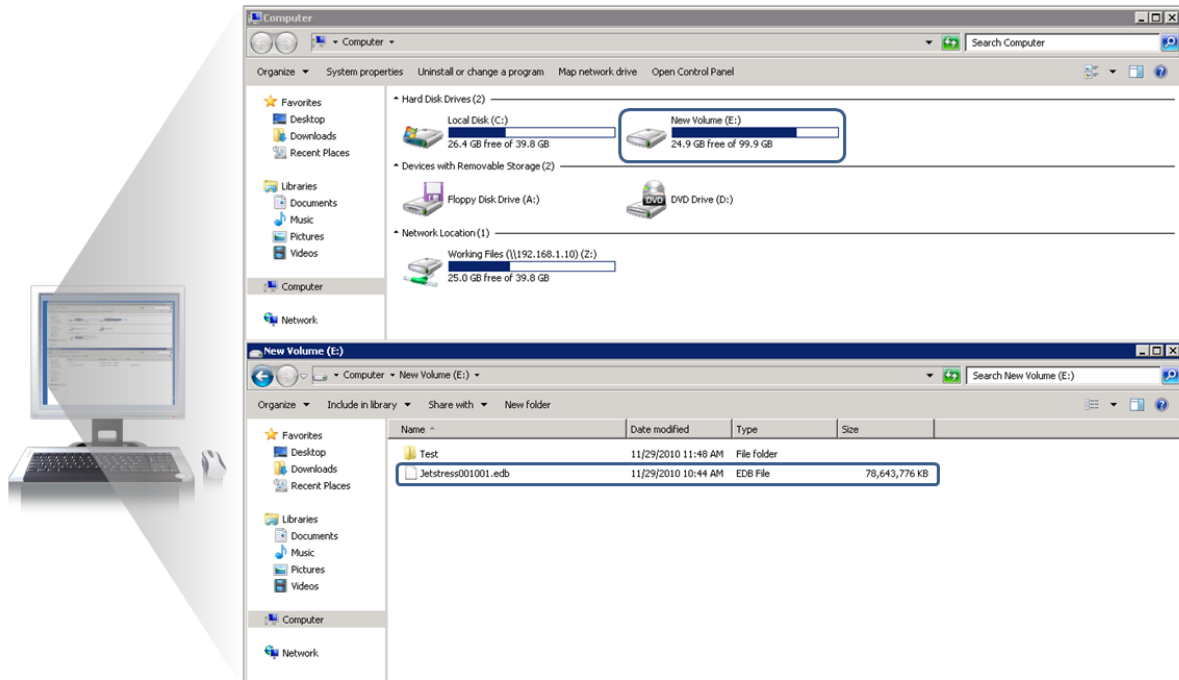
The new Clone option was selected and mappings were created from source volume (MWL-JET1_01) to target volume (MWL-JET1) as shown in Figure 11.

Figure 11. FlashCopy Mappings



When the Clone copy was fully synchronized on the Storwize V7000, the 80 GB database file was deleted on the Windows host. After the file deletion, the source and target mapping were reversed on the Storwize V7000. The Windows host system was rebooted and the 80 GB database file was immediately available on the host while the volume synchronization process ran in the background as shown in Figure 12.

Figure 12. FlashCopy Windows Host View



Why This Matters

The ability to quickly respond to new application storage requirements while providing reliable application access directly relates to revenue generation as lost application access and slow provisioning practices can have a major impact on an organization's finances.

ESG believes that thin provisioning and snapshot technology are two of the most useful functions of a storage system. Thin provisioning simplifies the cumbersome task of storage provisioning and improves capacity utilization. Snapshot technology improves availability and application access. With a wizard-driven configuration process and advanced management capabilities, ESG Lab testing has confirmed that Storwize V7000 thin provisioning can be used to reduce the cost and complexity of storage provisioning while providing significant capacity savings as FlashCopy snapshots can be leveraged to improve availability.

