

SQL OPPORTUNITIES

DR. ALLON COHEN OF OCZ TECHNOLOGY GROUP DISCUSSES HOW FLASH VIRTUALISATION CAN HELP BUSINESSES GET THE MOST OUT OF MS SQL SERVER 2012



SQL Server 2012, the latest release of Microsoft's enterprise DBMS, includes new features and enhancements that improve database availability, simplify the moving of databases between instances, employ more productive management and development tools, and provide significant enhancements in performance, programmability and security.

Being data access intensive, the performance of this database application is dependent on storage performance. The speed of the storage implementation determines the time it will take to scan and analyse large portions of data, and dictates whether users receive the business insight they need, in the time frame they require.

To enable a large number of users to be serviced without contention, and to maximise the user experience of MS SQL Server applications, the underlying storage latency and transactional IOPS must deliver optimal

performance. Providing immediate access to data becomes especially critical during peak usage so that productivity is not adversely affected. Transactional access rates and database read latencies can significantly impact the time it takes to complete data warehouse queries in enterprise and cloud environments.

At OCZ we have developed a solution that dramatically increases MS SQL Server transactional IOPS performance, reduces database read latencies, dramatically improves query completion times, and is optimised for SQL Server 2012, enabling flash virtualisation and data caching to increase application performance and data access. The OCZ solution includes host-based PCI Express (PCIe) Z-Drive R4 solid-state drives (SSDs) and VXL caching and virtualisation software. Introducing this combined solution into an MS SQL Server 2012 analytical environment improves query processing by factors up to 1700%, dramatically reducing processing window times while unleashing the full power of SQL Server 2012 in virtualised data centres.

The combination of PCIe SSDs and VXL software enables the full potential of SQL Server 2012 in virtualised data centres through the following key capabilities:

- Delivers live, on-demand business data exploration and analysis by combining SQL Server 2012 xVelocity column store indexes with OCZ host-based flash virtualisation and caching.
- Enables auto-detection, hot-zone caching that automatically identifies frequently accessed data pages within SQL Server 2012 to deliver on-host flash caching capabilities.
- Divides database file groups between virtualised all-flash drives, storage area

network (SAN) drives, and flash-cached drives to deliver optimal performance and a reduction in total cost of ownership (TCO).

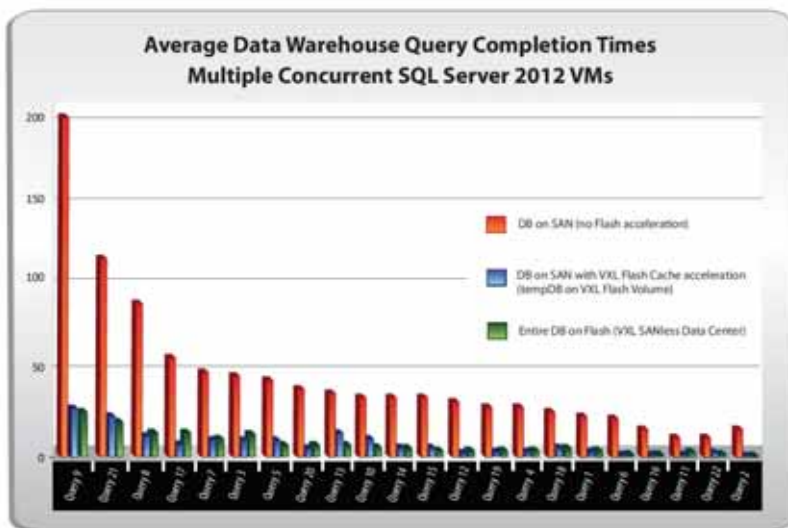
- Places performance critical files (such as SQL Server 2012 tempDBs) on host-based flash while retaining network accessibility.
- Drives dynamic SQL Server 2012 VM migration from one server to another through VMware vMotion support, end-to-end mirroring, high availability (HA) and fault tolerance to server and flash failures.

