

SOLUTION BRIEF

Intel® Select Solutions
High Performance Computing
2nd Generation Intel® Xeon® Scalable Processors
June 2019



Intel® Select Solutions for Simulation & Visualization

Quickly deploy an optimized infrastructure that delivers faster simulations and photorealistic visualizations that are crucial in the age of big data.



Digital simulations and visualizations are driving design today in industries as diverse as architecture, energy, scientific research, and manufacturing. To keep pace with innovation demands and the vast amounts of data generated for insight, organizations across these industries now require more compute power than ever for their simulation and analysis workloads.

For example, in the manufacturing sector, smart, connected resources are delivering real-time analytics through Internet of Things (IoT) sensors, providing organizations with product performance data that, with the help of compute-intensive applications, can lead to better, cheaper, and more innovative designs for their customers. Another recent development is that organizations armed with enough compute power can now innovate through experimentation with *digital twins*: complete digital simulations of physical models that enable more design iterations and the replacement of design assumptions with facts, which can help lead to higher quality products in less time. Another key trend driving the need for high compute capabilities is *in situ analytics*, which is emerging as an improved approach to scientific investigation and engineering analysis. By simultaneously running the workloads of data-management, analysis, and visualization with computational simulation on a single system, scientists and engineers can use *in situ analytics* to achieve higher levels of productivity by avoiding input/output (I/O) problems and bottlenecks.

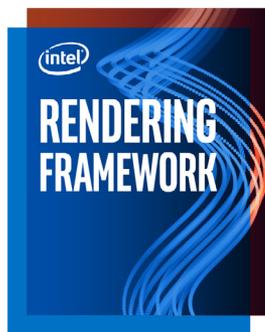
To meet these ambitious demands for real-time simulations and visualizations, increased analysis, and data management on the same system, organizations are now forced to consider new computing paradigms, such as high-performance computing (HPC). HPC aggregates computing power and delivers higher performance than is possible with a typical workstation. However, many organizations do not have the skills or expertise to design and build scalable HPC clusters for their needs. Designing an HPC cluster, after all, involves more than choosing the right processor, core count, fabric, memory, and storage. The administration and optimization of the applications must also be considered, in addition to the system software that is needed to optimize computer resources and make them more efficient. Even enterprise businesses with HPC expertise can spend months researching and assembling the components needed for their HPC solutions.

[Intel Select Solutions for HPC](#)

Intel® Select Solutions for HPC offer easy and quick-to-deploy infrastructure that reduces the complexity of advanced computing and helps accelerate the time to actionable insights for users in industry and science. The portfolio of solutions includes workload-optimized hardware configurations with pre-loaded software for simulation and visualization, genomics analytics, and HPC artificial-intelligence

(AI) converged clusters. Each of these solutions shares a common Intel Select Solutions for Simulation & Modeling base architecture and complies with the Intel® HPC Platform Specification. The HPC family of Intel Select Solutions offers the advantage of validated compatibility with a wide range of HPC workloads, including those listed in the Intel® HPC Application Catalog.

Intel Select Solutions for Simulation & Modeling serve as a common foundation for this family of Intel Select Solutions for HPC and are designed for productivity, compatibility, and workload-optimized performance. Intel Select Solutions for Simulation & Visualization (formerly known as Intel Select Solutions for Professional Visualization) build upon the computational power in Intel Select Solutions for Simulation & Modeling by also offering users advanced rendering capabilities for pre- and post-processing. Users of Intel Select Solutions for Simulation & Visualization receive the benefit of having an end-to-end solution for both compute and visualization.