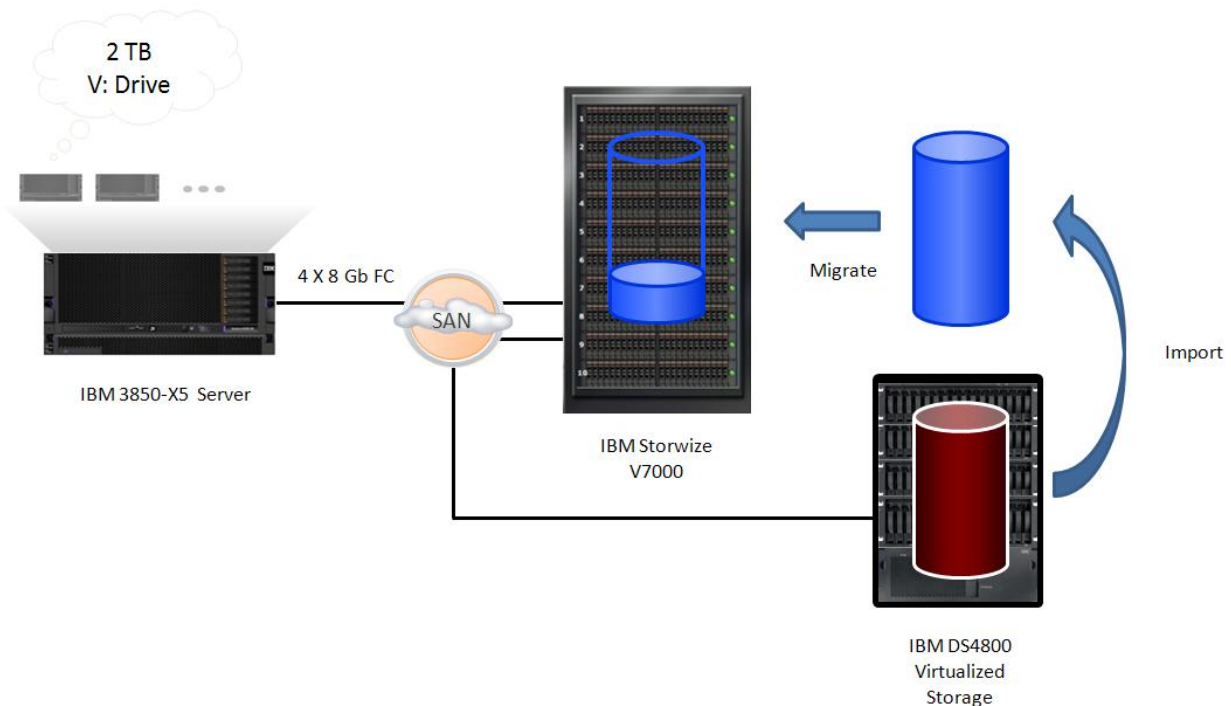
Powerful Enterprise-class Features

The Storwize V7000 disk system is a feature-rich storage solution that provides a powerful set of management tools enabling great flexibility while helping to make the most challenging storage administration tasks easy to tackle. As shown previously in Figure 5, both internal and external storage can be virtualized and managed via the Storwize V7000 graphical user interface. The GUI provides an easy to use management console and includes configuration wizards for many administration tasks. The ability to combine multiple storage concepts like external storage device imports and thin provisioning add to the power of the Storwize V7000, creating flexible capacity management.

ESG Lab Testing

ESG Lab tested and confirmed the ability to virtualize external storage devices by importing, presenting, and managing a DS4800 volume and its associated data via the Storwize V7000 system. As shown in Figure 13, a DS4800 volume was imported to the Storwize V7000, combined with a thin provisioned internal volume, and presented to a host server with multiple virtual Windows machines.

Figure 13. Virtualizing External Storage with the IBM Storwize V7000



The volume import procedure was conducted and configured using the Storwize V7000 Import Wizard. The wizard made the import procedure easy and intuitive by providing descriptions and configuration options during the short two-step setup process.

The Import Wizard is just one of the administration wizards that can be launched from the Storwize V7000 GUI. As shown in Figure 14, the Import Wizard was used to import a volume and its data from an external DS4800 storage array.

