

Accelerate Insight with MEGWARE's Intel® Select Solution for Professional Visualization

Leverage MEGWARE's deep expertise in high performance computing and big data solutions to build your next-generation platform for data visualization

Visualization interprets data from complex simulations and calculations and presents the results as intelligible information that the human eye and brain can more easily understand. Visualization is used in a wide range of industries as diverse as architecture, entertainment, and engineering and in an array of scientific research disciplines. From simulated temperature gradients changing in the core of a distant star over time to the expected turbulence dynamics of an airplane wing through changing weather, and deeply buried stresses on skyscrapers during large-magnitude earthquakes, visualization clearly reveals what large data sets bury within them.

Technology Challenges of Visualization Solutions

The more detailed and larger the volume of data, the greater potential of higher-resolution imagery and the more informative the visualization can be. With the growing data sets used in various disciplines, excellent image fidelity can be drawn from the massive data volumes. But, the limitations of today's graphics processors make visualizing such large datasets a challenge.

Additionally, users want their simulations and visualization to be interactive. They can then study what-if scenarios by modifying parameters during computation and see the visual result in real time to gain greater insights. Such interactivity can significantly slow down a visualization system, especially with very large datasets.

Until recently, dedicated interactive solutions have failed to strike an adequate balance among performance, visual fidelity, and cost. Rasterization techniques on graphics-specific hardware can accelerate rendering of smaller 3D models but do so at the expense of higher fidelity. Ray tracing techniques offer the highest fidelity for visualizations, but the performance of ray tracing algorithms on graphics hardware has been an impediment. The inherent raster-focused architecture of graphics processing units (GPUs), along with their limited memory and input/output (I/O), fail to deliver adequate performance for ray tracing algorithms.

MEGWARE – A Trusted Intel Partner

MEGWARE, known across Europe for its turn-key HPC simulation and visualization solutions, has been building computing systems for customers since the 1990s. MEGWARE engineers design, configure, and install systems in close collaboration with customers to fully satisfy their specific demands for optimized HPC performance.

MEGWARE plans, designs, delivers, and installs entire cluster solutions—racks, servers, PDUs, network equipment, storage, software, etc.—at the customer's site. From academia to industrial clients who want to have a full-service package, including premium level support over multiple years, MEGWARE brings long-standing expertise.

In addition, MEGWARE offers its own hardware and software components for optimized HPC performance and management, such as MEGWARE ColdCon® technology for direct liquid cooling, SlideSX® server chassis, and ClustWare® management software, among others. This makes MEGWARE solutions unique in their efficiency, manageability and, ultimately, helps to reduce total cost of ownership.

MEGWARE's Intel Select Solution for Professional Visualization

MEGWARE's Professional Visualization platform, an Intel® Select Solution for Professional Visualization, uses Intel® Xeon® Scalable Processors, Intel® Omni-Path Architecture (Intel® OPA), and other Intel® technologies, such as Intel® SSD Data Center storage devices, to optimize performance and deliver outstanding reliability. This combination delivers high, interactive performance for both raster-based (OpenGL*) and ray tracing-based visualizations. The processor's high memory bandwidth coupled with the massive memory capacity available in a MEGWARE MiriQuid® server enables the MEGWARE Professional Visualization solution to render very large-scale datasets without a discrete GPU. Eliminating the need for a GPU allows scientists, engineers, and digital artists to use a single holistic platform for both computing and visualizations.

Software-Defined Visualization

MEGWARE's Professional Visualization solution is built on Intel's software-defined visualization stack of commonly used libraries and applications that is highly optimized to take full advantage of all modern Intel® architecture capabilities. The libraries allow flexible, high-performance and scalable visualization of complex, enormous 3D datasets (more than 1 terabyte) that is not achievable with GPU-based solutions. Some of the included libraries are:

Embree*: A CPU-optimized ray tracing kernel library

OSPRay*: A rendering engine for clusters based on Embree

OpenSWR*: A high-performance Mesa* OpenGL CPU rasterization library

Intel's software-defined visualization solution stack runs best on a cost-effective and power-efficient MEGWARE high-performance cluster. As the compute and visualization problem grows, a MEGWARE cluster can easily scale out as needed to meet compute performance, responsiveness, or memory requirements. In contrast, scalability in a GPU-based visualization solution often relies on complex data handling to "fit" the data into the GPU's constrained memory.