POWERED BY INTEL®
RENDERING FRAMEWORK

Intel® Rendering Framework

Intel's software-defined visualization libraries are key components of Intel Select Solutions for Simulation & Visualization. These libraries, collectively known as the Intel® Rendering Framework, offer CPU-based software that delivers a flexible, high-performance, scalable, cost-effective, and power-efficient solution for simulation and visualization, including large 3D data (more than 1 TB) visualizations that are not attainable with GPU-based solutions. Running these software libraries on CPU-based hardware eliminates the need for discrete GPUs, which, in turn, allows scientists and engineers to use one holistic platform for both simulations and visualizations. Another advantage of a CPU-based solution is that it can scale as needed across the nodes in an HPC cluster to meet the performance or memory size required. Unlike with GPU-based visualization solutions, CPU-based solutions can scale without needing to rely on tricks or techniques to "fit" the data into constrained memory for analysis. Finally, software-defined visualization running on Intel® CPUs provides the performance needed to help speed up interactivity during visualizations.

The Intel Rendering Framework offers a set of optimized, open source capabilities that enable high-performance, high-fidelity visualization applications to run on Intel platforms. Its libraries scale in the parallel processing environment of an HPC cluster, and they include:

- **Intel® Embree***: A CPU-optimized ray tracing kernel library that provides a high level of photorealism, image fidelity, and interactivity.

- **Intel® OSPRay***: A scalable rendering engine based on Embree.
- **Intel® OpenSWR***: A high-performance, highly scalable software rasterizer for OpenGL*. Fully integrated with Mesa* OpenGL.
- **Intel® Open Image Denoise***: An AI-accelerated image denoiser to achieve superior visual quality.

Intel Select Solutions for Simulation & Visualization

Intel Select Solutions for Simulation & Visualization are pre-validated and tested solutions that combine 2nd Generation Intel® Xeon® Scalable processors and other Intel technologies into a proven architecture based on the Intel HPC Platform Specification. Intel Select Solutions for Simulation & Visualization reduce the time and cost of building an HPC cluster and are designed to provide optimized performance for simulation and visualization workloads.

In addition, Intel Select Solutions for Simulation & Visualization are validated to ensure:

- The solutions include key components and technologies to deliver performance and scalability.
- The solutions are compliant with industry standards and best practices for Intel-based clusters, as defined in the Intel HPC Platform Specification.
- The solutions meet or exceed defined performance levels in targeted characteristics important to HPC applications.

What Are Intel® Select Solutions?

Intel Select Solutions are pre-defined, workload-optimized solutions designed to minimize the challenges of infrastructure evaluation and deployment. Solutions are validated by OEMs/ODMs, certified by ISVs, and verified by Intel. Intel develops these solutions in extensive collaboration with hardware, software, and operating system vendor partners and with the world's leading data center and service providers. Every Intel Select Solution is a tailored combination of Intel® data center compute, memory, storage, and network technologies that delivers predictable, trusted, and compelling performance.

To refer to a solution as an Intel Select Solution, a vendor must:

1. Meet the software and hardware stack requirements outlined by the solution's reference-design specifications
2. Replicate or exceed established reference-benchmark test results
3. Publish a solution brief and a detailed implementation guide to facilitate customer deployment

Solution providers can also develop their own optimizations in order to give end customers a simpler, more consistent deployment experience.

Visit the following web page (updated frequently) to see a full list of applications that are verified as compatible with the Intel HPC Platform Specification: intel.com/content/www/us/en/high-performance-computing/hpc-application-catalog.html.

Hardware and Software Selections

Intel Select Solutions for Simulation & Visualization comprise several key hardware and software components.

Compute

Intel Select Solutions for Simulation & Visualization use the Intel Xeon Gold 6148 processor or the Intel Xeon Gold 6252 processor, or a higher model number Intel Xeon Scalable processor, in the “Base” configuration, and they use the Intel Xeon Platinum 8180 processor or the Intel Xeon Platinum 8280 processor, or a higher model number Intel Xeon Scalable processor, in the “Plus” configuration. The Base configuration offers all the benefits of Intel Select Solutions, whereas the Plus configuration enables dialing up the power and impact of the system. Intel Xeon Gold 6148 processors and Intel Xeon Gold 6252 processors both offer 20 cores to deliver exceptional performance for compute and data-intensive workloads. Optionally, Intel Xeon Platinum processors—with up to 28 cores—can be used to meet the most challenging compute needs.¹ Solutions incorporating the latest Intel Xeon Gold 6252 processors and Intel Xeon Platinum 8280 processors deliver the same performance or incremental performance gains as compared to similarly configured solutions based on previous-generation Intel Xeon Scalable processors.

