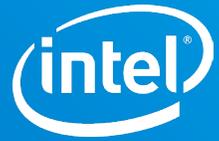


SOLUTION BRIEF

Intel Storage Builders
Enterprise Data Center Infrastructure



Achieving Transformative Application Performance with Vexata Systems and Intel® Xeon® Processors and Intel® SSDs

Vexata delivers enterprise storage arrays based on Intel® Optane™ SSDs and Intel PCIe*/NVMe* SSDs to enable transformative application performance for database and analytics workloads.



Executive Summary

Enterprises are recognizing the need for digital transformation to stay competitive, build new business models, and enhance customer experience in this digital economy. High-performance, scalable, and easy-to-deploy application solution stacks are fundamental towards achieving these goals. However, traditional approaches fall short due largely to slow and inefficient storage system architectures that fail to utilize solid-state media effectively for application acceleration. Vexata and Intel have collaborated to solve the digital transformation challenges using a solutions-based approach that brings the best out of applications running on Intel multi-core processors using Vexata storage systems that incorporate cutting-edge Intel compute, networking, and storage media technologies.

Digital Transformation Challenges

The IT industry is undergoing a digital disruption, resulting in the need to process higher volumes of data in real time. Enterprise and Cloud native applications are placing significant demands on IT infrastructure. While compute infrastructures based on multi-core processors from Intel enable massive application acceleration, data and storage infrastructures have lagged significantly behind despite major advances in storage media.

Intel offers high capacity, high performance NAND Flash SSDs and Intel® Optane™ SSDs based on the ultra-low latency 3D XPoint™ memory media. However, enterprises have been unable to fully exploit these media for application stack acceleration due to the inefficient architectures of incumbent enterprise storage arrays. Storage array bottlenecks lead to under-utilized database and analytics servers and wasted software licenses. The result? A need for high performance, easy-to-deploy data infrastructures that can enable cloud-scale digital transformation.

Achieving Digital Transformation with Intel and Vexata

Intel and Vexata worked on demonstrating how enterprises can leverage Vexata Scalable Storage Systems and Intel processor-based servers to achieve massive performance, reliability and simplicity for their application workloads. With a differentiated architecture premised on Intel processors and accelerators, Vexata arrays achieve a dramatically higher performance than existing All Flash Arrays through low latency, high-speed parallel access to SSDs.¹ By eliminating I/O bottlenecks, Vexata storage systems enable enterprises to achieve transformative performance for their enterprise and cloud-native applications.

Intel CPU and SSDs: Fundamental to Vexata's Differentiation

Vexata Scalable Storage Systems deliver over 7M IOPS and up to 85GB/s of mixed read/write bandwidth at ultra low latencies, as low as 40µs. These performance numbers are an order of magnitude better than existing All Flash Arrays and are achievable due to an architecture that is premised on a scalable processor control plane and low-latency Intel® 3D NAND and Intel® Optane technologies. (Figure 1 shows a real 80/20 Oracle workload achieving over 5M IOPS at 40us read latency with a Vexata All Flash Array with Intel® Optane™ SSDs.)



Figure 1: Vexata storage system read/write performance using Intel CPU and Intel® SSDs.

One of the key elements of this architecture is the separation of the control plane from the data plane. All I/O control processes and services are implemented in a CPU-based control plane, and all data processing is offloaded to dedicated hardware. This results in a parallel and wide data access to and from the SSDs at high bandwidth and ultra low latencies.

The Intel® Xeon® Scalable processor runs Vexata's Operating System, VX-OS, within the redundant I/O controller. VX-OS is tightly coupled to these cores and utilizes a portion of these cores for I/O control processing, while dedicating other cores

Intel Components in Vexata Systems

The table below summarizes the key Intel components used in Vexata products to enable ultra-high performance.

Compute	Storage Media	Networking
Single socket E5-2697v4 with 18 cores (current generation) <ul style="list-style-type: none"> 7M IOPS with Vexata acceleration Single socket Skylake SP with 24 cores or higher (next gen) 10M IOPS projected with Vexata acceleration 	<ul style="list-style-type: none"> 2TB Intel® SSD DC P3700 Planar NAND 3.2TB, 6.4TB and 12.8TB Intel® SSD DC P4600, 3D NAND, 2.5" 375GB and 750GB Intel® Optane™ SSD P4800X All SSDs enable Vexata arrays to hit ultra low latencies 	<ul style="list-style-type: none"> Intel 2x10GE 82599 Controllers Intel DPDK for low latency communication between Vexata I/O Controllers

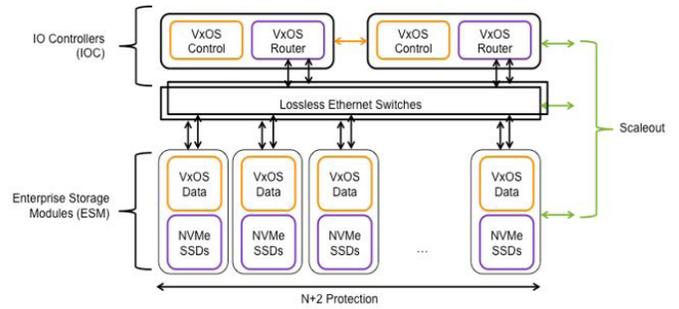


Figure 2: Vexata scaleout system architecture featuring Intel CPU and Intel® SSDs.