Figure 14. Import Wizard Step 1 of 2

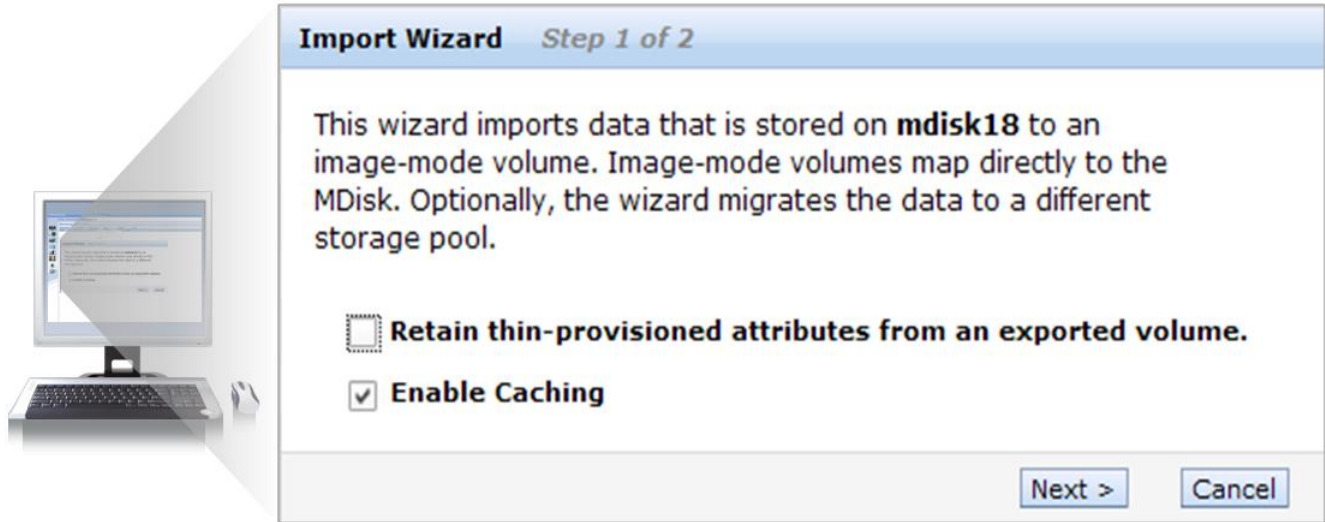
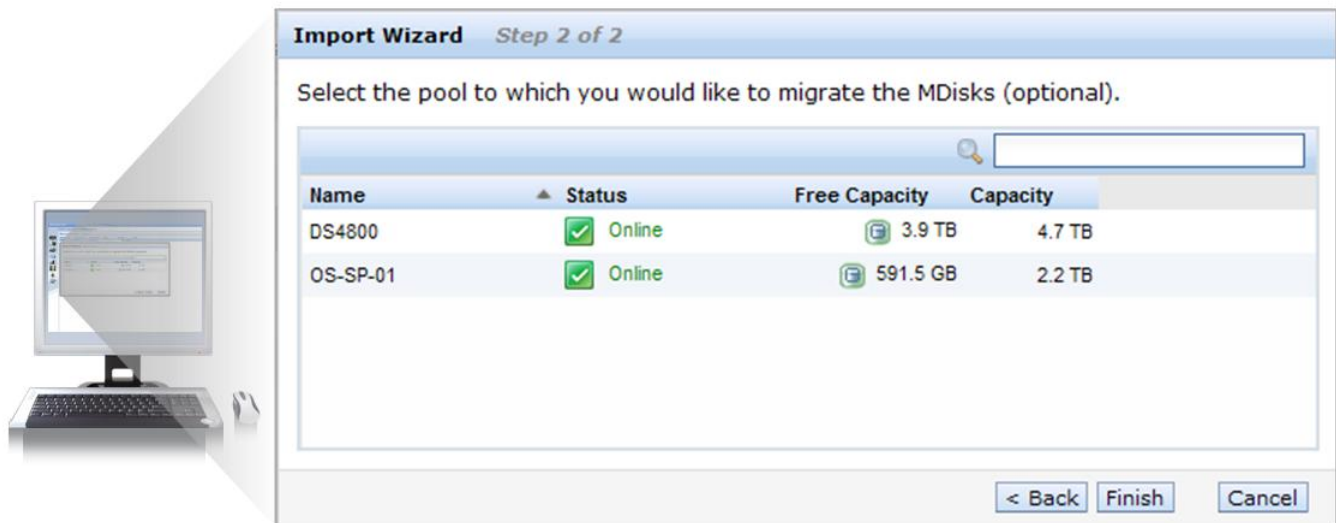


Figure 15 shows the pool selection screen—the second and final step of the volume import process.

Figure 15. Import Wizard Step 2 of 2



The original volume data was maintained during the import process and once imported, presented back to the original Windows machine via the Storwize V7000.

Upon completion of the import process, a thin provisioned volume (Copy 1) was added to the original imported volume as shown in Figure 16.

