MICROSOFT SQL SERVER ON VMWARE vSAN™

Simplicity, Agility, Resilience, and Performance for All of Your SQL Workloads

SQL Server 2016 on a vSAN Infrastructure

**Delivering the needs of your SQL applications, the right way.**

The Microsoft SQL Server 2016 on VMware vSAN™ all-flash solution depicts an overall strategy for running SQL workloads on the Hyper-Converged Infrastructure (HCI) with the achieved performance improvements, resynchronization queue regulation, and identify the potential differences in behavior and identify recommendations to ensure a smooth transition from an external storage to a Hyper Converged, Scale-out architecture like vSAN.

SQL Server consistently leads in performance benchmarks, such as TPC-E and TPC-H, and in real-world application performance. Gartner recently rated SQL Server as having the most complete vision of any operational database management system. With SQL Server 2016, performance is enhanced with a number of new technologies, including many new features, and enhancements including enterprise-grade performance, security, availability, and scalability, and so on.

UNIQUE CAPABILITIES

SHIFTING STORAGE RELATED SETTINGS FROM HARDWARE TO SOFTWARE

- Define a desired outcome for your SQL Server OLTP workloads and achieve best performance on all-flash vSAN using NVMe as the cache tier.

- Offer the resynchronization queue regulation of vSAN, with fairness adjustment on the VM performance and backend resynchronization at the same time.
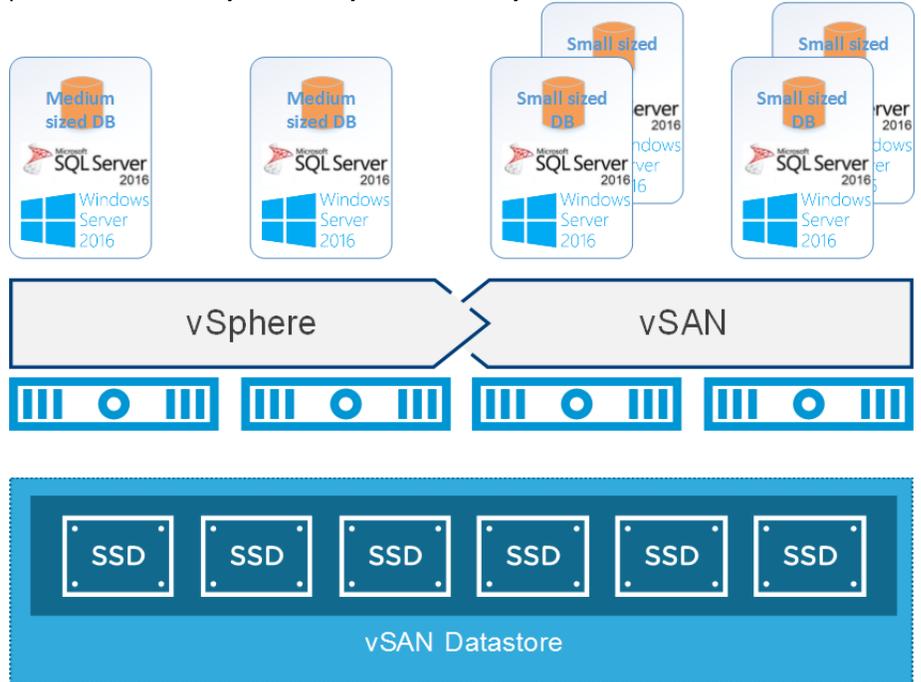
In this solution, we deployed a 4-node VMware vSAN Cluster to support the Microsoft SQL Server environment. Each Dell server is deployed with an identical configuration and the ESXi host booted from local disk.

Hyper-Converged Infrastructure for Cloud-Native Applications

VMware vSAN, the market leader in Hyper-Converged Infrastructure, enables low cost and high performance next-generation HCI solutions, converges traditional IT infrastructure silos onto industry-standard servers and virtualizes physical infrastructure to help customers easily evolve their infrastructure without risk, improve TCO over traditional resource silos, and scale to tomorrow with support for new hardware, applications, and cloud strategies. The natively integrated VMware

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- Adopt and integrate the very latest hardware technologies like 3D XPoint NVMe devices into a cluster.

- Scale up or out incrementally, as needed by an organization.