Intel Xeon Scalable processors feature significant enhancements that can benefit HPC applications, including improvements in I/O, memory, fabric integration, and Intel® Advanced Vector Extensions 512 (Intel® AVX-512).²

For HPC users adopting AI, Intel® Deep Learning Boost (Intel® DL Boost) uses the Vector Neural Network Instructions (VNNI) set to accelerate performance of AI deep learning (inference) workloads, such as speech recognition, image recognition, object classification, machine translation, and others. VNNI accomplishes in a single instruction set what formerly required three, resulting in up to an 11x performance increase in low-precision inferencing for systems based on 2nd Generation Intel Xeon Scalable processors, compared to systems based on previous-generation processors.³

Fabric

Intel® Omni-Path Architecture (Intel® OPA) provides 100 gigabits per second (Gbps) bandwidth and a low-latency, next-generation fabric for HPC clusters. The 48-port switch chip delivers a 33 percent increase in density over the traditional 36-port switch Application-Specific Integrated Circuit (ASIC) historically used for InfiniBand* networking, which reduces the number of required switches. Intel OPA can also reduce cabling-related costs, power consumption, space requirements, and ongoing system-maintenance requirements.

Intel® HPC Platform Specification

The Intel HPC Platform Specification defines common industry practices and requirements for building Intel-based clusters. This architectural foundation provides a consistent and stable platform enabling development and deployment

of a wide variety of high-performance, compute- and data-intensive workloads. Included in the foundation are the Intel software performance libraries and runtime environments that allow applications to experience optimized value from the underlying Intel processors and technologies. The Intel HPC Platform Specification enables organizations to achieve high performance with flexibility, scalability, balance, and portability.

Verified Performance through Benchmark Testing

All Intel Select Solutions are verified to meet a specified minimum level of workload-optimized performance capabilities. Intel Select Solutions for Simulation & Visualization define performance watermarks that demonstrate optimized capabilities for HPC applications. These 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.

The Complete Family of Intel® Select Solutions for HPC

The family of Intel Select Solutions for HPC provides a common foundation for productivity, compatibility, and workload-optimized performance across a broad range of traditional HPC applications. Intel Select Solutions for Simulation & Modeling serve as a common foundation for this family of solutions. Other solutions in this family, such as Intel Select Solutions for Simulation & Visualization, build upon this common foundation with additional elements to support their specific HPC needs. Besides the Intel Select Solutions for Simulation & Visualization, the family of Intel Select Solutions for HPC includes:

- Intel Select Solutions for Simulation & Modeling: Deploy an infrastructure that is optimized for highly scalable simulation and modeling applications to help accelerate product design with greater levels of customization and optimization. These solutions improve delivery and uptime through simplified deployment and advanced diagnostic tools.
- Intel Select Solutions for Genomic Analytics: Ease deployment and speed time to analysis of genomics pipelines for life-sciences research and healthcare insights. The solutions include workflow-definition-language scripts that allow users to replicate Genome Analysis Toolkit* (GATK*) best-practices pipelines or create their own pipelines.
- Intel Select Solutions for HPC & AI Converged Clusters: Extend the simulation and modeling solution to allow users run a wide range of analytics and AI applications on common infrastructure. These solutions increase flexibility, improve utilization, and support the trend toward converged simulation, modeling, analytics, and AI workloads to accelerate discoveries and insights.

Visualization Benchmarks

To model and tune for visualization performance, an OSPRay ray tracing performance benchmark was used that measures and tests system capabilities for single-node and multi-node scalability for ray tracing rendering. This solution was also tested and optimized for a broader range of visualization workloads with a set of ParaView benchmarks focused on OpenSWR, OSPRay, and Embree performance, as integrated into the popular ParaView application from Kitware, Inc.

