

# Hyperconverge Microsoft SQL Server to Simplify Application Delivery



# Introduction

Microsoft® SQL Server® 2016 delivers high performance—but storage-intensive workloads aren't a good match for traditional infrastructure. From vendor and device restrictions to complicated management, running workloads on hardware alone is no longer practical.

## SOLUTION OVERVIEW

To run SQL workloads efficiently, you need the low cost and high performance of hyperconverged infrastructure (HCI). In the Solution Overview, you'll see how the market-leading all-flash HCI solution from VMware® vSAN™ enables radically simple storage that allows you to scale on demand.

## CUSTOMER CASE STUDY

**CINGroup** provides bankruptcy lawyers with the software they need to do their job efficiently and accurately. They needed to ensure their applications were at peak performance, despite a growing customer database, while keeping costs competitive. In the case study, you'll find out how their opportunities expanded when they moved to a hyperconverged infrastructure. Among the benefits: They were able to easily manage their expansive database with minimal staff, and ensure that every user was able to access critical resources at any time.



HYPERCONVERGED INFRASTRUCTURE FEATURED WORKLOAD

# Microsoft SQL Server on VMware vSAN

# Microsoft SQL Server on VMware vSAN

Get simplicity, agility, resilience, and performance for all of your SQL workloads

## UNIQUE CAPABILITIES

Shift 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 back-end resynchronization at the same time.

## Deliver to 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 hyperconverged infrastructure (HCI) with performance improvements and resynchronization queue regulation. The solution identifies potential differences in behavior and makes recommendations to ensure a smooth transition from external storage to a hyperconverged, scale-out architecture such as 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. SQL Server 2016 introduced a number of *new features*, as well as enhancements for enterprise-grade performance, security, availability, and scalability.

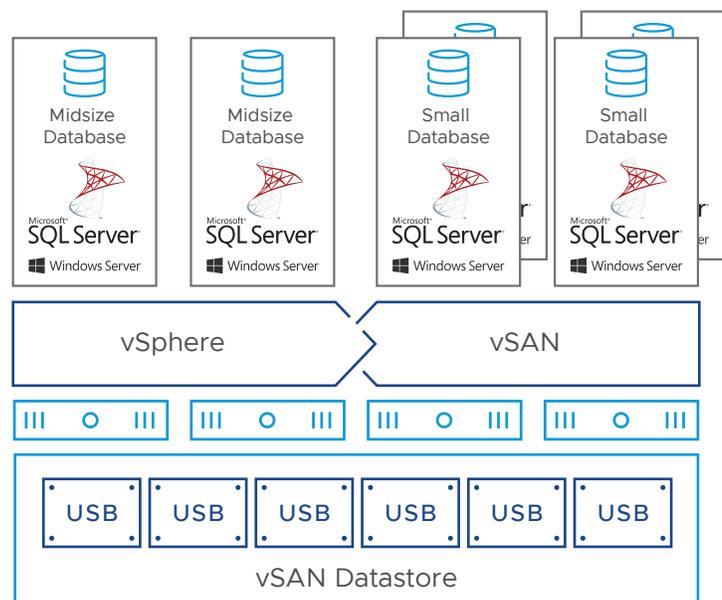


FIGURE 1: The SQL Server and vSAN solution.

In this solution, a four-node vSAN cluster was deployed to support the SQL Server environment. Each Dell server is deployed with an identical configuration and the VMware ESXi™ host booted from the local disk.

#### ADAPT TO CHANGING NEEDS

- Adopt and integrate the latest hardware technologies, such as 3D XPoint NVMe devices, into a cluster.
- Scale up or out incrementally as needed.
- 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.

#### HCI for cloud native applications

The market leader in HCI, vSAN enables low-cost, high-performance, next-generation HCI solutions. vSAN converges traditional IT infrastructure silos onto industry-standard servers and virtualizes physical infrastructure to help customers easily evolve their infrastructure without risk. It improves TCO over traditional resource silos, and scales to tomorrow with support for new hardware, applications, and cloud strategies. The natively integrated VMware infrastructure combines the radically simple vSAN storage, the market-leading VMware vSphere® Hypervisor, and the VMware vCenter Server® unified management solution on the broadest and deepest set of HCI deployment options.

