Meeting Top-Tier SLA Requirements with a Common Infrastructure

Telefonica validates a high-throughput and low-latency Virtual Data Center solution with VMware vSAN* architecture powered by Intel® Xeon® Scalable processors and Intel® Optane™ DC SSDs

Results:

- The ability to offer the advantages of a consolidated, modern virtual infrastructure to Telefonica’s customers, meeting all SLAs for virtualized mission-critical applications on a single homogenous architecture based on VMware and Intel® technologies
- Sustained high throughput and low latency for varying block sizes and increasing cluster capacity occupation
- Excellent operational efficiency with a standardized, consistent architecture across all VDC nodes
- Easy, low-cost data center manageability
- Accelerated infrastructure provisioning

Telefonica* is one of the largest telecommunications companies in the world. Based in Madrid, Spain, the company operates in 16 countries and serves more than 336 million customers. The desire for increased simplicity, efficiency and agility, combined with hybrid deployments and infrastructure refresh cycles, is driving cloud service providers (CSPs) like Telefonica toward hyperconverged infrastructure (HCI). Telefonica worked with Intel, VMware* and the server original equipment manufacturer (OEM) to design and conduct a proof of concept that explored how HCI could solve two important business problems: lower data center costs and improve data center manageability—without compromising the performance of Telefonica’s Virtual Data Center (VDC) service around the globe.

Challenge

As Telefonica’s VDC service evolved over time, a heterogeneous data center environment hindered operational efficiency and total cost of ownership (TCO) suffered. Recognizing the potential business value of an HCI solution, and that VMware is a leading enterprise software technology provider, Telefonica defined a consolidated platform that was easy to manage and provided excellent throughput. However, the cache devices used in the test platform did not deliver the low storage latency required by Telefonica’s customers’ mission-critical workloads. This meant that the test solution, if deployed, would require Telefonica to maintain two architectures—the vSAN* platform for less stringent storage service-level agreements (SLAs) and a traditional storage area network (SAN) for the top-tier SLA.

Solution

The answer to solving the latency problem lay in using a new technology for the vSAN caching tier—Intel® Optane™ DC SSDs—enabling Telefonica’s vSAN-based infrastructure to meet Telefonica’s most demanding storage SLAs. Intel Optane DC SSDs provide consistent latency, quality of service, and low latency in the demanding mixed read/write workloads seen in a storage caching layer, delivering data rapidly to the CPU and applications. An optimized HCI solution based on the latest VMware and Intel® technologies was just what Telefonica—and its customers—needed.
Finding the Right Platform for Performance and Operational Efficiency

As Telefónica expanded the VDC service over the years, it deployed new VDC nodes in various countries. Concentrating on leveraging local procurement agreements and the expertise of local operation teams resulted in different VDC nodes using a variety of servers and other hardware from different suppliers. As the nodes grew, this heterogeneous data center environment became hard to manage, and governance was increasingly difficult. Operations teams were large because there were so many different configurations and management tools in use across the VDC nodes in Spain, Brazil, the United States, Colombia, Mexico, Chile, Peru and Argentina. The end result was ever-increasing costs.

Seeking a better operating model, Telefónica decided to explore HCI—scale-out, software-integrated infrastructure that applies a modular approach to compute, network and storage on standard hardware, using distributed, horizontal building blocks under unified management. HCI simplifies operational tasks by eliminating complex SANs and consolidating storage and compute on a single node. Throughout the cloud services industry, HCI is quickly replacing SAN—the global HCI market size is expected to grow from USD 4.1 billion in 2018 to USD 17.1 billion by 2023, at a compound annual growth rate (CAGR) of 32.9 percent. VMware is a leading supplier of HCI solutions, with a high degree of flexibility, comprehensiveness and innovativeness.

Having chosen vSAN as the foundation of their evolution towards a homogenous VDC service platform, powered by Intel® Xeon® Scalable processors, Telefónica collaborated with VMware, Intel, and the server OEM to define a vSAN configuration and test plan. Tests showed that the platform could not meet Telefónica’s top-tier storage SLA (Platinum). This meant Telefónica would have to continue to use traditional storage equipment for Platinum storage—undermining the operational efficiencies they had hoped to gain from vSAN. After further consultation with Intel and VMware, Telefónica decided to evaluate Intel Optane DC SSDs for the vSAN cache, to see if that approach could enable them to meet all their critical performance metrics such as high throughput and low latency.

“Finally, we can get a hyperconverged system that can match or exceed the performance of our traditional top-tier storage.”
— José María Cuéllar
B2B Global Cloud Director, Telefónica Business Solutions

Eliminating vSAN Congestion Is the Key to Meeting Stringent SLA Requirements

Telefónica’s original vSAN configuration used NAND-based SSDs for the vSAN cache. This type of SSD provides poor performance in mixed read/write operations, which will result in significant congestion at the cache and the capacity SSDs for large datasets. This congestion increased latency beyond the acceptable level for Telefónica’s Platinum storage tier.

Reconfiguring the vSAN nodes with Intel Optane DC SSDs reduced congestion for large datasets across the cluster of four vSAN nodes. As a result, the vSAN cluster was able...
to provide sustained high throughput, low latency and consistent behavior over time for different I/O patterns—exactly what Telefónica needed.

