

Stellar performance for a virtualized world

IBM storage systems leverage VMware technology



Highlights

- Leverages integration to offload I/O intensive operations for optimal performance and efficiency
- Significantly increases vSphere's consolidation capabilities with VAAI support
- Alleviates bottlenecks, improves throughput for critical applications and enables new virtual machine workloads
- Reduces virtual machine copy time from minutes to seconds, freeing up valuable server resources
- Streamlines data protection for virtual machines with non-disruptive backup and recovery
- Boosts performance for Virtual Desktop Infrastructures with built-in storage capabilities like snapshots and solid state disk optimization

In today's virtualized world superior storage and server performance along with the ability of IT administrators to predictably deliver an increasing number of I/Os to virtual machines is becoming an absolute requirement. This is especially imperative as tier one applications are increasingly being moved to virtualized environments. At the same time, many IT budgets remain flat and yet the need for data center transformation continues to drive more server virtualization and consolidation efforts.

Significant value and economic benefit can be achieved by increasing the number of virtual machines per physical server (ESX host) in VMware environments. Increasing the number of virtual machines helps enable better physical server utilization

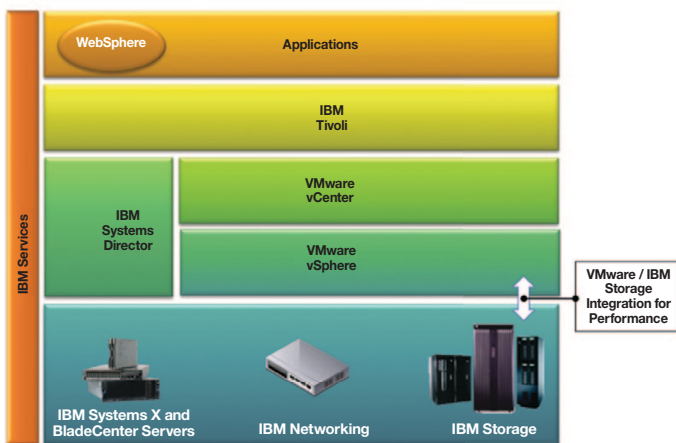
and can result in overall cost savings by using fewer physical servers. Key to increasing the number of virtual machines per physical server is the performance of storage systems and software. IBM storage systems along with IBM® Tivoli® storage management software solutions are designed to help remove bottlenecks, optimize performance and take advantage of integration opportunities with VMware thereby improving host performance to enable the consolidation of multiple virtual machines.

There are a number of areas that have been identified where the I/O operations of storage systems are impacting the expansion of additional virtual machines to better utilize server resources as well as approaches to address those performance impacts.

- vSphere Storage APIs for Array Integration (VAAI) provides a means to communicate with supported storage systems to offload operations to those storage systems.
- Use of storage system features such as writeable point-in-time copies and residency of common data in cache or use of high-performing solid state drives (SSDs) can accelerate the operations for Virtual Desktops.
- VMware vStorage APIs for Data Protection (VADP) usage reduces the conflict for I/O operations in protecting virtual machine data.
- VMware vSphere Storage Distributed Resource Scheduler (SDRS) can increase performance by helping to avoid or alleviate I/O bottlenecks with automated policies.

IBM solutions play a key role in improving performance and support additional virtual machine workloads. IBM storage systems and Tivoli storage management software have performance attributes and capabilities in addition to high-value advanced features and integration with VMware geared for optimization.

Business Value Increases with VMware and IBM



Delivering significant value through integration

IBM storage systems support vSphere Storage APIs for Array Integration to significantly increase vSphere's consolidation capabilities and give organizations the dramatic gains in performance while upgrading to new storage system technology. Within the IBM storage portfolio, IBM XIV® Storage System,

IBM Storwize® V7000 Unified and IBM System Storage® SAN Volume Controller (SVC) offer VAAI support and can provide significant improvements in vSphere performance, scalability, and availability.