#### Improve performance with adaptive resync

The new Adaptive Resync feature in vSAN ensures a fair share of resources are available for virtual machine (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, Adaptive Resync guarantees a level of bandwidth to ensure one type of traffic isn't 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

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

#### SQL Server performance

The key performance indicators measured included aggregate DVD OPM, total IOPS, bandwidth, and latency on the vSAN level. The results showed that database performance scaled up when increasing the vCPU number on each VM, and the increment of the OPM was near linear. vSAN back-end performance was excellent when supporting concurrent OLTP workloads.

#### Adaptive Resync

The I/O contention can be automatically adjusted by Adaptive Resync. During periods in which no resync traffic exists, VM I/O may consume 100 percent of the bandwidth, and under contention, resync I/O will be guaranteed at least 20 percent of the bandwidth. This process was proven by running OLTP workloads on the 4 x 100GB database simultaneously and measuring the OPM influence, as shown in Figure 2. When the VM workloads were running, the resynchronization IOPS was suppressed. And the OPM downgrade of DVD Store 3 was around 2.6 percent compared with no resynchronization activities in the back-end.

**LEARN MORE ABOUT SQL AND vSAN**

- *Virtual Blocks* – The VMware blog site for all topics related to storage and availability
- *StorageHub* – The one-stop location for all documentation on storage and availability, including existing [SQL Server on vSAN reference architectures](#)

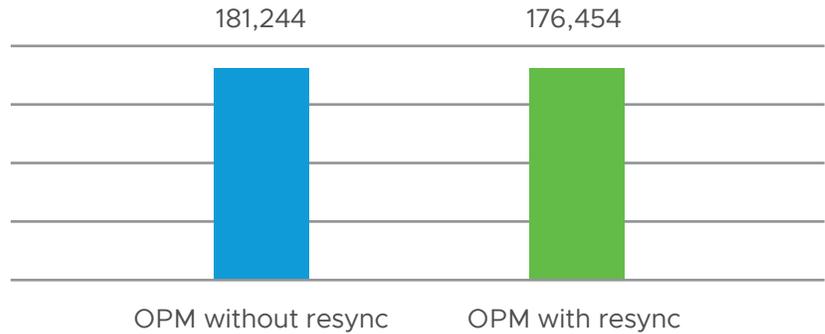


FIGURE 2: OPM comparison without and with resync.

**Database batch insertion performance and tuning options**

Database batch insertion operations or bulk copy operations can extract data from plain text or other sources into a SQL Server database. The performance on the four-node vSAN all-flash solution was tested with the two different storage policy-based management (SPBM) policies, as well as two additional methods to tune the batch insertion performance from the SQL Server configuration and transaction perspectives. This verified that 1 million database insertion operations can finish in minutes. Adjusting the setting from the database side can further help reduce the insertion duration.

**Summary**

- The OLTP performance is excellent due to the high-throughput, low-latency NVMe SSD.
- Enabling hyper-threading and providing additional virtual CPU to a VM allows it to achieve the best OLTP performance. OLTP (DVD Store) performance is CPU bound; additional CPUs can benefit from 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.
- The database batch insertion was validated on the vSAN 6.7 all-flash solution with NVMe as the cache tier, along with two additional options to improve the batch insertion performance.



FEATURED CUSTOMER CASE STUDY

CINgroup

**INDUSTRY**

U.S. LEGAL BANKRUPTCY

**LOCATION**

DAYTON, OHIO

**KEY CHALLENGES**

- Maintain application performance as customer datasets grow
- Keep prices competitive and profit margins healthy by reducing TCO
- Enable IT to be more flexible and react faster to business demands

**SOLUTION**

By virtualizing nearly 100% of its servers with VMware vSphere, CINgroup can manage a large and growing data warehousing environment with minimal staff and data center resources. Recently, the company migrated from a traditional SAN solution to VMware vSAN, reducing costs, improving scalability, and accelerating performance for customer-facing workloads.