HPC Benchmarks

Intel Select Solutions for Simulation & Visualization are optimized for compute-intensive workloads. Through this optimization they can ensure fast turnaround from computation to visual results, including in the rapidly emerging workflow of in situ visualization. Two popular HPC benchmarks are used to represent and model a variety of common compute applications and to verify high performance. The High Performance LINPACK* (HPL*) benchmark solves a dense linear system in double precision arithmetic calculation on distributed memory. The High Performance Conjugate Gradient (HPCG) benchmark models data-access patterns of real-world applications such as sparse-matrix calculations, testing memory subsystems, and internal interconnect. HPL and HPCG benchmarks also provide the ability to look at both individual node performance and the combined performance of the entire system.

System Benchmarks

Finally, Intel uses three additional micro-benchmarks to measure performance of key characteristics of the system to best pair with simulation and visualization. These benchmarks measure compute power, memory bandwidth, and interconnect fabric performance. DGEMM is a double precision general matrix multiplication workload that measures computing capabilities of the processor and memory. STREAM* measures the sustainable memory bandwidth and corresponding computation rate for simple vector kernels. IMB PingPong* measures the speed and latency of passing a single message from peer to peer across the interconnect fabric.

Base and Plus Configurations

Intel Select Solutions for Simulation & Visualization include two configurations. The Base configuration specifies the minimum required performance capability for Intel Select Solutions for Simulation & Visualization. The Plus configuration provides one example of how system builders, system integrators, and solution and service providers can further optimize to achieve higher performance and capabilities, as shown in Table 1. For example, the Plus configuration can provide 3x faster ray tracing performance as measured by the OSPRay ray tracing benchmark.⁴ Use the OSPRay ray tracing benchmark results when comparing the Base configuration to the Plus configuration.

INTEL® SELECT SOLUTIONS FOR HIGH PERFORMANCE COMPUTING (HPC)

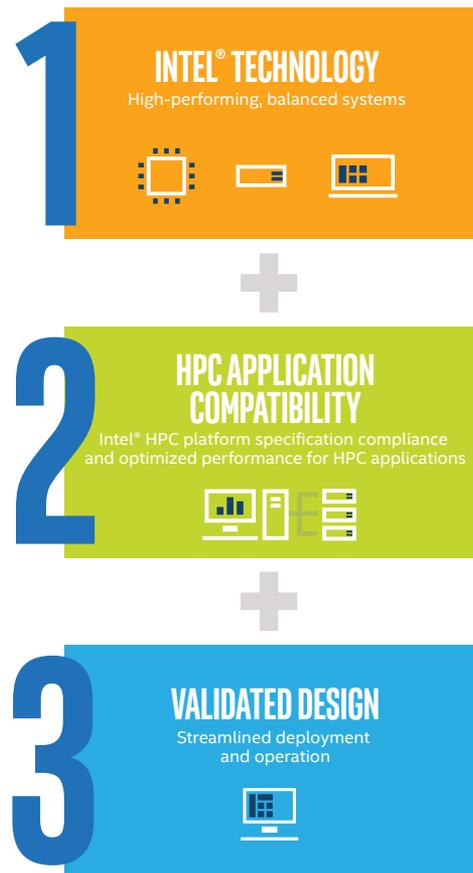


Figure 1. Intel® Select Solutions for HPC combine Intel® hardware and software technologies into an optimized, validated design that simplifies your path to a high performance, scalable HPC deployment

Intel® Select Solutions for Simulation & Visualization

- Offer users the ability to run both computational and rendering algorithms on CPU-based clusters without having to invest in a separate graphics processing unit (GPU)-based cluster for post-processing and visualization
- Are performance-optimized and tested for highly scalable simulation and visualization applications, such as OpenFOAM*, ParaView*, and VisIt*
- Include open source libraries and APIs for advanced rendering, known as Intel® Rendering Framework, that have been adopted by more than 80 third-party application providers
- Are optimized for parallel-processing architectures in Intel® CPUs for increased performance
- Provide access to a large memory space to support the delivery of large and complex datasets