IBM storage systems in combination with VAAI deliver valuable benefits across VMware environments of all sizes. These benefits commenced with vSphere 4.1, with the capability to offload processing for certain I/O intensive operations from ESX hosts to storage systems through integrated support for VAAI. Offloading the I/O intensive operations can eliminate redundant data flows between the physical server and storage, reducing the workload on the server and allowing more virtual machines to be deployed on the physical server running VMware ESX. The workload relief on the ESX server includes freeing up CPU cycles, memory for transfers and I/O bandwidth that can be used in support of other processes and can ultimately extend asset life.

When deploying VAAI-enabled IBM storage systems with vSphere 4.1 or higher, along with the required IBM Storage Device Driver for VMware on the hosts, higher-value functions can automatically become available. This integration opens the door to significant benefits in performance by taking advantage of the VAAI functions enabled with IBM storage systems. Benefits include:

- Increased efficiency when cloning virtual machines and creating new virtual machines. Virtual Machine provisioning time can drop from minutes to seconds.
- Reduced time and ESX server impact when using VMware Storage vMotion. The time required to move the volumes from one datastore to another can be dramatically reduced and the impact to other processes running on the physical server can be diminished.

- Expanded consolidation of storage to include IBM storage systems with the ability to share the storage resources across VMware hosts utilizing the Virtual Machine File System (VMFS). Multiple accesses of ESX hosts to the same datastore are common operations with virtual machine power on, snapshot creation and deletion and vMotion.
- Increased resources to deploy more virtual machines on a physical server. Reducing the CPU, memory and I/O bandwidth requirements can allow for additional virtual machines to be deployed and more efficiently use the resources of the physical server.
- Hardware-accelerated Block Zeroing: Writing zeroes to blocks for security reasons when deploying new virtual machine datastores
- Hardware-assisted Locking: A granular locking mechanism implemented by the storage system to help enable protection of accesses to data in a multi-host environment

VMware VAAI is an important step forward for administrators striving to achieve new levels of storage performance and efficiency. VAAI when combined with IBM storage systems can help enterprises of all sizes achieve optimum efficiency for VMware environments.

Accelerate performance with VAAI and IBM storage

There are three functions called primitives offered with VAAI that are designed to expedite certain operations by leveraging storage system capabilities. The hardware acceleration is accomplished by implementing advanced API functions within IBM storage systems—including XIV, Storwize V7000 Unified and SVC—equipped with specific versions of the embedded software. The three primitives include:

- Hardware-accelerated Full Copy: The ability to offload the copy operation when cloning virtual machines or migrating data

Previously these functions required full physical server implementations resulting in additional overhead and serialization which impacted performance. When leveraging VAAI with tightly integrated IBM storage systems support, the physical server can be alleviated from the tasks that can be more efficiently performed by the storage systems.

Reduce full copy time from minutes to seconds

Deploying a new virtual machine is an important undertaking and often time-critical where the virtual machine provisioning time is one of the metrics tracked by IT. Creating a datastore for a virtual machine or cloning a system usually involves copying information to populate the virtual machine system. Using IBM storage systems to accomplish this movement can reduce the time required from minutes to seconds. The VAAI hardware-accelerated Full Copy primitive allows the operation to run on the IBM storage system instead of the vSphere host. The virtual machine provisioning time is reduced and the physical server resources are made available for other processing requirements.

VMware also provides Storage vMotion, a valuable feature which allows IT administrators to migrate a virtual machine and its disk files from one datastore to another while the virtual machine is running. This function can also consume physical server resources of CPU, memory and I/O bandwidth, and impact other operations on that physical server. As the size of disk capacity to be migrated grows, the time consumed during

this process can increase from minutes to hours. The hardware-accelerated Full Copy primitive can be engaged with Storage vMotion and used in combination with IBM storage systems to offload the migration from the physical server. VAAI uses a modified version of the SCSI Extended Copy command to perform the migration at the storage system level resulting in better utilization of resources and improved performance.