Figure 16. Thin Provisioned Copy 1

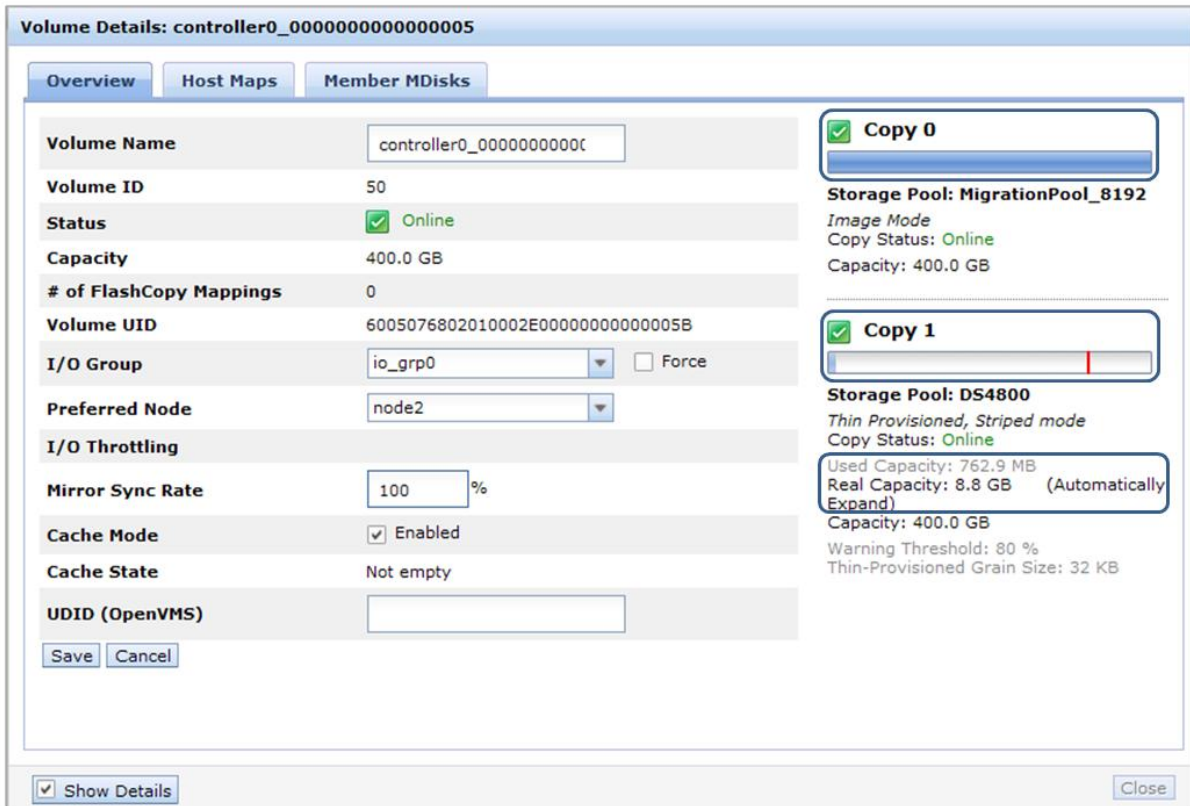


Figure 16 shows the traditional provisioned Copy 0 volume and the thin provisioned Copy 1 volume. It should be noted that each volume contained the same 8.8 GB of used data. The traditional volume used 400 GB of physical space to store 8.8 GB while the thin volume only consumed the 8.8 GB of physical space to store the same data.

Why This Matters

Recent ESG research indicates that IT professionals consider data growth management a high priority for 2011 and plan to invest in solutions to address this issue. When introducing new, more efficient storage technology, it is not uncommon to find existing data poorly provisioned and distributed across a multitude of storage devices. The benefits of implementing an efficient storage solution can be easily gobbled up in time spent on complex migrations and investments in third party migration tools.

ESG Lab has confirmed that a Storwize V7000 addresses these issues through its ability to virtualize, import, and manage a wide variety of existing storage devices, enabling flexible, easy migration and efficient data provisioning.

Predictably Scalable Performance

IBM uses the latest hardware and field-proven storage software from the SVC and DS8000 storage product lines to deliver the exceptional performance of the IBM Storwize V7000. The hardware platform is built for speed and scalability using a pair of highly available controllers powered by the latest Intel chipsets. Each controller is equipped with 8 GB of high speed cache memory. Up to eight Fibre Channel interfaces (8 Gbps) and four iSCSI interfaces (1 Gbps) are supported across a pair of controllers for host connectivity. A mix of SAS, Nearline SAS, and SSD drives is supported to meet a wide variety of price/performance requirements.

The performance of the hardware platform is amplified by field-proven IBM storage software including the SVC storage virtualization engine, the DS8000 RAID stack, and Easy Tier, illustrated in Figure 18, which automatically moves frequently-used data to high performance SSD drives and infrequently-used data to cost-effective Nearline SAS drives. Thousands of customers across the globe rely on the field-proven performance of the SVC engine at the heart of the Storwize V7000.