Table 1. Configuration details for the Intel® Select Solutions for Simulation & Visualization Base and Plus configurations

| INGREDIENT | INTEL® SELECT SOLUTIONS FOR SIMULATION & VISUALIZATION BASE CONFIGURATION | INTEL® SELECT SOLUTIONS FOR SIMULATION & VISUALIZATION PLUS CONFIGURATION |
|---|---|---|
| COMMON HARDWARE COMPONENTS | | |
| MESSAGE FABRIC SWITCH | Intel® Omni-Path Switch | Intel Omni-Path Switch |
| MANAGEMENT NETWORK | 1 gigabit Ethernet (GbE) | 1 GbE |
| MASTER/HEAD NODE | | |
| Minimum Number | 1 | 1 |
| CPU | 2 x Intel® Xeon® Gold 6148 processor (2.40 GHz, 20 cores/40 threads), Intel Xeon Gold 6252 processor (2.50 GHz, 20 cores/40 threads), or a higher number Intel Xeon Scalable processor | 2 x Intel Xeon Platinum 8180 processor (2.50 GHz, 28 cores/56 threads), or Intel Xeon Platinum 8280 processor (2.70 GHz, 28 cores/56 threads) |
| MEMORY | 192 GB or higher with 2 GB/core or higher, 1 DPC (all memory channels must be populated) <ul style="list-style-type: none"> For Intel Xeon Gold 6148 processors: 2,666 MHz For Intel Xeon Gold 6252 processors: 2,933 MHz | 192 GB or higher with 2 GB/core or higher, 1 DPC (all memory channels must be populated) <ul style="list-style-type: none"> For Intel Xeon Platinum 8180 processors: 2,666 MHz For Intel Xeon Platinum 8280 processors: 2,933 MHz |
| BOOT DRIVE | Intel® SSD DC S3700 or better (more than 200 GB preferred) | Intel SSD DC S3700 or better (more than 200 GB preferred) |
| DATA DRIVES | 2 x 4 TB Intel SSD DC P4500/P4510 or better/larger | 4 x 4 TB Intel SSD DC P4500/P4510 or better/larger |
| RAID CONTROLLER (FOR DATA DRIVES ONLY) | Intel® RAID Adapter RSP3TD160F or better | Intel RAID Adapter RSP3TD160F or better |
| DISPLAY CARD** | Display card capable of driving 6 displays with a resolution of at least 4096 x 2160 pixels** | Display card capable of driving 6 displays with a resolution of at least 4096 x 2160 pixels** |
| MESSAGE FABRIC | 100 Gb Intel® Omni-Path Host Fabric Interface (HFI) Adapter 100 Series | 100 Gb Intel Omni-Path HFI Adapter 100 Series |
| SOFTWARE | | |
| SOFTWARE-DEFINED VISUALIZATION SOFTWARE STACK | Version 2018.1 or later | Version 2018.1 or later |
| CLUSTER SOFTWARE STACK** | OpenHPC* 1.3.4 or later** | OpenHPC 1.3.4 or later** |
| FABRIC SOFTWARE | Intel® Omni-Path Fabric Software version 10.7.0.0.145 or later | Intel Omni-Path Fabric Software version 10.7.0.0.145 or later |
| COMPUTE NODES | | |
| MINIMUM NUMBER | 4 | 8 |
| CPU | 2 x Intel Xeon Gold 6148 processor (2.40 GHz, 20 cores/40 threads), Intel Xeon Gold 6252 processor (2.50 GHz, 20 cores/40 threads), or a higher number Intel Xeon Scalable processor | 2 x Intel Xeon Platinum 8180 processor (2.50 GHz, 28 cores/56 threads), or Intel Xeon Platinum 8280 processor (2.70 GHz, 28 cores/56 threads) |
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| BOOT DRIVE | 800 GB Intel SSD DC S3700 or better | 800 GB Intel SSD DC S3700 or better |
| MESSAGE FABRIC | 100 Gb Intel Omni-Path HFI Adapter 100 Series | 100 Gb Intel Omni-Path HFI Adapter 100 Series |

