

EMC Symmetrix VMAX Enginuity Version 5875

Virtualizing Tier-1 Applications with Confidence

This report presents an analysis of the value of the EMC Enginuity software update for the Symmetrix VMAX which was released for general availability in December, 2010. Analysis of the results of ESG Lab testing with VMware vSphere and Oracle RAC 11g was used to validate how VMAX software enhancements, including FAST VP and VMware VAAI API support, can be used to virtualize tier-1 applications with confidence.

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Enginuity 5875

Enginuity version 5875 is the latest release of software running inside the field-proven EMC Symmetrix VMAX series of enterprise-class disk arrays. Enginuity version 5875 delivers more efficiency, more scale, and more security with enhancements including:

VMware VAAI API Support to streamline virtual machine deployment and improve performance and efficiency in virtual server environments running vSphere version 4.1 or higher.

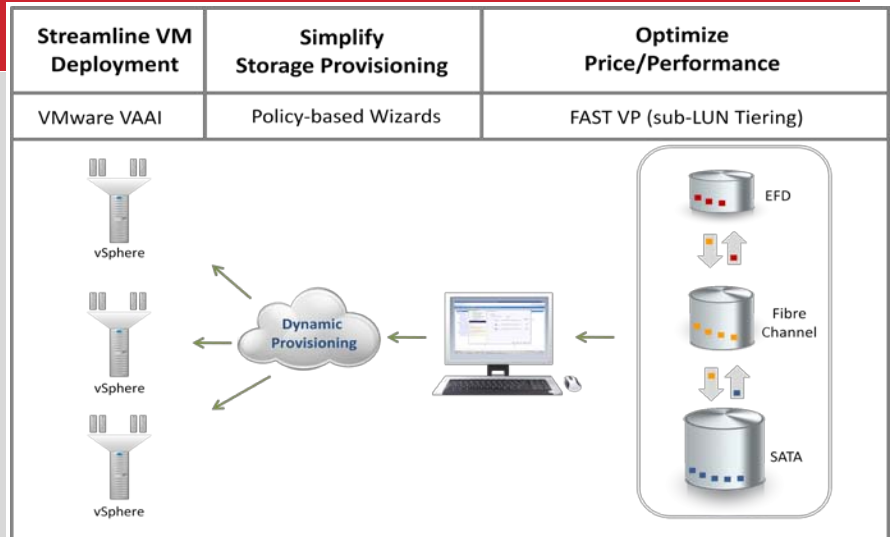
Faster Storage Provisioning with a growing family of policy-based wizards that provide an object-oriented view into ports, initiators, and storage groups.

Fully Automated Storage Tiering for Virtual Pools (FAST VP) using application policies and intelligent tiering algorithms to automatically move chunks of storage capacity to the right tier at the right time. FAST VP moves high performance data to enterprise flash drives (EFDs) to improve performance and less active data to high-capacity SATA drives to reduce costs.

Federated Live Migration to provide non-disruptive technology refreshes from DMX to VMAX disk arrays. Federated Live Migration reduces the time it takes to do a technology refresh from months to days as it increases efficiency with thick-to-thin migrations coupled with zero space reclaim.

Data at Rest Encryption to increase the security of sensitive applications using drive-level encryption. A unique encryption key for each drive is supported with RSA-integrated key management.

Native 10 GigE hot pluggable IO modules that provide high bandwidth Ethernet links for iSCSI host connectivity and Symmetrix Remote Data Facility (SRDF) replication.



Why This Matters

A recent ESG survey indicates that “increased use of server virtualization” is the number one IT priority for the next 12-18 months.¹ Yet despite the desire to increase use of server virtualization, nagging issues and challenges exist. Scalability, performance, reliability, and security are key concerns that must be addressed before organizations can move from a strategy of lowering costs with the virtualization of IT productivity applications to improving quality of service for tier-1 business-critical applications. The latest release of Enginuity software was designed to help organizations virtualize tier-1 applications with confidence as it adds more efficiency, scale, and security to EMC’s field-proven family of enterprise-class disk arrays.

¹ Source: ESG Research Report, [2010 IT Spending Intentions Survey](#), January 2010.

FAST VP (sub-LUN Tiering)

FAST VP uses application policies and intelligent tiering algorithms to automatically move chunks of storage capacity to the right tier at the right time. It can be used to optimize application performance with high-speed flash drives and reduce costs with high-density SATA drives.

ESG Lab Testing

ESG Lab tested FAST VP with a multi-user online transaction processing (OLTP) Oracle RAC 11g application running in a VMware-enabled virtual server environment.