**Fast Caching Enables Linear Performance Scaling**
Another important metric for Telefónica’s VDC nodes is linear scalability—that is, as the workload increases, so does the throughput. As shown in Figure 1, that is precisely what the Intel Optane DC SSD-based vSAN cache delivered during the proof of concept (PoC). As the block size in the test increased, the throughput (measured in MB/second) also increased linearly. Although latency also increased, again it was a linear increase consistent with the changes in block size, not a spike which would have indicated a bottleneck.

**Sustained High Throughput and Low Latency**
Figure 2 shows the test cluster’s performance in the most demanding scenario for a vSAN write cache, where the workload is 100 percent write and 100 percent sequential. Typically, this scenario would cause throughput and latency to degrade long before reaching the healthy cluster occupation limits recommended by VMware for vSAN.

However, with the Intel Optane DC SSDs’ fast response at the vSAN cache tier, even as the working dataset grows to higher cluster utilization levels, throughput stays consistent and latency remains similar to all-flash storage array performance—without the storage array expense and complexity.

**Technical Components of Solution**
The testbed configuration deployed for the proof of concept (PoC) consisted of the following elements (the production configuration may differ):
- Flash-optimized storage with VMware vSAN* v6.7
- High-performance Intel® Xeon® Gold 6130 processors
- vSAN cache drives: Intel® Optane™ SSD DC P4800X
- vSAN capacity drives: Intel® SSD DC P4500 (NVMe*-based)
- Network interface card (NIC): Intel® XL710-Q1 1-port 40 GbE
- HPE ProLiant* Gen10 servers

With Intel Optane DC SSDs as the cache device, Telefónica’s customers can expect consistent, first-class I/O performance. Once the solution is deployed in Telefónica VDC nodes, end users can take advantage of the platform’s fast, efficient workload execution. Based on the compelling case for HCI using Intel Optane DC SSDs, Telefónica anticipates deploying vSAN across their VDC nodes, with the following expected benefits:

- **A consolidated, modern virtual infrastructure.** With balanced compute and storage resources, Telefónica’s customers will be able to run IOPS-intensive operations on their virtual machines (VMs).

![Figure 1. As the block size increased from 4K to 16K to 32K, Telefónica’s tests showed that using Intel® Optane™ DC Solid State Drives (SSDs) for the vSAN* cache tier enabled throughput (MB/s) to scale linearly.](image-url)
• A single, homogenous platform. VMware and Intel technologies combine to provide a high-performance platform that can meet all Telefónica’s critical business metrics while providing consistent uptime and availability.

• Ability to meet demanding SLAs. Even when cluster occupation was high and block sizes were large, throughput and latency—both important metrics for Telefónica’s customers’ experience and satisfaction—met Telefónica’s stringent SLA requirements for various workloads. In particular, the test system maintained nearly half a million I/O per second (IOPS) with latency below 1.5 ms for both random and sequential read operations.

• Efficient operations. Operational teams will be more compact, due to the simplification and standardization of VDC nodes.

• Fast infrastructure provisioning. Telefónica will no longer need to configure a complex SAN and storage arrays.

Telefónica plans on conducting future testing that may lead to additional performance increases and cost efficiencies. The testing roadmap includes 2nd generation Intel® Xeon® Scalable processors and additional Intel Optane technology.

Figure 2. Intel® Optane™ DC Solid State Drives (SSDs) in the vSAN* cache tier enable throughput and latency to match the performance of an all-flash storage array, even as the cluster capacity occupation nears 100 percent.

VMware® and Intel: Enabling Next-Generation Virtualized Environments

For more than ten years, Intel and VMware have collaborated to deliver innovative data center transformation solutions. That legacy continues even today, through optimized VMware hyperconverged solutions based on Intel® architecture. With VMware’s software and best-in-class compute, storage and network hardware, cloud service providers can confidently scale and extend their businesses while gaining business agility, security features and operational efficiency.

Learn More

You may find the following resources helpful:

• Telefónica Virtual Data Center Service
• VMware vSAN®
• Intel® Optane™ Data Center Solid State Drives
• Intel® Xeon® Scalable processors

Find the solution that is right for your organization. Contact your Intel representative or visit intel.com/CSP.
Congestion is a feedback mechanism to reduce the rate of incoming IO requests from the vSAN client layer to a level that the vSAN disk groups can service, thereby shifting latency from the lower layers to the ingress without changing the overall throughput of the system. This avoids wasted CPU cycles in processing I/O requests that might eventually be dropped. Sustained and large values of congestion may lead to higher latency and lower throughput than desired.

Workload: 4 KB block size, 70% read / 30% write, 100% random, 33% cluster occupation, failures to tolerate (FTT) = 1.

Workload: 70% read / 30% write, 100% random, 33% cluster occupation, 64% write cache occupation, with block sizes of 4, 16 and 32 KB, failures to tolerate (FTT) = 1.

VMware recommends 20 percent minimum slack space on vSAN* clusters to avoid disk rebalancing.

Workload: 4 KB block size, 100% write, 100% sequential, various cluster capacity occupation, failures to tolerate (FTT) = 1.

Workload: 4 KB block size, 33% cluster occupation, failures to tolerate (FTT) = 1.

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