The performance scalability of the SVC engine has been demonstrated in published Storage Performance Council (SPC) results. SPC is a vendor-neutral standards body designed to be a source of comparative storage subsystem performance information. There are two application workloads supported by SPC: SPC-1 simulates an interactive database application and SPC-2 simulates a bandwidth-intensive application such as those that process large files, large database queries, or video on demand. When this report was published, IBM had the industry-leading SPC-1 result of 380,489 IOPS with a six-node SVC cluster in front of two IBM DS8700 disk arrays.⁴ The SVC engine running inside a dual controller Storwize V7000 had excellent published results of 56,510 SPC-1 IOPS⁵ and 3,123 SPC-2 MBPS.⁶

ESG Lab Mixed Workload Testing

ESG Lab has confirmed that the performance and scalability of the Storwize V7000 is well suited for a mix of applications running in a consolidated virtual server environment. The ESG Lab mixed workload performance benchmark was designed to measure the performance capabilities of a single Storwize V7000 storage system subjected to an IO-intensive mix of virtualized business applications running on a pair of IBM x3850 X5 servers in a virtual server environment powered by VMware vSphere. Taking a cue from the server-focused VMware VMmark benchmark, a cell concept was used during the design of this test. Each cell was composed of four applications (e-mail, database, web server, backup jobs), each running in its own virtual machine. IBM System x3850 X5 servers were used to exercise up to four cells and sixteen virtual applications in parallel. The Microsoft Jetstress utility was used to simulated Exchange 2010 traffic and the Oracle Orion utility was used to emulate OLTP and OLAP database traffic. The industry standard Iometer utility was used to emulate thousands of web server users and up to four backup jobs.

Storwize V7000 disk capacity was used for all storage capacity including VMware virtual disk files (VMDK), Windows Server 2008 R2 operating system images, application executables, and application data. The operating system images were installed on VMDK volumes. All of the application data volumes under test were configured as mapped raw LUNs (also known as raw device mapped, or RDM, volumes).

Mixed workload testing was performed with a single IBM Storwize V7000 equipped with 215 SAS drives. The Exchange VMs were configured with 64 SAS drives for the database and 25 drives for logs. Oracle was configured with 52 drives and the web server and backup workloads were configured with 32 drives each.

⁴ http://www.storageperformance.org/benchmark_results_files/SPC-1/IBM/A00087_IBM_DS8700_SVC-5-1-6node/a00087_IBM_DS8700_SVC5.1-6node_executive-summary-r1.pdf

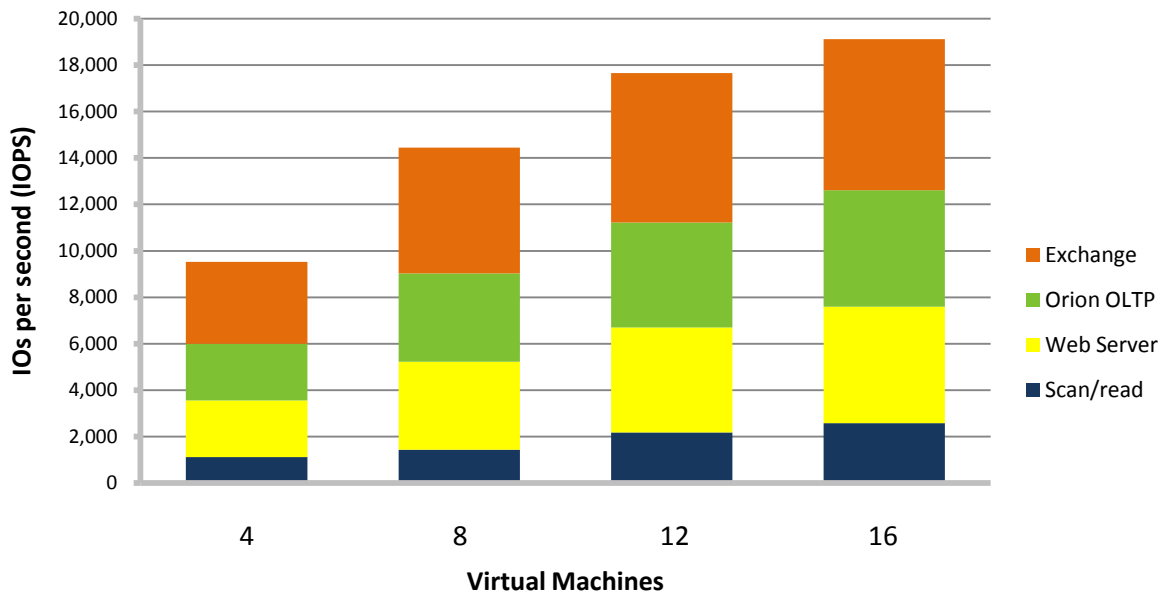
⁵ http://www.storageperformance.org/benchmark_results_files/SPC-1/IBM/A00097_IBM_Storwize-V7000/a00097_IBM_Storwize-V7000_2-node_SPC1_executive-summary.pdf

⁶ http://www.storageperformance.org/benchmark_results_files/SPC-2/IBM_SPC-2/B00052_IBM_Storwize-V7000/b00052_IBM_Storwize-V7000_SPC2_executive-summary.pdf

Volume ownership was balanced across the dual controllers within the Storwize V7000 and distributed evenly over the eight host interfaces. The volumes were spread evenly over two VMware host groups with a multipath policy of most recently used (MRU).