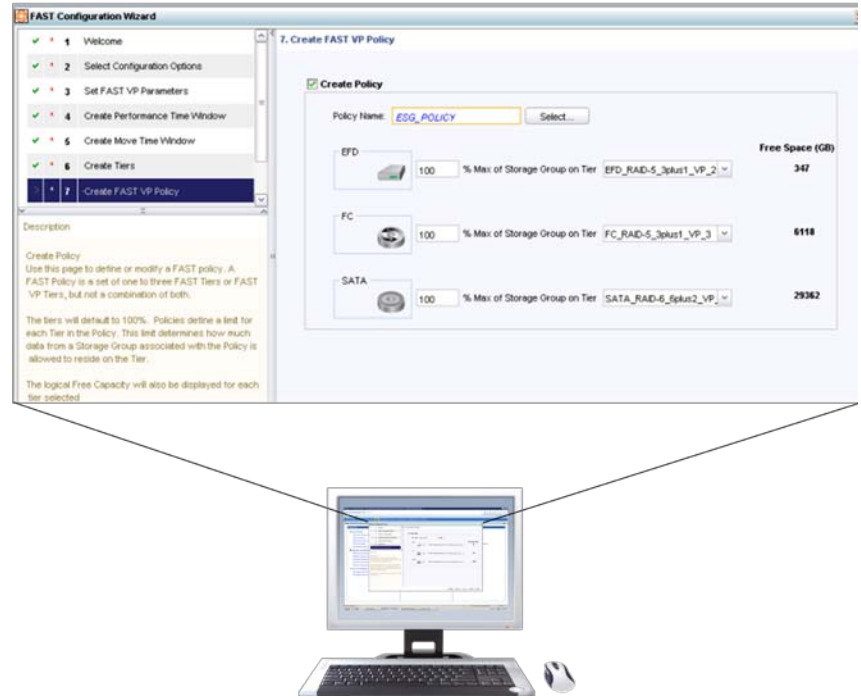
Database and storage performance statistics were captured before and after configuring FAST VP to move from a configuration with 128 15K PRM FC drives to a three-tier configuration with eight 200 GB EFD drives and 28 high capacity SATA drives (2 TB).

ESG Lab confirmed that wizard-driven FAST VP configuration is fast and intuitive. Using the wizard, it was easy to walk through the process of configuring FAST VP. A policy of 100% was set for each tier for the Oracle Application. This was chosen to let the FAST VP intelligent algorithms decide the tier capacities, thereby optimizing both the performance and cost associated with the application. ESG Lab noted that values of less than 100% can be used to limit the amount of pool capacity used by each application. Symmetrix and Oracle statistics were monitored before and after the FAST VP policy had been running for 3.5 hours.

The swingbench load generator was used to emulate a 700-user online transaction processing (OLTP) system that generated more than 200,000 transactions per minute as it emulated a warehouse order entry application. FAST VP was configured with an aggressive relocation rate of one to observe maximum data migration during the testing window. EMC recommend using the default relocation rate of five or higher to minimize performance impact on application response times during FAST VP movements.

It should be noted that ESG Lab testing was performed with a goal of emulating a tier-1 database application that exceeds the performance requirements of most organizations. It should also be noted that the synthetic benchmark used during ESG Lab testing is more uniformly random than real-world applications that tend to have more locality of reference. As a result, ESG Lab is confident that most organizations will be able to use less EFD capacity to achieve similar, if not better, performance and cost benefits with FAST VP.

Wizard-Driven FAST VP Configuration



The Results

After three hours, 518 GB of the 2,016 GB of Oracle capacity had “tiered up” to EFD. The FAST performance algorithm identified 112 GB of inactive data which was migrated to SATA drives.

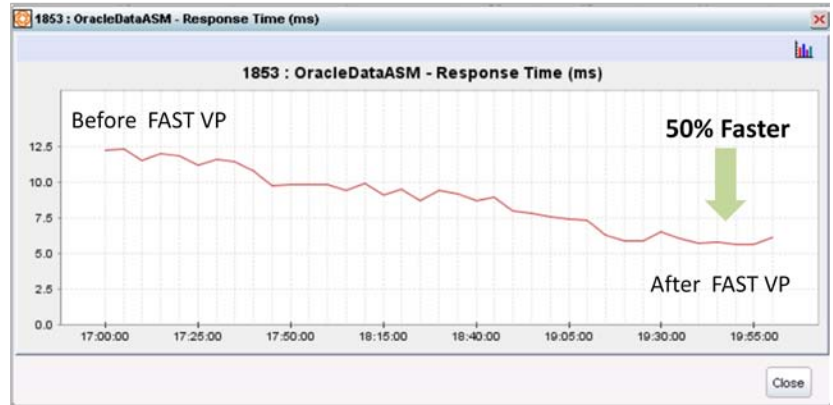
As shown in the figure, FAST VP and EFD drives reduced Oracle IO response times by 50% for a virtualized Oracle application.