FIRMWARE AND SOFTWARE OPTIMIZATIONS

| | | |
|---|--|---|
| <p>ENABLED TECHNOLOGIES</p> | <p>The following technologies or settings are required to be enabled: Trusted Platform Module (TPM) 1.2, Intel® Trusted Execution Technology (Intel® TXT), Intel® Hyper-Threading Technology (Intel® HT Technology), Intel® Turbo Boost Technology, Xtended Prediction Table* (XPT*) prefetch, performance power-management settings</p> <p>The following technology is recommended to be enabled: Intel® Volume Management Device (Intel® VMD)**</p> | <p>The following technologies are required to be enabled: TPM 1.2, Intel TXT, Intel HT Technology, Intel Turbo Boost Technology, XPT prefetch, performance power-management settings</p> <p>The following technology is recommended to be enabled: Intel VMD**</p> |
| <p>MINIMUM PERFORMANCE STANDARDS⁴</p> | <p>Verified to meet or exceed the following minimum performance capabilities:</p> <ul style="list-style-type: none"> • OSPRay*: less than 13,520 ms across all 4 nodes • ParaView* Volume Rendering: OSPRay less than 3.75 sec across all 4 nodes • ParaView Contour Geometry: OSPRay less than 16.6 sec, OSPRep* less than 4 sec, and SWR* less than 1.55 sec across all 4 nodes • HPL*: more than 8,050 gigaFLOPS across all 4 nodes • HPCG*: more than 135 gigaFLOPS across all 4 nodes and 34 gigaFLOPS on each node • DGEMM*: more than 2,048 gigaFLOPS on each node • STREAM*: more than 166,000 MB/s on each node • IMB PingPong*: more than 11,300 MB/s bandwidth with a maximum of 1.8 µs latency | <p>Verified to meet or exceed the following minimum performance capabilities:</p> <ul style="list-style-type: none"> • OSPRay: less than 4,500 ms across all 4 nodes • ParaView Volume Rendering: OSPRay less than 1.35 sec across all 4 nodes • ParaView Contour Geometry: OSPRay less than 7.8 sec, OSPRep less than 1.52 sec, and SWR less than 0.73 sec across all 4 nodes • HPL: more than 23,000 gigaFLOPS across all 4 nodes • HPCG: more than 310 gigaFLOPS across all 8 nodes and 39.4 gigaFLOPS on each node • DGEMM: more than 3,050 gigaFLOPS on each node • STREAM: more than 198,000 MB/s on each node • IMB PingPong: more than 11,500 MB/s bandwidth with a maximum of 1.7 µs latency |
| <p>BUSINESS VALUE OF CHOOSING A PLUS CONFIGURATION OVER A BASE CONFIGURATION⁴</p> | <p>3x faster ray tracing performance as measured by the OSPRay ray tracing benchmark</p> | |

**Recommended, not required

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- **Intel Select Solutions for Genomic Analytics:** Ease deployment and speed time to analysis of genomics pipelines for life-sciences research and healthcare insights. The solutions include workflow-definition-language scripts that allow users to replicate Genome Analysis Toolkit* (GATK*) best-practices pipelines or create their own pipelines.
- **Intel Select Solutions for HPC & AI Converged Clusters:** Extend the simulation and modeling solution to allow users to run a wide range of analytics and AI applications on common infrastructure. These solutions increase flexibility, improve utilization, and support the trend toward converged simulation, modeling, analytics, and AI workloads to accelerate discoveries and insights.