As shown in Figure 17, a single Storwize V7000 delivers the IO processing power and bandwidth needed to simultaneously support 54,208 simulated Exchange 2010 mailboxes *and* 5,015 Oracle Orion small database IOs per second *and* 849 MB/sec of throughput for large OLAP Oracle Orion operations *and* 5,015 simulated web server IOPs *and* 644 MB/sec of throughput for bandwidth-intensive backup jobs—all while delivering predictably fast response times. Note how the performance of the Storwize V7000 scaled well as a mix of real-world application workloads ran in parallel on up to 16 virtual machines running on a pair of powerful IBM x3850 X5 servers.

Figure 17. Storwize V7000 Mixed Workload Scalability

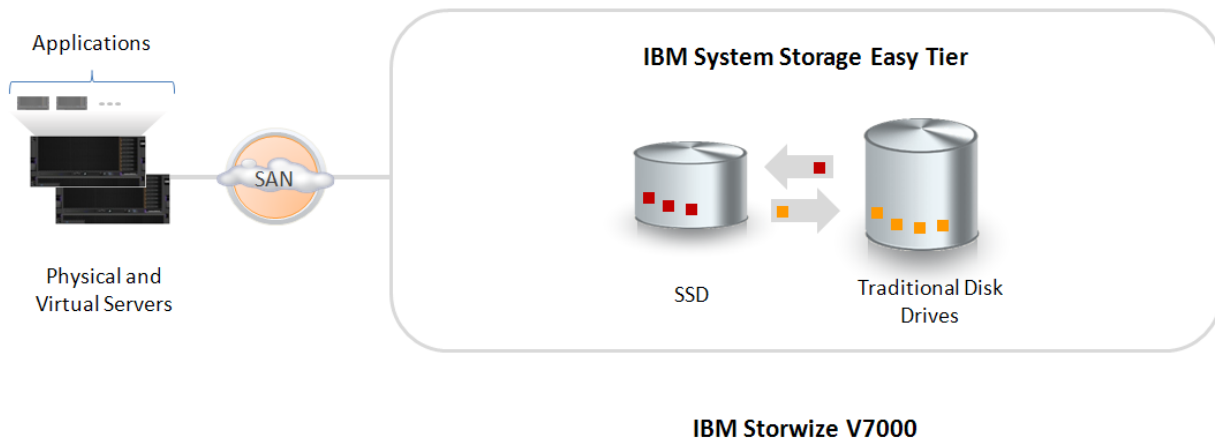


Easy Tier

The solid state drives (SSD) supported by the Storwize V7000 can be used to improve application performance while simultaneously reducing power and cooling requirements in the data center. Easy Tier increases the efficiency and simplicity of deploying SSD drives. Easy Tier, and its associated tool Storage Tier Advisor, help IT managers plan for, deploy, and manage the deployment of SSD drives in conjunction with traditional spinning hard drives.

As shown in Figure 18, Easy Tier uses sub-LUN data tiering technology that can be used to automatically move frequently-used data to high performance SSD drives and infrequently-used data to Nearline drives. Easy Tier can be configured to improve the performance for existing storage being virtualized by the IBM Storwize V7000 system and can operate with any combination of internal or externally virtualized SSD or HDD devices.

