

MS Exchange Server Acceleration

Maximizing Users in a Virtualized Environment with Flash-Powered Consolidation

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Introduction

Microsoft (MS) Exchange Server is one of the most widely used e-mail server platforms in enterprise environments. It utilizes client applications such as MS Outlook to connect hundreds or even thousands of users in an organization to central servers to enable e-mail communications and other personal management capabilities such as calendars, tasks, contacts, notes, journals, and web browsing. In conjunction with MS SharePoint Server, MS Exchange Server enables SharePoint sites to be developed for the public exchange or access of folders, calendars, meeting schedules and databases (DBs).

To maximize the end user experience of MS Exchange Server, storage latency and transactional input/output operations per second (IOPS) must be performing at the highest levels in order to successfully service these large numbers of users, and not adversely affect their productivity especially during peak usage. These two parameters directly impact the usability of the e-mail system as well as the number of mailboxes that can be hosted in a virtual server environment. Therefore, transactional access rates and database read latencies are key performance parameters designated by Microsoft to determine the number of users that can be supported in a given

environment, and in turn, how the user experience will be perceived.

This white paper will present a solution that dramatically increases MS Exchange transactional IOPS and reduces database read latency to maximize performance, as well as the user experience. The solution also allows for further server consolidation, as well as lower power and cooling requirements, leading to a reduction in overall Total Cost of Ownership (TCO).

Virtualization of the MS Exchange Server Environment

Virtualization achieves cost reductions through consolidation for MS Exchange Server environments. With MS Exchange Server running in a Virtual Machine (VM), multiple VMs can run on one platform and can be moved or copied from one physical host to another to help balance the data center system load or to expand processing capabilities. From a cost perspective, deploying and managing less physical hosts (and multiple VMs) significantly reduces overall system and maintenance costs versus adding and managing isolated servers for each application load.

In virtualized environments, storage has traditionally been relegated to external storage arrays. These external storage arrays are typically filled with hard disk drives (HDDs) that in most cases experience difficulty in servicing a large number of VMs concurrently due to their preference for sequential, non-random access to data. Additionally, external storage increases latency and causes data bottlenecks as data access occurs through slower, external link protocols such as FC (Fibre Channel) and iSCSI.

Since all connected VMs and associated applications in a virtualized environment need access to external storage simultaneously from the host, the next logical step is to cache the most frequently used data on flash memory that resides

within the virtualization host server. This approach enables any VM on the host, such as MS Exchange Server, to access data at a much higher speed and lower latency. The key to this approach is utilizing software that delivers flash caching and storage virtualization into this virtualized server platform.

To maximize storage capabilities, PCI Express (PCIe) flash cards (such as OCZ's Z-Drive R4 SSD) can be deployed within the virtualization server (that hosts the MS Exchange Server) enabling flash cache to scale with either the size of the cluster or the total capacity of the external storage area network (SAN). This provides complete scalability in deployment and management of the flash within the cluster.

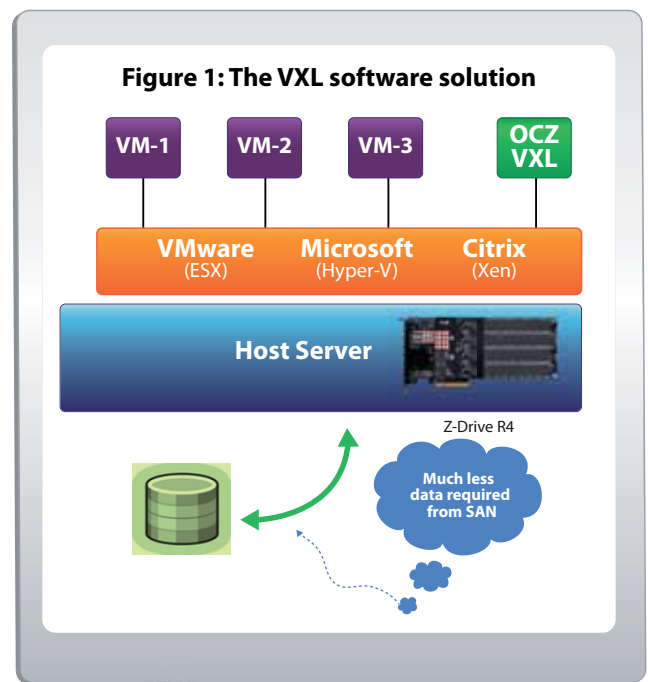
The OCZ VXL Software Solution

To achieve the highest transactional IOPS and storage latency in virtualized MS Exchange Server environments, OCZ Technology's VXL software provides an optimized solution designed to operate in and enhance performance of enterprise virtualization environments. The software includes a rich feature set that delivers heightened data acceleration, high availability (HA) and resiliency, and is deployed as a virtual appliance on the virtualization host server, distributing flash resources on demand across VM applications to maximize performance. See Figure 1.