- Maintain full independence of storage from demands of other clusters. Just as with compute and memory, vSAN storage is a cluster resource that remains independent from other clusters.

infrastructure combines radically simple VMware vSAN storage, the market-leading VMware vSphere® Hypervisor, and the VMware vCenter Server® unified management solution all on the broadest and deepest set of HCI deployment options.

Improved Performance with Adaptive Resync on vSAN

vSAN introduces an all new Adaptive Resync feature to ensure a fair share of resources is available for VM I/Os and Resync I/Os during dynamic changes in load on the system. When the I/O activity exceeds the capabilities of the bandwidth provided, the Adaptive Resync feature guarantees a level of bandwidth to ensure one type of traffic is not starved for resources. Adaptive Resync is intelligent enough to allow for maximum bandwidth to be used during periods in which VM I/Os and resync I/Os are not contending for resources. This provides an optimal use of resources.

Solution Highlights

To measure SQL Server database performance, we used DVD Store 3, an open-source database load testing and benchmarking tool. It implements an OLTP workload, and reports throughput in OPM (order per minute).
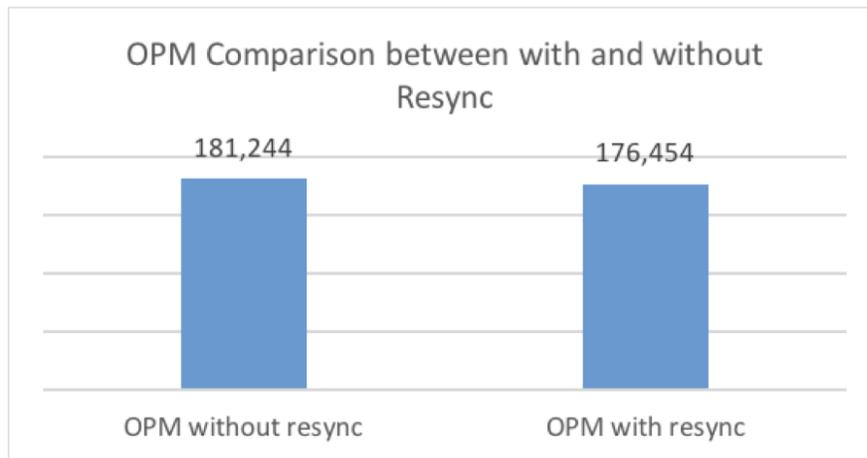
SQL Server Performance

We measured the key performance indicators include aggregate DVD OPM, and the total IOPS, bandwidth, and latency on the vSAN level were also measured. Our performance results showed that the database performance scaled up when increasing the vCPU number on each virtual machine and the increment of the OPM was near linear. And the vSAN backend performance was excellent when supporting the concurrent OLTP workloads.

Adaptive Resync on vSAN

The I/O contention can be adjusted by the adaptive resync mechanism of vSAN automatically. During periods in which no resync traffic exists, VM I/O may consume 100% of the bandwidth, and under contention, resync I/O will be guaranteed at least 20% of the bandwidth. We proved the process with running OLTP workloads on the 4 x 100GB database simultaneously and measured the OPM influence shown in the figure. That is when the VM workloads were running, the resynchronization IOPS was suppressed. And the OPM downgrade of DVD Store 3 was around 2.6 percent comparing with no resynchronization activities in the backend.

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DB Batch Insertion Performance and Tuning options

Database batch insertion operation or bulk copy operations are very normal to extract data from plain text or other sources into SQL Server database. We tested the performance on the four-node vSAN all-flash with the two different SPBM policies, and provided two additional methods to tune the batch insertion performance from the SQL Server configuration and transaction perspectives. We verified that one million DB insertion operations can finish in minutes. And adjusting the setting from DB side can further help on reducing the insertion duration.

Takeaways

- The OLTP performance is excellent, give the credit to the high throughput and low latency NVMe SSD.

- We showcased that enabling hyper-threading, giving more virtual CPU to VM can achieve best OLTP performance. And the OLTP (DvD Store) performance is CPU bound. Better CPU can benefit the performance.

- Adaptive Resync in vSAN manages the different types of traffic in a different queue to control the classes of I/O in various ways, which can ensure data is compliant with assigned storage protection and performance policies.

- We validated the DB batch insertion on vSAN 6.7 all-flash with NVMe as cache tier. We also provided two additional options to improve the batch insertion performance.

For more details, stay tuned for our complete solution reference architecture.

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