This approach alleviates the storage bottlenecks associated with using database applications in virtualised environments, and enables MS SQL Server 2012 to be virtualised with confidence.

SQL Server 2012 has been optimised to improve storage performance by including a host of storage access schemes that can benefit from flash virtualisation and caching capabilities. The combined OCZ virtualisation approach addresses these storage access schemes with key best practices that improve SQL Server 2012 performance and access to database indexes. The following details how this approach addresses key SQL Server 2012 storage requirements:

CACHING XVELOCITY COLUMNSTORE INDEXES:

SQL Server 2012 features a new column-oriented database index architecture that stores content by column rather than by row, making this approach ideal for data warehouse applications where aggregates are computed over large numbers of similar data items. The columnar database technology enables quick processing of highly complex queries over large datasets storing terabytes of information, as is typical for OnLine Analytical



Average data warehouse query completion time for three concurrent VMs with and without flash acceleration

Processing (OLAP) workloads.

SQL Server 2012 uses velocity columnstore indexes (based on columnar database technology) to decrease the execution time of data warehouse queries. When xVelocity columnstore indexes are created, the SQL Server query optimiser accesses the columnar data to improve query performance, and will constantly attempt to load as much columnstore data as required, and as quickly as possible, to available client memory in response to requested queries. It is therefore highly beneficial to store the columnstore indexes on as fast a platform as possible. Being a frequently accessed dataset that is not altered very much, xVelocity indexes greatly benefit from the capabilities of PCIe-based flash.

VXL virtualization software efficiently loads a cached copy of xVelocity columnstore indexes to flash that dramatically improves access to them, while at the same time, retains a copy on the SAN. If users are frequently creating and constantly using xVelocity indexes, creating the indexes directly to flash, using VXL's Flash Volume virtualisation functionality, will accelerate index processing times and can

negate the need for external SAN access altogether. IT managers can generate large TCO savings by deploying xVelocity columnstore indexes on OCZ host-based flash rather than with DRAM, attaining large performance increases without large expenditures for memory.

CACHING TEMPDB ON FLASH:

Data warehouse applications may request to consume large amounts of RAM for intermediate query results, and in many cases, when SQL Server does not have enough RAM available, the queries automatically spill into SQL Server's tempDB (temporary database). When tempDB resides on a remote SAN, this redirection can create a drastic drop in database performance.

With OCZ's combined virtualisation solution, tempDB write operations may be directed to a virtualised flash volume residing on the host, dramatically reducing any performance impact of tempDB usage. VXL software virtualises host-based flash and makes it available to the SQL Server VM wherever it resides in the virtualised environment. This unique capability utilizes the PCIe-based Z-Drive R4 SSD for tempDB usage while retaining all of the virtualisation

capabilities of the SQL Server VM, including the capability to perform vMotion while continually accessing the tempDB. This unique capability is in sharp contrast to other flash caching software products that place the tempDB on the local host which puts draconian limits on the connected SQL Server virtual machine, and causes important virtualisation capabilities (such as vMotion, end-to-end mirroring, high availability and fault tolerance) to be negated.

AUTOMATIC DETECTION/CACHING OF FREQUENTLY ACCESSED DB PAGES:

Database files can reach terabytes in size while only the 'hot data' within them are frequently accessed. As the database changes, these 'hot data' zones may move to different locations within the file causing difficulty in detecting important data to cache and delays in both detecting and accessing the data.

VXL software features an advanced caching engine that dynamically detects 'hot data' within large database files and will cache the hottest and most relevant data effectively. Using the hot zone detection engine, OCZ VXL can efficiently cache large databases even with small amounts of flash. Available host cache resources can be shared with other VMs in the environment as the SQL Server 2012 VM no longer needs to cache the entire database.

DIVIDING DB TABLES BETWEEN DIFFERENT FILE GROUPS:

SQL Server 2012 allows database files to be grouped for administrative, data allocation, and placement purposes. Database tables can be placed in a separate file group with each file group having its own physical storage location. This feature is especially useful with large databases that may include multiple tables, with each table having its own requirements for access, allocation, and data replication.