A closer review of Oracle AWR reports revealed that FAST VP delivered:

- 59% faster DB sequential read times
- 57% less user IO wait time
- 51% less SQL execute elapsed time
- 14% less CPU time
- 12% less log file sync wait time
- 20% more transactions per minute

Oracle AWR reports also indicated that FAST VP improved performance for the top three time events (DB sequential read time, CPU time, and log file sync time, respectively). In other words, the top three events that the Oracle OLTP application was waiting for were improved with FAST VP.

Improving Oracle Performance with FAST VP
Oracle Data ASM Response Time (less is better)



Why This Matters

Companies continuously face challenges in cost effectively meeting the capacity and performance requirements of applications—especially those with strict performance requirements. Failure to meet performance requirements can result in lost productivity and costly loss of services. Over-provisioning to avoid performance problems is a waste of money.

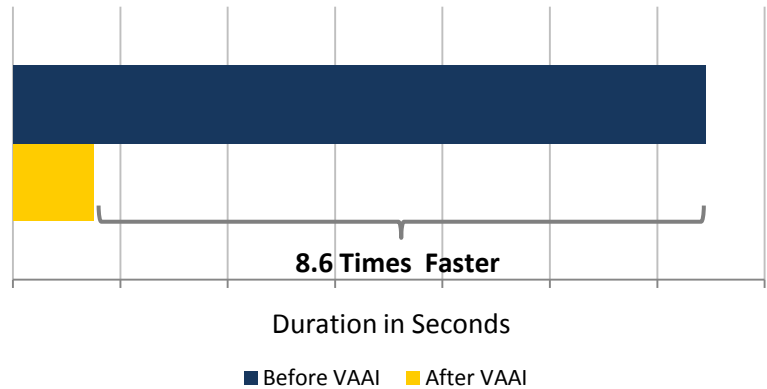
ESG Lab has confirmed that FAST VP can be used to improve the performance and cost efficiency of tier-1 application delivery in a virtual server environment. During testing with a mix of EFD, FC, and SATA drives, FAST VP not only increased the performance of a fully virtualized Oracle RAC application, it also increased the amount of work that the virtualized infrastructure could handle.

With FAST VP, Symmetrix customers now have the option of moving from an all Fibre Channel drive configuration to a fully automated mix of SATA and EFD drives with movement of data happening automatically and transparently at the sub-LUN level. With guidance from the EMC professional service organization based on actual trace data analysis provided by the EMC Tier Advisor tool, ESG Lab is confident that most multi-user online applications can be moved to a mix of EFD and SATA that costs less, uses fewer drives, and consumes less power, cooling, and space.

VAAI Support

Engenuity version 5875 includes support for VMware vStorage APIs for Array Integration (VAAI). VAAI, which was introduced by VMware in vSphere version 4.1, offloads data-intensive operations to storage systems with a goal of accelerating the performance of common virtual server management operations. Three primitives are supported: Block Zeroing, which speeds the initialization of virtual machines; Full Copy, which accelerates the cloning and movement of virtual machines; and Scalable Lock Management, which streamlines coordination during virtual server management operations. By default, VAAI is turned on in a vSphere version 4.1 server. If the disk array is not VAAI capable, then the advanced primitives are simply not called.

VAAI Accelerates VM Init Time
(40 GB VM, less is better)



ESG Lab Testing

Block Zeroing was tested with VMware version 4.1 and an EMC Symmetrix equipped with Engenuity version 5875 software. A two-node vSphere server cluster with a pair of Dell PowerEdge R710 servers, each with 32 GB of RAM, was used during this phase of testing. The time that it took to initialize a 40 GB virtual machine was measured before and after VAAI Block Zero API acceleration. As shown in the figure above, the 40 GB virtual machine initialized 8.6 times faster with VAAI. ESG Lab audited the results of EMC tests for larger virtual machines and confirmed that the performance benefit is magnified as the size of the virtual machine increases—a 200 GB virtual machine initialized 17.87 times faster on a Symmetrix VMAX equipped with Engenuity version 5875 and VAAI Block Zero support.

Block Copy was tested with a 20 GB virtual machine that was 80% full, containing Windows Servers 2008 R2 operating system and application data. The time that it took to clone a VM before and after VAAI Block Copy acceleration was measured: cloning time was reduced from minutes to seconds as the 20 GB virtual machine was cloned 2.7 times faster with VAAI and the EMC Symmetrix VMAX.

Why This Matters

VAAI frees up hypervisor compute power, which can be used to run more virtual machines. This can increase VM to host ratios without adding more physical server resources, or it can increase the workload each VM can handle.