VXL software employs an advanced caching and virtualization algorithm that features optimized caching strategies specific to MS Exchange applications and decides which data to cache in flash memory in the most efficient and optimal manner. This algorithm is transparent to VMs, and since the flash cache is shared dynamically between all VMs supported by the host server, VXL software ensures that the flash cache is optimally utilized at all times, regardless of how many VMs are running concurrently.

One of the key benefits of VXL software is that no guest agents are required within the application VM so IT deployment, management, and maintenance are much simpler. Utilizing hypervisor connectivity, VXL works with any operating system supported by a virtualization platform including Windows, Linux, OpenSolaris and FreeBSD. This is in contrast to other cache software solutions that require agent or driver installation on every VM in the virtualized cluster. The OCZ VXL 'no-agents' approach dramatically simplifies both the deployment and management of storage especially since there can be thousands of VMs in a virtualized environment.

As VXL software virtualizes the local flash resources, connected VMs are transparently accelerated and continue to function as they would regularly in virtualized environments. All key virtualization capabilities such as vMotion, HA, and fault tolerance are fully supported. Furthermore, VXL uses PCIe flash as a single, dynamic resource as opposed to the



static allocation per-VM performed by competitive solutions. As a result, VXL software dynamically distributes the flash between VMs based on need, making sure no VM holds the flash idly when it can be used elsewhere in the environment. This provides the highest return on investment (ROI) in a virtualized environment, where many VMs share the same flash and often do not reach peak work load requirements concurrently.

VXL software also enables virtualization of flash cards as a highly available network resource. It achieves this through VXL's 'SAN-less Data Center' mode that enables the flash to be exposed to any VM in a virtualized cluster without negating any of the virtualization capabilities of the hypervisor layer. This approach sets the precedence for an all silicon, SAN-less data center while still delivering high availability and mirroring without the need for costly external SANs.

The OCZ Z-Drive R4 PCIe Hardware Solution

OCZ's Z-Drive R4 PCIe card provides a compact, power-efficient solid-state solution that fits directly into a system's PCI Express slot to increase server application performance while delivering fast and reliable access to data without burdening host CPU and memory resources. When combined with OCZ's VXL software, any PCIe-based Z-Drive R4 model (including the Z-Drive R4 CloudServ™) can be utilized as an accelerator for traditional iSCSI and FC storage.

This combination of VXL software with a Z-Drive R4 PCIe SSD

enables the delivery of a complete virtual performance system for enterprise customers looking to efficiently distribute flash resources across VMs as a means to maximize performance of key applications. Since cached data is treated as a virtualized storage entity, VMs can be migrated seamlessly between host servers without performance loss. This also eliminates the need for costly tier-1 SANs in a wide range of enterprise IT infrastructures and is simpler and more cost effective to maintain.