**BUSINESS RESULTS**

- Providing exceptional performance for customers with sub-millisecond storage response times
- Protecting 90% market share with reliable, cost-effective services
- Reduced storage CapEx by 70% and OpEx by 10%
- Directing more financial & employee resources to product development

## Cingroup Achieves Unprecedented Performance With Hyperconverged Infrastructure

CINgroup provides innovative software for attorneys practicing bankruptcy as well as educational resources and services such as credit counseling to help consumers navigate their financial future. The CINgroup family consists of the following leading brands in the legal bankruptcy market: Best Case® Bankruptcy, CINcompass®, and CIN Legal Data Services®. As its business transitions from desktop software to cloud-based services and the datasets for customers become larger, the company is preparing for unprecedented data growth. At the same time, it must keep performance high and costs down to protect its 90% bankruptcy market share.

Building on its success virtualizing servers with VMware vSphere, CINgroup decided to migrate from a traditional Fibre Channel SAN to VMware vSAN, a software-defined, hyperconverged storage solution. As a result, storage latency dropped from 5ms to less than 1ms, enabling the company to continue providing excellent performance even as its business grows. By reducing CapEx and OpEx, the company can direct more resources to product development, improving quality and increasing the pace of innovation.

**The Challenge**

CINgroup is the leader in bankruptcy software solutions for the U.S. market, helping attorneys provide essential services to clients, facilitate collaboration, increase productivity, and grow their practices. Today the company owns approximately 90% of its market, an enviable position it has earned through consistent innovation and an unrelenting focus on customer satisfaction.

The company was an early adopter of server virtualization, using VMware vSphere to virtualize nearly 100% of its data center environment. As a result, CINgroup has been able to react quickly to business demands while keeping its data center efficient and IT headcount low. "Without vSphere, we'd be pushing the limits of our on-premises data center and purchasing more co-lo space," says Bob Tester, Enterprise Architect, CINgroup. "Power and cooling costs would be through the roof, and we'd need at least ten more people to maintain day-to-day operations."

“The biggest reasons to recommend VMware vSAN are the cost savings, the performance increase, and the agility and scalability that you don’t get with a traditional SAN solution. With vSAN, we can maintain great performance for our customers at a predictable cost.”

BOB TESTER  
ENTERPRISE ARCHITECT  
CINGROUP

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#### VMWARE FOOTPRINT

- VMware vSphere Enterprise 6.2
- VMware vSAN 6.2

#### APPLICATIONS VIRTUALIZED

- Microsoft SQL Server, Microsoft Exchange Server, Cisco Call Manager, data warehousing and web applications

#### PLATFORM

- HP Apollo 2000 System with ProLiant XL190r servers
- Cisco Nexus 40GbE network

As the software industry has matured, CINGroup has expanded its products and services, offering both traditional “desktop software” as well as cloud-based bankruptcy forms preparation. “Like most software companies, the cloud is our future,” says Tester. “As we deliver more features and functionality via the cloud, we will need to store a lot more data on behalf of our customers.”

The company faces data growth challenges in other areas as well: Bankruptcy requirements are becoming more complex and data-intensive. Data sources are becoming richer, and customer demand is increasing. In addition to storing and serving more data, CINGroup must keep the data always available to customers, which requires an active-active data center configuration. As data grew and equipment aged, CINGroup faced cost and performance pressures. Engineers spent considerable time reconfiguring workloads to optimize data warehousing performance.

“We were caught in the familiar lifecycle of a traditional SAN solution,” says Tester. “Every three to four years, it would be cheaper to buy a new storage array than continue paying maintenance on the old equipment. Performance was also a concern—as the size of our Microsoft SQL Server databases increases beyond 3TB, we need to do more maintenance within smaller windows. Backups need to perform better. We needed a more cost-effective way to scale while maintaining throughput.”