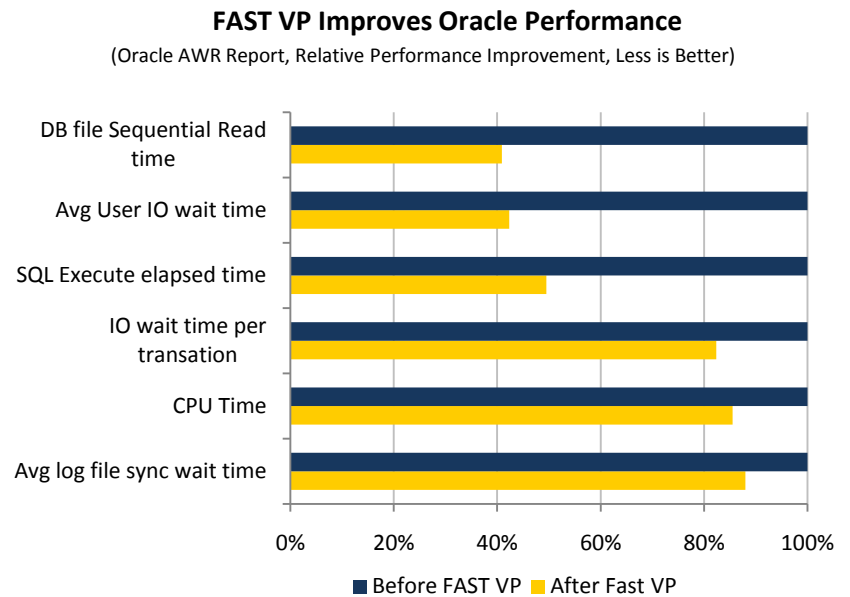
VAAI reduces the time needed for virtual server administration (faster VMotion, Storage VMotion, cloning, VM deployment, and more). This helps the IT organization respond quicker to the needs of the business as it reduces the time and expense associated with virtual server administration.

VAAI Block Zero makes it easier to take advantage of VMware fault tolerance. VMware fault-tolerance-enabled VMs need their virtual disks converted from either the thin disk or zeroed thick disk format to the eager zeroed thick disk format. This process can be very time-consuming as the conversion process zeros every block on the virtual disk. VAAI Block Zeroing drastically reduces the time—and overhead—of this operation as it uses far fewer IO commands to get the job done.

ESG Lab Highlights

ESG Lab performed hands-on testing at an EMC facility in Hopkinton, MA. The following is a summary of the results:

- ESG Lab confirmed that EMC is continuously improving the wizard-driven storage provisioning process for its Symmetrix product line.
- In a previous lab report, ESG confirmed that VMAX virtual provisioning was 82% faster and significantly easier (83% fewer operations, less decisions, and significantly more automated) than traditional provisioning methods.²
- A tier-1 Oracle RAC application was virtualized on an EMC Symmetrix with VMware vSphere 4.1.
- FAST VP and EFD drives dramatically increased the scalability and performance of a tier-1 OLTP application supporting 700 simulated users and more than 200,000 transactions per second. Oracle AWR reports indicate that 20% more transactions were processed as response times were reduced by 50% and user wait times were reduced by 58%.
- A 40 GB virtual machine was configured 8.6 times faster and a 20 GB virtual machine was cloned 2.7 times faster with the VAAI support built into VMware vSphere 4.1 and EMC Symmetrix disk arrays running Enginuity version 5875 software.



Issues to Consider

Deploying FAST VP with real-world applications should magnify the performance gains that can be achieved with FAST VP. As a matter of fact, an ESG Lab audit of trace data collected from EMC customers has confirmed that most organizations will see more performance gains using significantly less flash drive capacity.

Similarly, deploying FAST VP with high density SATA drives and mature real-world applications should get better savings than were achieved during ESG Lab testing. Applications that have been running in production for months or years should have larger amounts of inactive data and would benefit from additional cost savings as more data is moved to cost-effective SATA drives.

The Bigger Truth

EMC Symmetrix has a solid history of supporting mission-critical applications in tier-1 environments. The Enginuity 5875 software update, released for general availability in January 2011, extends the enterprise-class capabilities of this field-proven product line. ESG Lab has verified that the increased scalability and efficiency of EMC Symmetrix can be used to virtualize an Oracle RAC application with VMware vSphere. Application-level performance for an Oracle OLTP application was dramatically improved using a combination of FAST VP technology and high-speed enterprise flash drives. VAAI-enabled offload increased efficiency as it dramatically accelerated the time it takes to deploy and manage a virtual server environment. Put it all together and it's clear that Enginuity version 5875—with more efficiency, more scale, and more security—can be used to virtualize tier-1 applications with confidence.

Learn more at www.emc.com

² <http://www.enterprisestrategygroup.com/2009/04/esg-lab-validation-report-emc-symmetrix-v-max-24xforever-storage-for-virtualized-data-centers/>