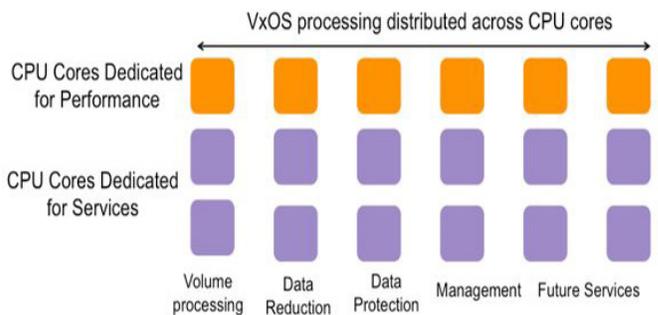


Figure 3: Vexata Operating System (VX-OS) software features distributed across Intel CPU cores.

for volume services, data reduction, encryption offload control, and so on (Figure 3).

Just as an Oracle database application is able to make use of more processor cores to increase performance, VX-OS is able to utilize the advances in multi-core processor technologies to offer higher performance with greater features.

Achieving Application Acceleration with Intel Xeon and Vexata Systems

The backbone of the digital economy heavily depends on the performance of databases such as Oracle and SQL Server, and analytics platforms such as SAS Analytics. The performance and the efficiency of the underlying data infrastructure is largely premised on using multi-core processors for spreading out application load and the elimination of I/O bottlenecks from the storage subsystem.

Vexata storage systems, coupled with Intel scalable processor-based servers and high-speed Fibre Channel switching enable creation of the industry’s most reliable, efficient, and highest performing application stacks.

The reference design (Figure 4) was used to show application workload performance for Oracle RAC, SAS Analytics and Kx. The results of the benchmarking are shown in Figure 5, along with the advantages of using the Vexata stack.

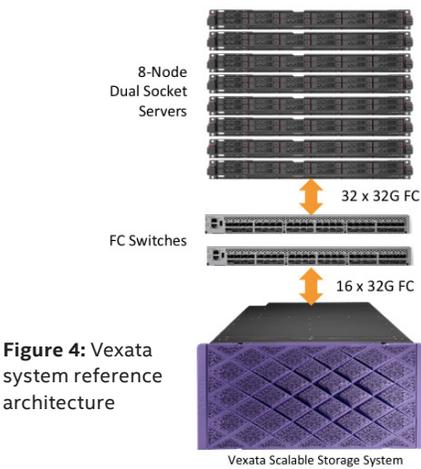


Figure 4: Vexata system reference architecture

Hardware Components	
Servers	4 or 8 Dual socket Intel E5-2699v4 servers with 512GB of memory and 4 ports of 32G FC with Broadcom LPe32002-M6 adapters
Switches	(2) 48-port 32G FC Brocade 620 Switches
Storage	Vexata VX-100F Flash System with 64 drives of 2TB Intel® SSD DC P3700 (3D NAND Flash memory)

Benchmarking Results

Workload	Oracle RAC	SAS Analytics	Kx
Server configuration	8 servers with OEL7.2	8 servers with RHAT7.2	4 servers with RHAT7.2
Software version	Oracle 12c database	SAS Analytics 9.4	Kx kdb+ version 3.5
Results	5.2M OLTP IOPS at 220us latency	240 sessions at CPU/Real Time ratio of 1.1	36.8GB/s of bandwidth
Comparison	20x higher than competing All Flash Arrays	12x higher than competing All Flash Arrays	New STAC-M3 records in 8 of 17 Antuco and 14 of 24 Kanaga benchmarks

Figure 5

About Vexata

Vexata’s active data infrastructure solutions enable transformative performance at scale for the I/O intensive applications driving digital business. Based on its groundbreaking VX-OS software, Vexata solid state storage systems deploy simply and seamlessly into enterprise and cloud data center environments. For more information visit vexata.com or follow us @VexataCorp.

About Intel

Intel® Solid State Drives (SSDs) set the standard for storage performance, stability, and efficiency. The Intel® Optane™ SSD DC P4800X helps eliminate data center storage bottlenecks and allows bigger, more affordable data sets. The Intel® Optane™ SSD DC P4800X for the data center can accelerate applications, reduce transaction costs for latency sensitive workloads, and improve overall total cost of ownership (TCO).



1. Benchmarks substantiating the performance differentiations from both internal and external sources (SAS with Intel, ESG, STAC) are published at <https://www.vexata.com/resources/> Intel technologies’ features and benefits depend on system configuration and may require enabled hardware, software or service activation. Learn more at intel.com, or from the OEM or retailer.

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