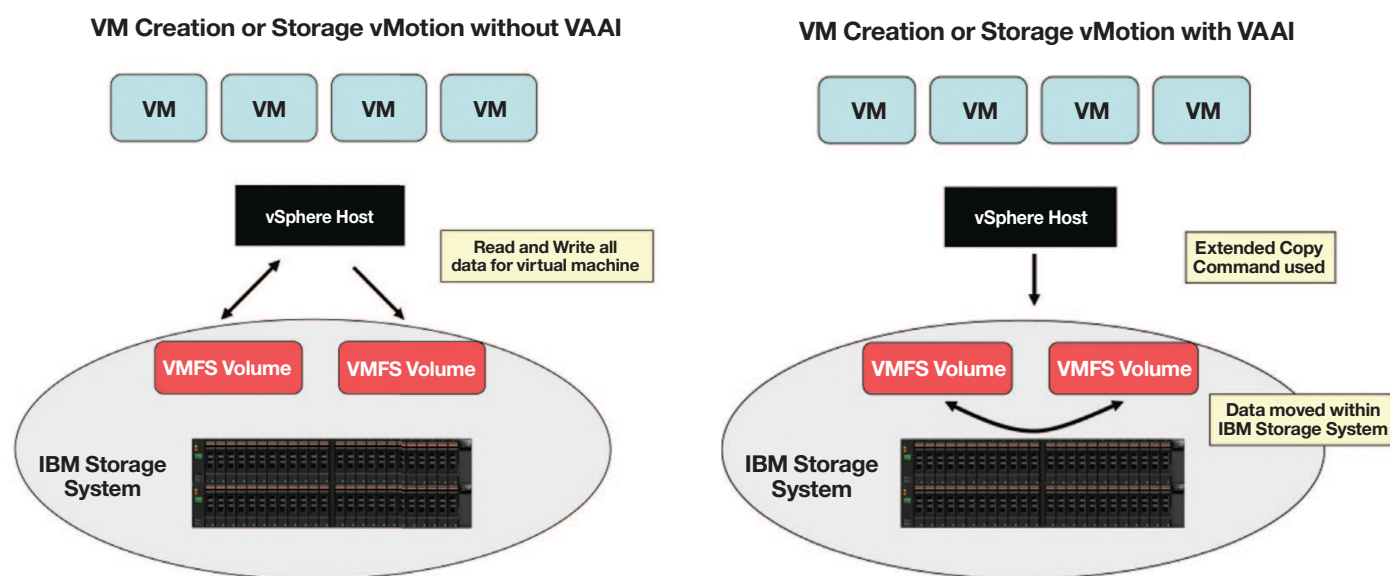


Figure 1: The hardware-accelerated Full Copy primitive speeds virtual machine creation and cloning, and can also be engaged with Storage vMotion for virtual machine migration by offloading the operations to the enabled IBM storage systems.

Expedite datastore creation

The default mode for creating datastores when a VMware virtual machine is created is “zerothick” where a fully allocated volume is created and written with zeroes before usage. VMware Fault Tolerance mode requires that volumes be created with “eager-zerothick” format where the space is also fully allocated and zeroed before usage. Zeroing out the data requires ESX to write zero blocks from the physical server prior to the block being used requiring the time-consuming process and usage of CPU, memory and I/O bandwidth resources. IBM storage

systems with hardware-accelerated Block Zero can substantially expedite this process by using storage-based capabilities that run as background tasks to mark disk extents as zeros without actually writing zeros. Zeroes are then written to the blocks as they are first consumed.

IBM storage systems can exploit this primitive to help eliminate redundant traffic between the vSphere host and storage subsystem and decrease the amount of time required for the operation to complete.