As part of the SQL Server 2012 file group feature set, VXL software enables users with the flexibility to select between storing the data tables on SAN volumes, on virtualised 'all flash'

CASE STUDY

"To enable a large number of users to be serviced without contention, and to maximise the user experience of MS SQL Server applications, the underlying storage latency and transactional IOPS must deliver optimal performance. Providing immediate access to data becomes especially critical during peak usage so that productivity is not adversely affected. Transactional access rates and database read latencies can significantly impact the time it takes to complete data warehouse queries in enterprise and cloud environments."

volumes, or on flash-cached volumes. When flash-cached volumes are selected, VXL software automatically detects which database pages from the SAN need to be cached on flash, and will assign flash resources by demand to the SQL Server 2012 VM. Large TCO savings are enabled with the flexibility to pick and choose which DB tables can use commodity storage for capacity, and which tables can efficiently benefit from the performance enhancements of flash.

RETAINING LOG FILES ON MIRRORED FLASH VOLUMES:

Log files are an essential component in making sure databases can be successfully recovered if needed. It is therefore critical to keep the logs stored in an environment that has no single point of failure. This has traditionally been a challenge for flash solutions that do not have storage virtualisation capabilities.

VXL software has a unique storage virtualisation feature-set that enables transparent mirroring of SQL Server logs between two flash cards, thereby assuring that the log files can be accessed with ultra high performance, while at the same time, are highly available for recovery if required.

UNLEASHING THE POWER OF VIRTUALISATION

As CPU and DRAM computing power increases across data centres worldwide, IT professionals continue to use server virtualisation as a means to increase efficiency

and reduce costs. However, their efforts are usually hampered by the deficiencies that virtualisation exposes on HDD storage. Up until recently, any virtualisation that attempted to reduce server operating expenses (OPEX) and capital expenditure (CAPEX) were offset by the increased costs associated with HDD SANs. Unfortunately, HDD storage had become an inhibitor of virtualisation, blocking enterprises and cloud providers from realising its true benefits and associated cost savings.

In our VM testing, CPU utilisation was typically in the 3% to 10% range when running the standardised data warehouse query tests against HDD-only databases. During many of the processing cycles, the CPUs were simply waiting uselessly for data to process from the HDDs. In contrast, with Z-Drive R4 PCIe cards and VXL software deployed, the three VMs running in parallel (each utilising 20 CPU cores) were fully occupied for large portions of time and maintained the server's 60 CPU cores' utilisation in the 80% to 100% range. As a result, host-based flash with OCZ virtualisation enables IT departments to fully benefit from the CPU and DRAM power available in today's virtualised enterprise servers.

CONCLUSION

OCZ VXL software, when combined with an OCZ Z-Drive R4 PCIe SSD, provides an enterprise solution to flash-based virtualisation and acceleration in the data centre that

dramatically increases SQL Server 2012 transactional IOPS performance, reduces database read latencies, dramatically improves query completion times, and is optimised for the SQL Server 2012 release. In our sample configurations, introducing this combined virtualisation solution into a SQL Server 2012 analytical environment improved query processing by factors up to 1700%.

Storage access times become especially critical for DB applications such as SQL Server 2012 that require the analysis of large amounts of data, as the time it takes to analyse data dictates whether users will receive the business insight they need, in the time they need it. In such cases, introducing OCZ virtualisation into the SQL Server 2012 environment can dramatically reduce processing window times.

The integrated OCZ hardware/software solution alleviates the storage issues that can "bog down" virtualised server deployments. Enterprise IT departments and cloud providers can now virtualise even heavy application loads, such as SQL Server 2012, with confidence, even when running concurrently with additional loads. As a result, reduced CAPEX and OPEX efficiencies are realised that create a dynamic, high-performance environment, capable of handling the ever-increasing storage loads and requirements typically associated with enterprise data centres and cloud environments.

More info: www.oczenterprise.com