

Intel Manufacturing Automation Gets Performance Boost in the VMware vSAN Cache Tier

Intel Manufacturing factories rely on advanced technology for smooth 24/7 operation. Each factory includes two data centers with hundreds of servers to manage materials, equipment automation, process control, inventory, analytics, and more.



Manufacturing IT recently built a separate and completely virtual integration environment for Intel's Non-volatile Memory Solution Group (NSG) factory. This offered an opportunity to introduce Intel® Optane™ SSDs as cache tier on I/O-intensive workloads **to reduce the number of disk groups required**. Whether running applications, websites, databases, file servers, or other services, storage performance is often the most important factor in delivering high-performing business solutions. And higher disk throughput is key to achieving performance.

We targeted web, application, and database servers using common factory workloads and the results were outstanding. Testing revealed that two disk groups performed as well as three and write-intensive workloads performed even better. We compared automation system use cases involving defect analysis application servers and database servers on a virtualized platform with Intel Optane storage media against systems with NAND SSD (All-Flash) systems. With nearly 200 physical servers hosted in the integration environment, the results gave us confidence to virtualize most factory integration compute environments with servers that simulate the factory setting before applying changes in production.

Day-Two Automation P2V¹

11% Faster
Write Transactions

Physical servers
using NAND SSD

Virtual Servers
with
intel
OPTANE
SSD

Using VMware vCenter Converter, our day-two client/server migration of 5 physical servers (1 TB) took **only 4 hours compared to 4.5 hours**.

Defect Analysis Application¹

14% Faster
Defect Analysis

3 Disk Group
using NAND SSD

2 Disk Group
with
intel
OPTANE
SSD

We tested a defect source analysis application—a heavy job that correlates defects to their source—resulting in **14 percent faster speeds with Intel® Optane™ SSDs**.

SQL DB Restore¹

2x Faster
SQL DB Restoration

3 Disk Group
using NAND SSD

2 Disk Group
with
intel
OPTANE
SSD

A common factory SQL database was restored 2x faster with Intel Optane SSDs. Commonly used factory commands included a mix of read and write queries performed similarly, while **write-intensive queries performed up 20 percent faster**.

Intel Optane SSDs in VMware vSAN deployments can effectively increase throughput and reduce latency without cost constraints or capacity limits.

intel
OPTANE
SSD



Save on Storage Cost with Intel® Optane™ SSDs

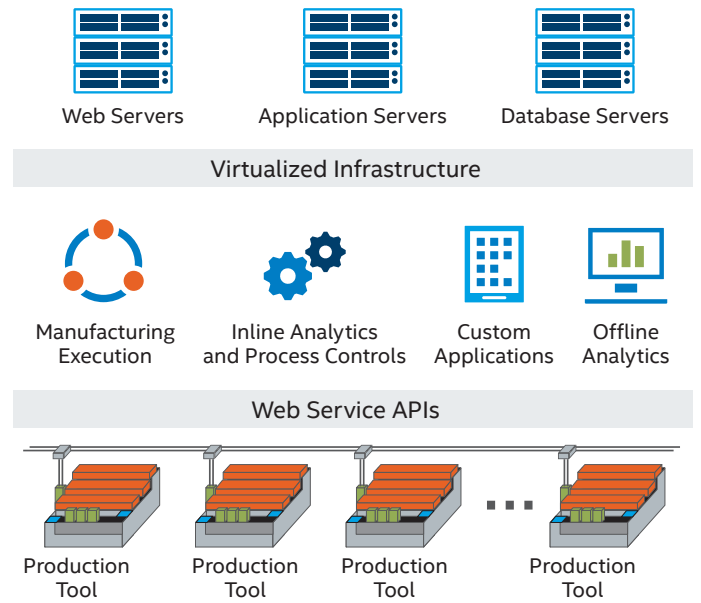
Intel factories process massive amounts of data in I/O-intensive workloads daily. Through virtualization on VMware vSAN, we have seen impressive gains in server consolidation. The earlier design used NAND SSDs in the cache tier while the new design uses Intel Optane SSDs to gain additional performance boost that the varying workloads demand in our NSG factory. Adding Intel Optane SSDs to the cache tier in our virtual environments has allowed us to reduce the number of disk groups from 3 to 2. As a result, we maintained the same performance levels as well as reduced storage costs. Additionally, **Intel Optane SSD cache required only 375 GB compared to 900 GB on the NAND SSD All-Flash system**. By virtualizing our entire integration environment, we simplified the maintenance for greater uptime and better hardware utilization.