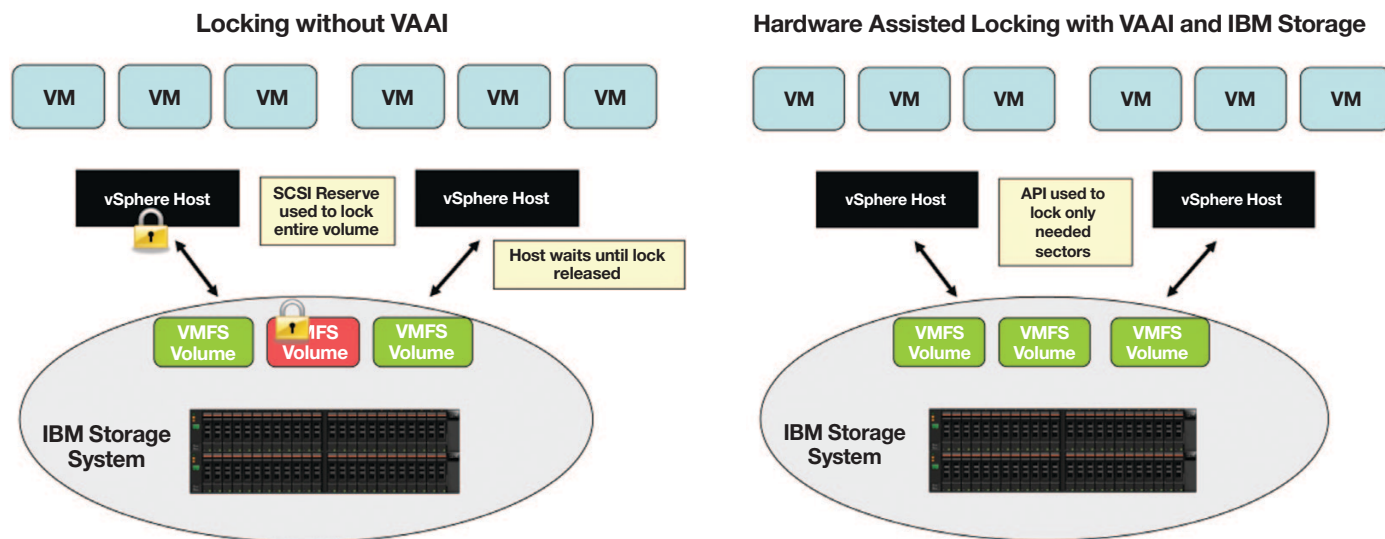


Figure 2: The hardware-assisted Locking primitive can enhance performance under heavy load conditions. This feature also makes it possible to support up to 2 TB volumes per datastore. Users may find that the gain in the number of virtual machines that can be supported per storage system as a result is an even more desirable benefit.

Protect access to shared data

VAAI-enabled storage systems from IBM provide the ability to share the storage resources across VMware hosts via the Virtual Machine File System (VMFS). VMFS is used for controlling access to volumes on storage systems as the location for datastores. In order for virtual machines to share storage resources, VMFS places SCSI reservations to prevent more than

one host from writing to a volume at a time. Rather than a lock being placed by a host on the entire LUN, hardware-assisted Locking enables IBM storage systems to place a lock on a single block of data. This primitive enhances performance in many ways and significantly increases the scalability of VMFS volumes and vSphere clusters.