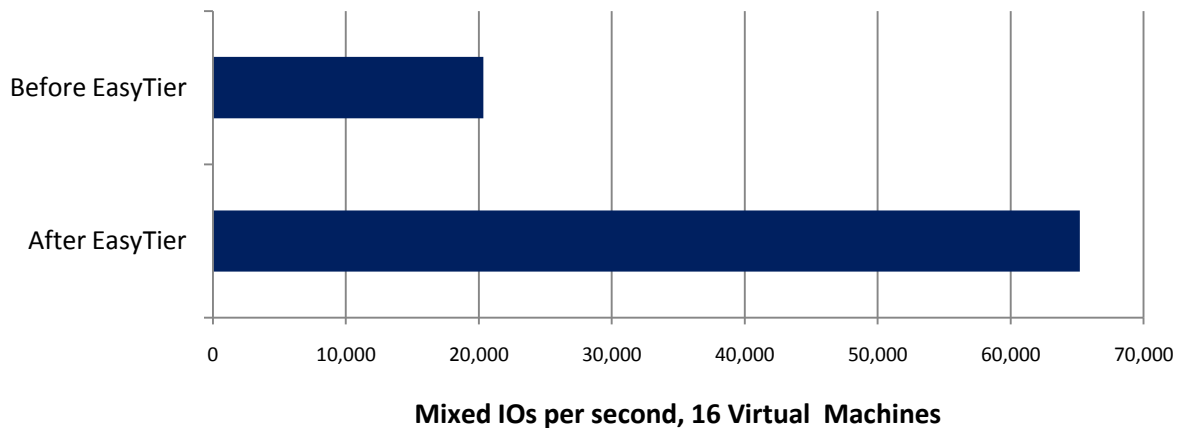
Figure 18. IBM System Storage Easy Tier



ESG Lab evaluated the performance boost that can be achieved with SSD drives and Easy Tier. Twenty-four SSD drives were added to the pool of SAS drives used during the first round of mixed workload testing. An Easy Tier policy was configured to automatically move frequently-used application data to 24 high speed SSD drives.

After re-running the mixed workload on all of the available virtual machines for 24 hours, Easy Tier more than tripled the amount of mixed workloads the solution could handle.⁷

Figure 19. Boosting Mixed Workload Performance with Easy Tier



At the application level, Easy Tier delivered:

- 341% more web server IOs per second
- 277% more Oracle OLTP IOs per second
- 69% more Exchange 2010 users
- 33% faster Exchange database read response times
- 43% faster Oracle OLTP IO response times

Why This Matters

ESG research indicates that storage scalability and performance are significant challenges for the growing number of organizations embracing server virtualization technology. Companies continuously face challenges in cost effectively meeting the capacity and performance requirements of applications—especially applications with strict performance requirements. Failure to meet these requirements can result in lost productivity and costly loss of services.

ESG Lab confirmed that the IBM Storwize V7000 has exceptional performance as evidenced by published industry standard SPC results and ESG Lab mixed workload testing in a VMware environment. ESG Lab also confirmed that a Storwize V7000 equipped with Easy Tier and SSD drives can be used to automatically increase the performance of a mix of applications running in a virtual server environment. Easy Tier and SSD drives not only reduced response times, they dramatically increased the amount of work that the virtualized infrastructure could handle.

⁷ For more detail on the ESG Lab mixed workload testing of the IBM Storwize V7000, see the full ESG Lab Validation Report, [IBM Storwize V7000: Real-world Mixed Workload Performance in VMware Environments](#), January 2011.

ESG Lab Validation Highlights

- ☑ The Storwize V7000 was exceptionally easy to configure and manage. ESG Lab was able to provision virtualized, thin provisioned storage in less than 10 minutes using intuitive, automated wizards.
- ☑ ESG Lab performed a non-disruptive import of an external disk volume and presented the data intact back to the original host without requiring a reformat of the storage during import.
- ☑ IBM Storwize V7000 was able to thin provision the imported volume to better use capacity without destroying user data.
- ☑ An IBM Storwize V7000 and a pair of IBM x3850 X5 servers delivers the IO processing power and bandwidth to concurrently support up to:
 - **54,208 mailboxes** using the Microsoft Exchange 2010 Jetstress utility
 - **and 5,015 database IOs per second** for small OLTP IOs with the Oracle Orion utility
 - **and 849 MB/sec of throughput** for large OLAP Oracle Orion operations
 - **and 5,015 simulated web server IOPs**
 - **and 644 MB/sec of throughput** for simulated backup jobs
 - with predictably fast response times and scalability
- ☑ As the number of virtual machines sharing a single Storwize V7000 increased, performance scaled in a near linear fashion with predictably fast response times (5.2 to 11.3 milliseconds for e-mail database reads, 4.72 to 5.06 milliseconds for Oracle OLTP IO operations).
- ☑ **Easy Tier and 24 SSD drives more than tripled the mixed IO capacity** of the Storwize V7000 (3.21 times more) as it noticeably improved application-level performance:
 - **33% faster Exchange** response times
 - **43% faster Oracle** OLTP database response times

Issues to Consider

- ☑ ESG Lab tested a Storwize V7000 system with a total of 240 drives (216 SAS, 24 SSD), which was beyond the maximum number of supported internal drives when this report was published. In this context, internal drives are the drives located within drive expansion trays connected to, and managed by, Storwize V7000 controllers. This limitation does not apply to the drives within a disk array that is externally virtualized with the Storwize V7000. IBM has publically stated that support for 240 internal drives is planned for general availability in early 2011.
- ☑ The field-proven architecture of the SVC currently support SVC code running on up to four pairs of controllers managed as a single system. The IBM Storwize V7000, which leverages the same SVC code base, currently supports only a single pair of controllers. ESG Lab believes that support for more than a single pair of controllers would be a welcome future enhancement for organizations that would like to scale the benefits of a singly managed pool of V7000 storage.
- ☑ ESG Lab is confident that most IT organizations will exceed the Easy Tier and SSD benefits documented in this report. This is due to the fact that real-world applications tend to have concentrated hot spots that are great candidates for Easy Tier and SSD. In contrast, the synthetic benchmarks used during ESG Lab testing are more uniformly random than real-world applications. As a result, ESG Lab believes that less SSD capacity should provide similar—if not better— performance benefits in real-world production environments.
- ☑ The test results/data presented in this document are based on industry-standard benchmarks deployed in a controlled environment. Due to the many variables in each production data center environment, it is still important to perform capacity planning and testing in your own environment to validate a storage system configuration.