#### The Solution

CINGroup considered buying more spindles and connecting more Fibre Channel paths, but decided that was not a sustainable solution. It also considered using public cloud, but worried that costs would be unpredictable. “We suspected that keeping our data warehousing and other workloads in-house would be more cost effective with a hyperconverged solution,” says Tester.

The company evaluated VMware vSAN, VMware’s hyperconverged solution, along with competing products. “We conducted a proof of concept with another HCI appliance vendor’s solution, and it did not perform well,” says Tester. “Random I/O was terrible. We were pushing a lot of throughput, and the appliance just couldn’t sustain it.”

CINGroup preferred the vSAN architecture because of its native integration with the VMware hypervisor, which optimizes the I/O path and simply works with all existing VMware features and solutions. “VMware explained the benefits of vSAN in very clear terms: we get a higher level of performance because it doesn’t impact our CPU and memory resources the way other vendors’ solutions do,” says Tester. “This was new technology to us, and I was trying to find a downside. I couldn’t, and our interactions with the VMware team during the evaluation process were exceptional.”

After determining that vSAN was the right match from a technology perspective, CINGroup found that it was a great fit financially as well. A cost analysis revealed that the company could purchase high-performance servers, upgrade its network to 40GbE, and replace its production SAN with vSAN under the same budget that was previously allocated to refresh its legacy SAN array. “With vSAN, the savings really lined up,” says Tester. “We were able to introduce commodity flash drives into a hybrid cluster at 90% less cost than using proprietary flash drives from our previous SAN vendor.”

CINGroup deployed two hybrid vSAN storage clusters (4 nodes and 6 nodes respectively) with 90TB of capacity supporting more than 200 virtual machines. “vSAN was easy to set up, and our transition was very smooth,” says Tester.

## Business Results & Benefits

Previously, with the traditional SAN, CINGroup was able to achieve average storage latency around 5ms—just low enough for most users to have a good experience. With vSAN, storage latency is always under 1ms, giving the company needed headroom for growing workloads and datasets without worrying about performance and responsiveness.

“We got a major performance boost with vSAN—even better than we expected,” says Tester. “Storage was a big bottleneck before, and now that problem is eliminated. With the ability to apply storage policies in vSAN on a per-VM basis, we’ll be able to maintain that performance as we grow without investing valuable engineering time.”

With fast, scalable storage, CINGroup can continue providing exceptional performance for its ever-increasing customer base even as it offers more cloud-based functionality. Developers have more freedom to innovate and introduce new functionality into the company’s products, knowing that databases will respond quickly. As storage is requested, it can be thin provisioned, allowing the company to improve utilization of capacity as it is actually needed and thus realize TCO savings.

CINGroup has significantly reduced total cost of ownership with vSAN, cutting storage CapEx by 70% and OpEx by 10%. “The equipment that we were able to retire due to vSAN gave us a 30% savings on our monthly power bill,” says Tester. “And we no longer need to manually optimize storage, reclaiming the equivalent of two full-time employees that can now be dedicated to solving business problems instead of technical issues.”

By reducing storage and management costs, CINGroup is directing more financial and employee resources to product development, improving quality and accelerating innovation to protect its valuable market share.

“The biggest reasons to recommend VMware vSAN are the cost savings, the performance increase, and the agility and scalability that you don’t get with a traditional SAN solution,” says Tester. “With vSAN, we can maintain great performance for our customers at a predictable cost—less than one-third of what it would cost us to host our data centers in the public cloud.”

## Looking Ahead

CINGroup is already planning to add a third vSAN cluster to support additional production workloads, helping the company accelerate its transformation into a cloud service provider. “For many years, VMware has earned our trust by giving us solutions and advice that help us stay ahead of the competition and increase the pace of business,” says Tester. “For us, vSphere and vSAN are a very effective combination.”