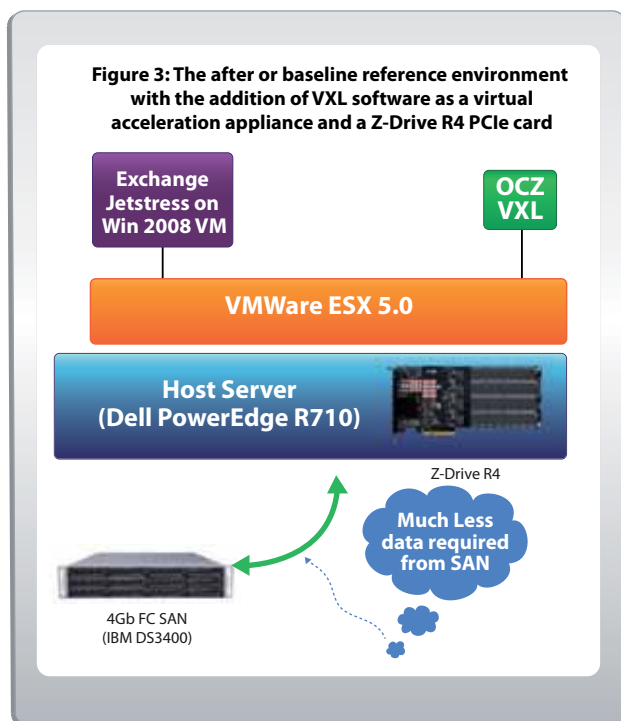
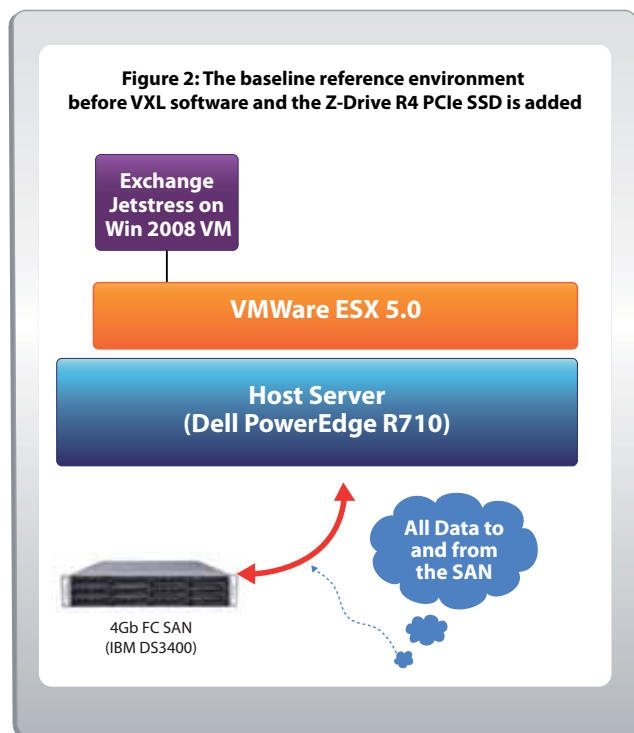
Performance Testing

This white paper presents the accelerated performance achievable with VXL software in virtualized MS Exchange Server environments. Using Microsoft Exchange Server's Jetstress traffic generator, the tests performed compare a VM running an MS Exchange Server database before and after VXL software and a Z-Drive R4 PCIe flash SSD are added to the host, testing for both transactional IOPS and database read latency.

The baseline reference environment (before VXL software and the Z-Drive R4 PCIe SSD is added) features a VM that implements the MS Jetstress traffic generator deployed on a Dell PowerEdge R710 host server and is connected to an IBM DS3400 storage array system utilizing a RAID 0 SATA LUN for database, and a RAID 5 SAS LUN for logs. A VMware ESX 5.0 hypervisor was used on the host server, containing 2 six core Intel XEON X5690 processors. See Figure 2.

The flash accelerated environment utilizes the baseline reference host with the addition of VXL software (as a virtual acceleration appliance) and a Z-Drive R4 PCIe card. In read cache mode, the flash is used to accelerate reads while all writes are directed to SAN storage (write-through). In the flash virtualization (SAN-less Data Center) mode, VXL virtualizes the Z-Drive R4 PCIe solution and exposes it as accelerated storage to the Microsoft Exchange Virtual Server. See Figure 3.

To simulate the sustained storage loads in a production MS Exchange Server environment, a standardized 2 hour Jetstress test of 200 mailboxes each, with 2 gigabyte mailbox sizes, was used for both environments. The total transactional IOPS and database latency metrics, before and after VXL acceleration, were then compared and the results appear in the next section.



Performance Results

The results of the acceleration tests indicate that deploying VXL software using a VMware ESX operating system with host-based flash provides a dramatic increase in transactional IOPS for MS Exchange running as a VM in the environment. The transactional IOPS increased more than 18x (from 252 IOPS to 4581 IOPS) in the SAN-less Data Center mode, and more than 6x (from 252 IOPS to 1473 IOPS) when writes are directed to SAN storage via write-throughs. This increase in IOPS

performance was accompanied by a large decrease in the database read latency (from 16.2ms to 1.5ms), reaching access times that were 13x faster than the Microsoft usability requirement of 20ms.

Table 1 below summarizes the transactional IOPS and database read latency before and after acceleration with VXL software and host based flash.