Fast Path to Deployment

MEGWARE's Intel Select Solution for Professional Visualization eliminates the need for system architects to perform lengthy research to determine the right balance that maximizes simulation and visualization capabilities. The solution provides a fast path for purchasing and deploying a high-performance cluster to enable visualization workloads without the cost, limitations, and system challenges of GPU-based solutions.

MEGWARE's configuration consists of a pre-validated selection of hardware and software components designed to meet the needs of demanding applications that include visualization workflows. These systems also provide the capabilities and agility necessary to eliminate the need for multiple single-purpose systems.

For performance and reliability, the MEGWARE solution combines Intel Xeon Scalable processors, Intel OPA fabric, and other Intel technologies, such as Intel SSD Data Center storage devices.

Verified Performance through Benchmark Testing

MEGWARE's Intel Select Solution for Professional Visualization has been verified to meet an Intel-specified minimum level of workload-optimized performance for HPC and visualization applications. Verified solutions meet or exceed design and testing standards, including two visualization-focused benchmarks, two well-known compute application benchmarks, plus three well-known industry computing micro-benchmarks that support a range of important system aspects and indicate potential scale-up and scale-out performance.

Inside MEGWARE's Professional Visualization Solution

The MEGWARE Professional Visualization platform comprises several key hardware and software components. Component choices deliver optimized performance for compute and visualization applications. Supportability is also addressed with the inclusion of Intel® Cluster Checker, which provides expert systems advice for administrators to use in keeping a cluster functioning.

Compute

The MEGWARE configuration uses the Intel® Xeon® Gold 6148 processor. The processor offers 20 cores to deliver exceptional performance for compute and visualization workloads.

Intel Xeon Scalable processors feature significant enhancements that benefit compute and visualization applications, including improvements in I/O, memory, fabric integration, and Intel® Advanced Vector Extensions 512 (Intel® AVX-512).

Fabric

Intel OPA provides 100 gigabits per second (Gbps) bandwidth and a low-latency, next-generation fabric for HPC clusters. The 48-port switch chip for Intel OPA delivers a 33 percent increase in density over the traditional 36-port switch ASIC historically used for InfiniBand* networking, which reduces the number of required switches. Intel OPA also reduces cabling-related costs, power consumption, space requirements, and ongoing system maintenance requirements. These advancements can lower fabric costs by up to 61 percent.¹

Storage

Solid State Drives set the standard for storage performance, stability, efficiency, and low-power consumption. With no moving parts, Intel's rugged SSDs are excellent for use in devices and for applications that require speed and reliability. Intel® Solid State Drives Data Center Series (Intel® SSD DC Series) give enterprises a competitive edge with extraordinary performance, endurance, and reliability. S-series SATA SSDs are optimized for mixed workloads, enabling switching from legacy HDDs. P-Series drives, with PCIe* interface, leverage superior bandwidth and the NVMe protocol to accelerate visualization of huge data sets.

Select Solution Configuration

Table 1 lists the basic hardware configuration of MEGWARE's platform for Intel Select Solutions for Professional Visualization. The configuration can easily be expanded to meet even more demanding computational tasks.

INGREDIENT	Configuration Details	
Master (1 node)		
PLATFORM	MEGWARE MiriQuid® Master Node	
CPU	2x Intel® Xeon® Gold 6148 processors at 2.40 GHz, 20 cores/40 threads	
MEMORY	192 GB (12 x 16 GB 2666 MHz DDR4) 4 GB memory per processor core and all memory channels populated	
BOOT DRIVE	240 GB Intel® SSD DC S4600	
DATA DRIVES	4 x 4 TB Intel® SSD DC P4510	
RAID CONTROLLER FOR DATA DRIVES	Intel® Virtual RAID on CPU (Intel® VROC)	
MESSAGE FABRIC	Intel® Omni-Path single-port PCIe* 3.0 x16 adapter with 100 Gbps	
MANAGEMENT NETWORK	Integrated 1 gigabit Ethernet (GbE)	
SOFTWARE	<ul style="list-style-type: none"> • Linux* operating system (RHEL, CentOS, SLES) • Software-Defined Visualization Software Stack • Intel® Parallel Studio XE Cluster Edition 	<ul style="list-style-type: none"> • Intel® Cluster Checker • MEGWARE ClustWare®
Compute (4 nodes)		
PLATFORM	MEGWARE MiriQuid Compute Node	
CPU	2x Intel Xeon Gold 6148 processors at 2.40 GHz, 20 cores/40 threads	
MEMORY	192 GB (12 x 16 GB 2666 MHz DDR4) 4 GB memory per processor core and all memory channels populated	
BOOT DRIVE	240 GB Intel SSD DC S4600	
MESSAGE FABRIC	1x Intel Omni-Path single-port PCIe 3.0 x16 adapter with 100 Gbps	
COOLING	<ol style="list-style-type: none"> 1. Standard air cooling 2. TCO-optimized with MEGWARE's extremely efficient ColdCon® direct liquid cooling technology, supporting high coolant inlet temperatures of up to 50°C 	