The Bigger Truth

One of the largest challenges facing IT today is managing unabated data growth in dynamic, virtualized environments. Innovation and automation are needed to reign in the cost and complexity associated with unrelenting growth and ever-changing business requirements. Virtualization technologies are needed to simplify, consolidate, and automate routine IT functions.

Innovative virtualization technologies are being deployed by a growing number of IT organizations. A recent ESG survey of 1,602 IT professionals indicates that server virtualization is leading the charge. Seventy-four percent of respondents report that they are actively using server virtualization.⁸ Server virtualization, like storage virtualization, is powerful game-changing technology that can be used to consolidate and simplify complex IT infrastructure. While the cost savings of consolidation drove the first wave of server virtualization adoption, the second wave is being driven by the mobility, flexibility, and enhanced fault tolerance that can be achieved with a virtualized IT infrastructure.

Like the early adopters of server virtualization, early adopters of storage virtualization report that management complexity has been simplified and costs have been reduced. Given the synergistic benefits, it is not surprising that ESG research indicates that a growing number of forward-looking organizations are deploying storage and server virtualization together. Fifty-seven percent have deployed both already or plan on doing so.⁹

ESG has confirmed that the IBM Storwize V7000 is a modular storage system with built-in efficiency and storage virtualization. Presenting virtual disk capacity on a just in time basis, space-efficient virtual disks eliminate the cost of unused and unallocated storage as they simplify the task of assigning storage capacity to applications. Leveraging the field-proven storage virtualization capabilities of the IBM SVC product line, the Storwize V7000 provides a centralized platform for valuable data services including online data migration, copy services, mirroring, and remote replication.

ESG Lab was particularly impressed with the exceptional ease of use and performance of the IBM Storwize V7000. The management GUI, which was derived from the IBM XIV storage product line, is wizard-driven and extremely easy to use. Industry standard SPC results and ESG Lab mixed workload testing in a VMware environment confirmed the performance prowess of the platform. Performance testing with Easy Tier and SSD drives reduced application-level response times as it more than tripled the amount of work that the virtualized infrastructure could handle.

IBM Storwize V7000 is an easy to use, rock-solid midrange storage platform with sophisticated enterprise-class functionality and built-in storage efficiency. ESG Lab believes that IT managers within mid- to large-sized organizations shopping for their next storage infrastructure upgrade—especially those with legacy storage they'd like to continue to utilize—should seriously consider the IBM Storwize V7000.

⁸ Source: ESG Research Report, [The Evolution of Server Virtualization](#), November 2010.

⁹ Source: ESG Research Report, [The Impact of Server Virtualization on Storage](#), December 2007, N=332.

Appendix

Table 1. Test Bed Overview

Storage	
IBM Storwize V7000	10 drive trays, 216 300 GB 10K SAS HDD, 24 SSD
IBM DS4800	4 drive trays, 64 15K RPM FC drives
Servers	
Two IBM System x3950 M2	CPU type: Intel Xeon 7740 (6 cores per socket @2.67 GHz) Total CPU cores: 48 Total RAM: 512 GB DDR-2
Host Bus Adapters	
QLogic 8 Gb FC Dual-port HBA for IBM System x	
Fibre Channel Switches	
Two IBM 2498-B24, each with 24 8 Gbps FC ports	
Virtualization Software and Guest Operating Systems	
Server Virtualization	VMware vSphere ESXi 4.1 Installable
Guest OS	Windows Server 2008 R2 Enterprise Edition

Table 2. Bill of Materials

IBM Code	Description	Quantity
2076-124	IBM Storwize V7000	1
2076-224	IBM Storwize V7000 Expansion Enclosure	9
85Y5862	300 GB 10K SAS HDD	216
85Y5861	300 GB SSD	24
723CA32	IBM System x3950 M2	2
42D0510	QLogic 8G Fiber Channel HBA	4
1815-88A	IBM DS4800 Storage System	1
1812-81A	IBM EXP810 Expansion Drive Enclosure	4
4201	300 GB 15K FC HDD	64



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