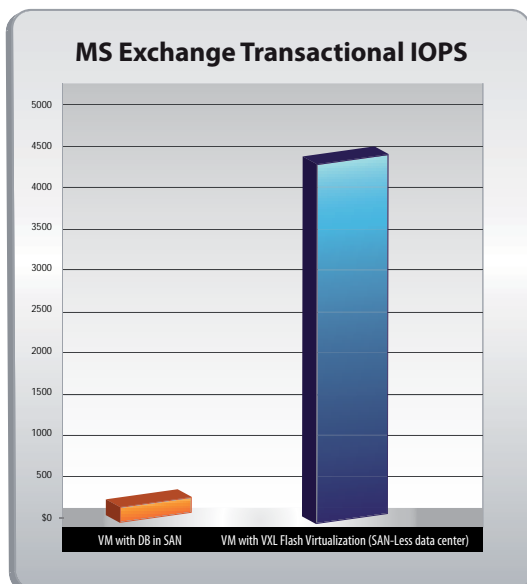
| | VM w/o Acceleration | VM accelerated with VXL (Write through to SAN mode) | VM with VXL SAN-less Datacenter (Flash Virtualization Mode) |
|----------------------------|---------------------|---|---|
| Transactional IOPS | 252 | 1473 | 4581 |
| Acceleration Factor | | x6 | x18 |
| Latency | 16.2 | 1.4 | 1.5 |

Table 1: MS Exchange transactional IOPS and database read latency with and without VXL acceleration

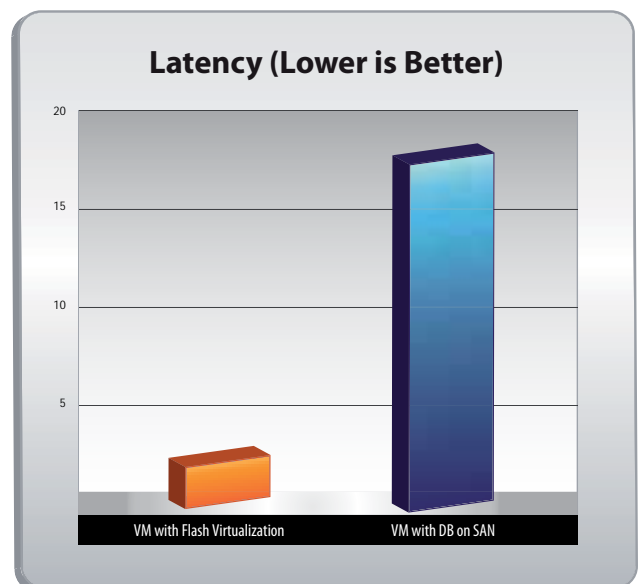
As outlined in Graph 1, the incorporation of VXL software and host-based flash provides an up to **18x increase** in transactional IOPS performance. For IT professionals, this addition of VXL software translates into support for many more users in a VM environment as well as the capability to support heavier usage loads and usage peaks without affecting a client's usability experience.

acceleration was reduced to less than a tenth of its previous value. It should be noted that before VXL and flash acceleration was added, the Exchange VM was close to failing the Microsoft recommended threshold requiring latencies of less than 20ms. When VXL and flash acceleration was added, latency was far below the 20ms requirement indicating that the Exchange VM easily passed Microsoft's usability requirement, which in turn, enables additional users within the same environment.

As is evident in Graph 2, database read latency with VXL



Graph 1: MS Exchange Transactional IOPS with and without VXL acceleration



Graph 2: Database read latency with and without VXL acceleration

Conclusions

OCZ VXL software, when combined with an OCZ Z-Drive R4 PCIe SSD, provides an enterprise-class solution to flash-based virtualization and acceleration in the data center. As demonstrated from the performance tests, when PCIe flash with host-based virtualization and acceleration software was added to the VMware environment, performance of MS Exchange VMs increased by a factor of 18 times.

This increased performance translates into a higher ROI in the enterprise as the same virtual infrastructure can now support a much larger number of users. Employee productivity also increases since peak usage no longer adversely affects end user performance.

The combined OCZ hardware/software solution alleviates the storage issues that bog down virtualized server deployments. Enterprise IT departments and cloud providers can enable virtualization for even heavy application loads, such as MS Exchange Server, with confidence. In addition, reduced CAPEX and OPEX efficiencies are realized that transform the data center into a dynamic, high-performance environment that is able to handle the ever-increasing loads and requirements typically associated with accelerating access to data in the enterprise.