Table 1. MEGWARE's Intel® Select Solution for Professional Visualization Configuration

Technology Selections

In addition to the Intel® Xeon® processor-based hardware foundation and Intel OPA, other technologies provide further performance gains:

Intel AVX-512: Boosts performance for the most demanding computational workloads, with up to double the number of floating point operations per second (FLOPS) per clock cycle, compared to previous-generation Intel® processors.

Intel® Cluster Checker: Inspects more than 100 characteristics related to cluster health. Intel Cluster Checker examines the system at both the node and cluster level, making sure all components work together to deliver optimal performance. It assesses firmware, kernel, storage, and network settings and conducts high-level tests of node and network performance using several benchmarks. Intel Cluster Checker can be extended with custom tests, and its functionality can be embedded into other software.

Intel® Cluster Runtimes: Supplies key software runtime elements that are required on each cluster to ensure optimal performance paths for applications. Intel runtime performance libraries, including Intel® Math Kernel Library (Intel® MKL) and Intel MPI Library, deliver excellent performance optimized for clusters based on Intel architecture.

MEGWARE ClustWare®: A comprehensive management and monitoring tool for HPC clusters of all sizes. This combined solution, comprising hardware and software modules, allows central control of the cluster system and reads specific performance parameters. An ever-increasing number of HPC system administrators rely on ClustWare® to optimize their cluster administration processes.

MEGWARE's expertise and choice of hardware deliver optimized performance for compute and visualization applications in a single comprehensive, verified solution.

For more information, visit MEGWARE at <https://www.MEGWARE.com/loesungen/specials/intel-select-solution-for-professional-visualization.html>.

For more information on Intel Select Solutions, visit intel.com/selectsolutions.

Intel® Xeon® Scalable Processors:

- Offer high scalability for enterprise data centers
- Deliver performance gains for virtualized infrastructure compared to previous-generation processors
- Achieve exceptional resource utilization and agility
- Enable improved data and workload integrity and regulatory compliance for data center solutions

The family includes Intel® Xeon® Platinum processors, Intel® Xeon® Gold processors, Intel® Xeon® Silver processors, and Intel® Xeon® Bronze processors.



The Intel® Select Solution minimum performance standard results may need to be revised as additional testing is conducted. The results depend on the specific platform configurations and workloads utilized in the testing during solution development and may not be applicable to any particular user's components, computer system or workloads. The results are not necessarily representative of other benchmarks and other benchmark results may show greater or lesser impact from mitigations.

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 information go to intel.com/benchmarks.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

¹ Configuration assumes a 750-node cluster, and the number of switch chips required is based on a full bisection bandwidth (FBB) fat-tree configuration. Intel® Omni-Path Architecture uses one fully populated 768-port director switch; the Mellanox EDR* solution uses a combination of 648-port director switches and 36-port edge switches. Intel and Mellanox component pricing are from kernelsoftware.com, with prices as of May 2016. Compute node pricing is based on the Dell PowerEdge R730* server from dell.com, with prices as of November 2015. Intel Omni-Path Architecture pricing is based on estimated reseller pricing, which is based on projected Intel manufacturer's suggested retail price (MSRP) pricing at time of launch.

Tests document performance of components on a particular test, in specific systems. Differences in hardware, software, or configuration will affect actual performance. Consult other sources of information to evaluate performance as you consider your purchase. For more complete information about performance and benchmark results, visit intel.com/benchmarks.

Cost reduction scenarios described are intended as examples of how a given Intel-based product, in the specified circumstances and configurations, may affect future costs and provide cost savings. Circumstances will vary. Intel does not guarantee any costs or cost reduction.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

For more complete information about performance and benchmark results, visit intel.com/benchmarks.

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