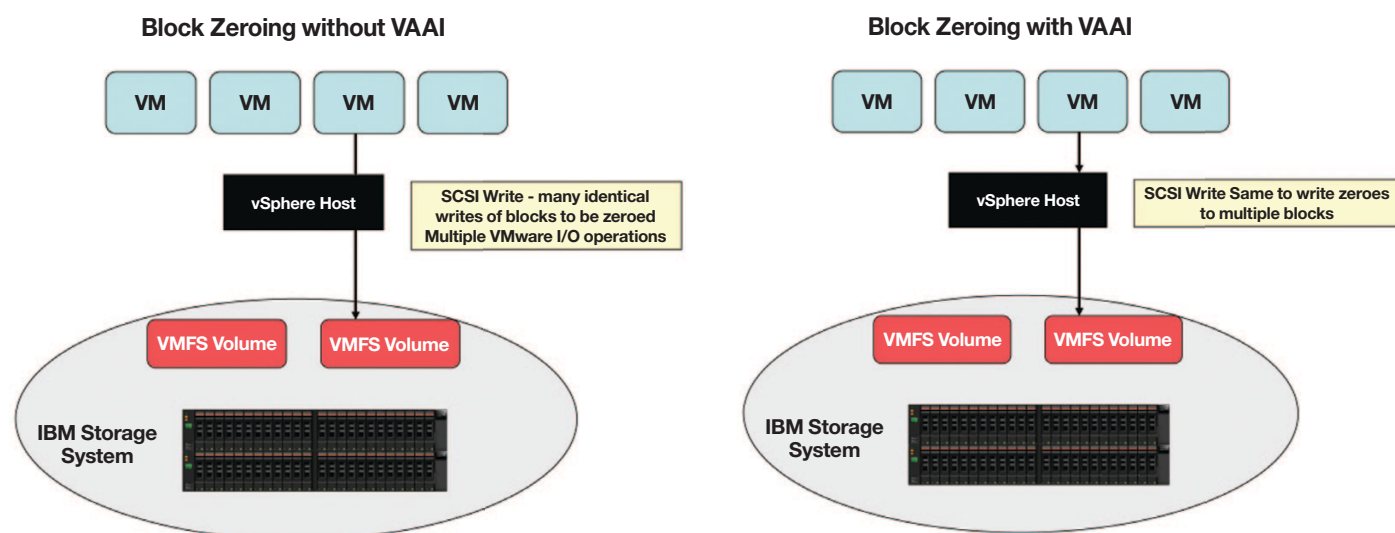


Figure 3: The hardware-accelerated Block Zeroing primitive helps eliminate redundant traffic between the vSphere host and IBM storage systems and decreases the amount of time required for the operation to complete

Boost VDI performance

IBM storage systems with self-optimizing and point-in-time copy capabilities can deliver performance improvements for Virtual Desktop Infrastructures (VDI) in VMware environments. A VDI deployment involves creating multiple desktop images that provide centralized administration and security for corporations. The desktop images are usually created from a single, golden image where a writeable clone copy is made multiple

times. Administrators have the option to create the writeable clone copy using system resources via VMware Linked Clones, or they can utilize the IBM storage system capability to create the clones. Leveraging the IBM storage system's point-in-time copy services to create writeable snapshots or space-efficient copies can ultimately result in improved performance for VDI implementations.

IBM Storage Systems and VDI

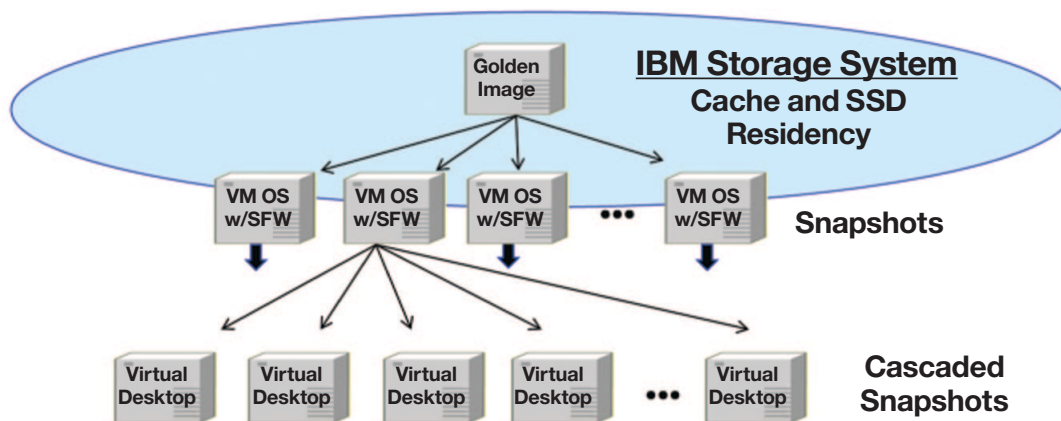


Figure 4: IBM storage system copy services can be used to create writeable snapshots or space-efficient copies and thereby enhance performance for Virtual Desktop Infrastructure deployments.