Understanding Intel Factory Automation

Intel Manufacturing and VMware have worked together to build a fast-growing integrated virtual environment that can take advantage of Intel Optane technology for performance optimization.

Intel manufacturing factory automation is well known for sophisticated process and manufacturing execution systems, and virtualization makes the infrastructure cost-effective. Intel Optane SSDs allow us to optimize, store, and accelerate large, complex datasets and workloads. The exceptional combination of low latency, high endurance, and consistent responsiveness of Intel Optane SSDs is ideal for fast caching or fast storage requirements in the Intel Manufacturing automation architecture.

The real-time benefits include significant performance boost on web servers, scheduled jobs, and database applications; a reduction in costs due to running more applications on fewer hosts; and simpler and quicker implementation when it comes to maintenance activities, such as applying patches.



Intel® Optane™ SSDs helped us meet the additional performance that the workload was demanding from the virtualized platform



Today, our NSG memory products division manufacturing factories are using our own manufactured Intel Optane SSDs in our VMware vSAN standard cluster that hosts virtual production web/application/database server roles with redundancy and high availability to use cases. This solution architecture provides better performance for our critical factory applications and databases.

In the future, we expect to include more VMs per host by upgrading the memory to Intel Optane persistent memory modules.

¹ Performance results are based on testing by Intel IT on March–July 2020. **Baseline:** 10-node vSAN cluster. Per node 2x Intel® Xeon® Platinum 8168 processor (2.7 GHz/24-core/205W), CPU sockets: 2; RAM capacity: 768 GB – 24x 32 GB DIMM; RAM Model: HPE 32 GB (1x 32 GB) Dual-Rank x4 DDR4-2666 CAS-19-19-19 Registered; storage: 3DG each with 7x 960 GB Intel® SSD S4600 and cache 1x 960 GB Intel® SSD S4600; Network: vSAN redundant network over 10/25Gb 2-port 640SFP28 Adapter; OS: VMware ESX 6.7. **New Configuration:** 6-node vSAN cluster. Per node 2x Intel® Xeon® Platinum 8168 processor (2.7 GHz/24-core/205W), CPU sockets: 2; RAM capacity: 768 GB – 24x 32 GB DIMM; RAM Model: HPE 32 GB (1x 32 GB) Dual-Rank x4 DDR4-2666 CAS-19-19-19 Registered; storage: 2DG each with 7x 1.92 TB Intel® SSD S4600 and cache 1x NVMRE Intel® Optane™ SSD P4800 375 GB; Network: vSAN redundant network over 10/25Gb 2-port 640SFP28 Adapter; OS: VMware ESX 6.7U3.

SQL database restore is 2x faster with Intel Optane SSD: same Factory DB restore to both environments took 31 minutes on the new configuration versus 61 minutes on the baseline (2x faster).

Write-intensive queries performed up 20% faster: same Factory DB restore to both environments, running two separate SQL sessions in loop, one doing read scan from all 555 DB tables and 2nd session updating all DB tables. Running loop for 60 minutes on baseline (non-Optane) and 90 minutes on new configuration (with Intel Optane SSD); update rate of 60111 records/sec on the Baseline versus 72370 records/second on the new configuration; read 31.6M records/seconds on the Baseline vs. 24.2M records/seconds on the new configuration.

Defect source analysis application performed 14% faster with Intel Optane SSD: running the job against the same DB, repeated test 4 times and processed historical data with average run time in baseline 2 minutes 4 seconds versus 1 minute 47 seconds in the new configuration.

Physical-to-virtual (P2V) migration performed 11% faster: VMware vCenter Converter stand-alone client/server version 6.2.8 build-8466193 for P2V of 5 physical servers, overall 1 TB, compared to the baseline system, which took 4 hours.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit <http://www.intel.com/benchmarks>. Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure. Intel technologies may require enabled hardware, software or service activation. Your costs and results may vary.

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