Technology Selections for Intel Select Solutions for Simulation & Visualization

In addition to the Intel hardware-based foundation for Intel Select Solutions for Simulation & Visualization shown in Table 1, the following 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.²
- **Intel DL Boost:** The performance acceleration extends to integer operations and handles the dense computations characteristic of convolution neural network (CNN) and deep neural network (DNN) workloads. It accelerates AI workloads, increasing Int16* and Int8* peak operations/second. Intel DL Boost was designed to accelerate performance of AI deep learning (inference) workloads (for example, speech recognition, image recognition, object classification, machine translation, and others).
- **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, checking that 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 the Intel® MPI Library benchmarks, STREAM, the HPL benchmark, the HPCG benchmark, and other 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.
- **Converged parallel programming for Intel Xeon Scalable processors and Intel® Xeon Phi™ processors:** Enables the creation of a highly integrated portfolio of powerful technologies, software tools, and libraries. Intel Xeon Scalable processors offer an unparalleled flexible framework, based on a common programming model that supports code modernization initiatives across AI frameworks.
- **Cluster Management Software Stack:** Provides a software stack required to deploy and manage Linux* HPC clusters. The stack includes provisioning tools, resource management, I/O clients, development tools, and scientific libraries, such as OpenHPC*, Bright Cluster Manager*, xCAT*, and others.

Meet Compute and Visualization Challenges for Big Data with Intel Select Solutions for Simulation & Visualization

Intel Select Solutions for Simulation & Visualization draw upon the power of Intel Xeon Scalable processors, Intel® Omni-Path Fabric, and Intel's software-defined visualization libraries to help research organizations, engineering firms, digital content creators, and others gain a deeper understanding of data or deliver stunning photorealistic imagery. Intel Select Solutions for Simulation & Visualization make high-fidelity, photorealistic images possible, even as datasets become increasingly large and more complex.

Software-defined visualization applications run on CPU-based systems and avoid the need for a discrete GPU. Using CPU-based platforms enables organizations to avoid data transfer, the expense of GPU devices, or the expense of separate systems. In this way, Intel Select Solutions for Simulation & Visualization can help save time and money while helping users get results more quickly by solving computing and visualization problems simultaneously. These advantages can help lead to better, faster insights for solving the toughest problems.

Visit intel.com/selectsolutions to learn more, and ask your infrastructure vendor, system integrator, or solution provider for Intel Select Solutions.

Intel® Xeon® Scalable Processors

2nd Generation Intel Xeon Scalable processors:

- Offer high scalability that is cost-efficient and flexible, from the multi-cloud to the intelligent edge
- Establish a seamless performance foundation to help accelerate data's transformative impact
- Support breakthrough Intel® Optane™ DC persistent memory technology
- Accelerate artificial-intelligence (AI) performance and help deliver AI readiness across the data center
- Provide hardware-enhanced platform protection and threat monitoring

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



Learn More

Intel Select Solutions for HPC: [intel.com/content/www/us/en/products/solutions/select-solutions/hpc.html](https://www.intel.com/content/www/us/en/products/solutions/select-solutions/hpc.html)

Intel HPC Platform Specification: [intel.com/content/www/us/en/high-performance-computing/hpc-platform-specification.html](https://www.intel.com/content/www/us/en/high-performance-computing/hpc-platform-specification.html)

Intel HPC Application Catalog: [intel.com/content/www/us/en/high-performance-computing/hpc-application-catalog.html](https://www.intel.com/content/www/us/en/high-performance-computing/hpc-application-catalog.html)

Intel Rendering Framework: <https://software.intel.com/sdvis>

Intel Xeon Scalable processors: [intel.com/xeonscalable](https://www.intel.com/xeonscalable)

Intel OPA: [intel.com/omnipath](https://www.intel.com/omnipath)

Intel Cluster Checker: <https://software.intel.com/intel-cluster-checker>

Intel Select Solutions are supported by Intel® Builders: [http://builders.intel.com](https://builders.intel.com). Follow us on Twitter: [#IntelBuilders](https://twitter.com/IntelBuilders)



¹ Intel. "Performance Benchmarks and Configuration Details for Intel® Xeon® Scalable Processors." [intel.com/content/www/us/en/benchmarks/xeon-scalable-benchmark.html](https://www.intel.com/content/www/us/en/benchmarks/xeon-scalable-benchmark.html).