Retaining the active data for the VDI golden image base in cache or on solid state disk (SSD) is another way to positively impact performance and increase the number of virtual desktops that can be supported, improving the access to the most common data. IBM storage systems utilize high-capacity cache and in the case of the XIV, Storwize V7000 Unified, SVC, and DS8000 can automatically manage highly active data movement to SSDs.

VDI workloads are characterized by occasional peak loads when many systems start up at the same time (boot storms), run virus scans, or get software updates. Performance improvements can be realized by managing these peak loads with IBM's advanced SSD optimization technology. IBM System Storage Easy Tier® is a "right-tiering" capability built into the DS8000, Storwize V7000 and SVC systems that automatically migrates data between storage tiers based on real-time usage analysis patterns, resulting in improved performance and efficient use of flash technology.

Streamline data protection and alleviate bottlenecks

VMware vStorage APIs for Data Protection (VADP) in combination with Tivoli Storage Manager for Virtual Environments helps reduce the contention for physical server resources and

alleviates performance bottlenecks experienced with prior data protection solution implementations. Previously individual agents were required on every virtual machine operating system deployed on a physical server. This impacted performance and limited the number of virtual machines that could be deployed on a physical server.

VADP allows storage backup software applications to communicate directly with the ESX/ESXi server for protecting virtual machine volumes. Tivoli Storage Manager for Virtual Environments takes advantage of this API to provide an optimized way to backup and restore data repositories. Tivoli Storage Manager for Virtual Environments can enable organizations to protect the massive amounts of information generated on virtual machines—without disruption to other operations on the server—and to restore data without the need for a traditional backup window.

Changed Block Tracking from VMware allows incremental backups along with periodic full backups without having to force a scan of the virtual machine guest operating system file system. The ability to manage incremental backups in Tivoli Storage Manager for Virtual Environments can be exploited across virtual machines without the need to communicate directly with each virtual machine.

Balance I/O and automate data placement

Storage Distributed Resource Scheduler (SDRS) is designed to increase manageability at scale through automated monitoring and remediation and improve application performance by avoiding storage resource bottlenecks. This vSphere 5 feature essentially balances I/O across datastores based on I/O metrics. SDRS intelligently places workloads on storage systems during provisioning based on the available storage resources. It performs ongoing load balancing between storage systems to ensure proper space utilization and avoids I/O bottlenecks based on predefined rules that reflect business needs and changing priorities with SDRS.

When used with IBM storage systems and the automated features of caching and tiering, SDRS provides an integrated, automated management of data placement that can optimize storage system usage to meet service requirements.

Why IBM and VMware

On a Smarter Planet™ it is critically important to continue to protect and optimize customer's investments in IBM products as well as industry leading solutions. That is why IBM remains dedicated and continues to make significant investments to enhance the ease of use and manageability of IBM storage

systems. In virtualized environments where VMware is the primary method of virtualizing server resources, the deployment of IBM storage systems supporting vStorage APIs for Array Integration significantly increases vSphere's consolidation capabilities. This support also provides customers with dramatic gains in performance while improving mobility to new storage system technology. Additional tight integration of IBM storage systems with Virtual Desktop Infrastructure enables better performance while exploitation of data protection APIs offers non-disruptive backup and recovery of massive amounts of virtual machine data. For large and small organizations alike, IBM's enhanced integration with VMware can deliver stellar performance, streamline IT operations, lower costs and increase IT productivity.

For more information

To learn more about IBM storage solutions, please contact your IBM representative or IBM Business Partner, or visit the following website: ibm.com/storage

For a list of high-quality solutions with our partner Independent Software Vendors (ISVs), including access to solution briefs and white papers, visit: ibm.com/systems/storage/solutions/isv



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Produced in the United States of America
June 2012

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