² Intel® Advanced Vector Extensions (Intel® AVX) provides higher throughput to certain processor operations. Due to varying processor power characteristics, utilizing Intel AVX instructions may cause a) some parts to operate at less than the rated frequency and b) some parts with Intel® Turbo Boost Technology 2.0 to not achieve any or maximum turbo frequencies. Performance varies depending on hardware, software, and system configuration and you can learn more at [intel.com/go/turbo](https://www.intel.com/go/turbo).

³ Intel. "Intel® AI—The Tools for the Job." August 2018. <https://itpeernetwork.intel.com/intelcisummit-artificial-intelligence/>.

⁴ Based on Intel testing as of May 29, 2018. **Base configuration:** *Master node:* Intel® Server Board S2600WFT, 2 x Intel® Xeon® Gold 6148 processor at 2.00 GHz (20 cores, 40 threads), 192 GB (12 x 16 GB 2,666 MHz DDR4 DIMM), boot drive: 480 GB SATA 3.0 6 Gb/s Intel® SSD DC S3520, capacity tier: 4 x 4 TB Intel SSD DC P4500 (NVM Express* [NVMe*]), Intel RAID Adapter RSP3TD160F, Intel® Omni-Path Host Adapter 1 Port PCIe* x16 Low Profile 100HFA016LS, Intel® Ethernet Connection X722 with Intel® Ethernet Converged Network Connection X527-DA2/DA4 or 10Gb Intel® Ethernet Converged Network Adapter X710. *Compute nodes:* Intel Server Board S2600WFT, 2 x Intel Xeon Gold 6148 processor at 2.00 GHz (20 cores, 40 threads), 96 GB (12 x 8 GB 2,666 MHz DDR4 DIMM), boot drive: 480 GB SATA 3.0 6 Gb/s Intel SSD DC S3520, Intel Omni-Path Host Adapter 1 Port PCIe* x16 Low Profile 100HFA016LS, Intel Ethernet Connection X722 with Intel Ethernet Converged Network Connection X527-DA2/DA4 or 10Gb Intel Ethernet Converged Network Adapter X710. **Software stack (SDVis Libs*, open source apps):** 2018.1. **Plus configuration:** *Master node:* Intel Server Board S2600WFT, 2 x Intel Xeon Platinum 8180 processor at 2.50 GHz (28 cores/56 threads), 384 GB (12 x 32 GB 2,666 MHz DDR4 DIMM), data drive: 480 GB SATA 3.0 6 Gb/s Intel SSD DC S3520, capacity tier: 4 x 4 TB Intel SSD DC P4500 (NVMe), Intel RAID Adapter RSP3TD160F, Intel Omni-Path Host Adapter 1 Port PCIe x16 Low Profile 100HFA016LS, Intel Ethernet Connection X722 with Intel Ethernet Converged Network Connection X527-DA2/DA4 or 10Gb Intel Ethernet Converged Network Adapter X710. *Compute nodes:* Intel Server Board S2600WFT, 2 x Intel Xeon Platinum 8180 processor at 2.50 GHz (28 cores/56 threads), 192 GB (12 x 16 GB 2,666 MHz DDR4 DIMM), data drive: 480 GB SATA 3.0 6 Gb/s Intel SSD DC S3520, Intel Omni-Path Host Adapter 1 Port PCIe x16 Low Profile 100HFA016LS, Intel Ethernet Connection X722 with Intel Ethernet Converged Network Connection X527-DA2/DA4 or 10Gb Intel Ethernet Converged Network Adapter X710. **Software stack (SDVis Libs, open source apps):** 2018.1.

The Intel® Select Solutions 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.

Performance results are based on testing as of the date set forth in the configurations and may not reflect all publicly available security updates. See configuration disclosure for details. No product or component can be absolutely secure.

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