

Intel® Select Solutions for Simulation and Modeling

Enhance competitiveness and productivity with an optimized, quick-to-deploy, HPC cluster for simulation and modeling, based on 3rd Gen Intel® Xeon® Scalable processors



Executive Summary

High-performance computing (HPC) simulation and modeling can be the key element of success for manufacturing and research companies that are facing an increasingly competitive environment. Numerous HPC applications provide capabilities to explore design parameters, reduce prototype costs, and produce optimized products more quickly. In addition, many of these applications can distribute computation across multiple machines that are configured to act as one large unit: an HPC cluster.

An HPC cluster can act as a scalable resource that enables faster results, finer-grained models—and ultimately—higher productivity compared to using a single system for simulation workloads. But for many organizations, the skills or expertise needed to deploy and maintain scalable HPC clusters for simulation and modeling workloads presents a barrier to adoption. Building an HPC cluster involves more than choosing the right processor, core count, and memory. Storage, remote-visualization, job scheduling, and workload management software all need to be considered. In addition, it is complicated to integrate the hardware and software to meet the requirements for simulation and modeling applications. In the end, businesses can spend weeks or more researching and assembling the components needed for their solution.

Intel® Select Solutions for Simulation and Modeling offer an easier path and quick-to-deploy infrastructure that significantly reduce this complexity for the purchaser. Using a standards-based approach defined in the Intel® HPC Platform Specification, these solutions provide verified interoperability with common applications used in simulation and modeling. Intel Select Solutions for Simulation and Modeling must also meet or exceed characteristics and performance thresholds that are needed for scaling performance across the cluster. Branded designs have demonstrated these capabilities and are ready to deploy for use. These preconfigured solutions are optimized to take advantage of 3rd Generation Intel® Xeon® Scalable processors to handle demanding workloads and enhanced scalability.

Intel® Select Solutions for Simulation and Modeling

Intel Select Solutions power HPC deployments with 3rd Gen Intel Xeon Scalable processors, Intel® Ethernet Network Adapters, and other Intel® technologies.

HPC APPLICATION
COMPATIBLE



VALIDATED DESIGN
STREAMLINES
DEPLOYMENT



HIGH-PERFORMANCE
INTEL® TECHNOLOGY



DELIVER PERFORMANCE
OPTIMIZED TO A
SPECIFIC THRESHOLD



Business Challenge

The global computer-aided engineering industry is projected to be worth USD 8.7 billion by 2026.¹ But to participate in this growing market, manufacturers need to bring high-quality innovative products to market faster while reducing total cost of ownership (TCO). Modern high-performance computing (HPC) workloads feature complex models composed of millions of elements, creating an insatiable demand for compute power. But “performance” can be measured in different ways for different workloads. For example, some workloads may benefit from straightforward increases in throughput, while other workloads are more sensitive to per-core performance. Hardware isn’t the only consideration though. The software running on top of the compute resources also plays a crucial role in reaching performance and TCO goals. Using the right job-scheduling and workload-management software, while keeping software licensing costs under control, is critical to building highly efficient HPC clusters.

Solution Value

Intel® Select Solutions for Simulation and Modeling are prevalidated and tested solutions that combine 3rd Generation Intel® Xeon® Scalable processors and other Intel® technologies into a proven architecture. These solutions can help reduce the time and cost of building an HPC cluster, and are designed to provide optimized performance for simulation and modeling workloads. Customers can use Intel Select Solutions to help lower total hardware costs because they can take advantage of a single system for both simulation and modeling.

These solutions use the approach defined in the Intel® HPC Platform Specification to provide verified interoperability with common applications used in simulation and modeling (such as those found in the [Intel® HPC Application Catalog](#)). Intel Select Solutions can be deployed easily on premises and in the cloud. As a result, end users can have confidence that they get the same predictable and scalable performance regardless of location.

Open-source libraries, developed by Intel, are optimized for the parallel processing architectures found in Intel® processors for increased performance. They can also deliver vivid visualization of complex, enormous datasets, as well as high-fidelity images for quickly gaining deeper insights into science and industry.

Solution Benefits

- **Harness more compute power** beyond workstations to solve larger simulation problems, with more geometric detail, and integrate complex physics.
- **Scale** complex modern analytical problem sets that require many billions of computations per second.
- **Avoid common barriers** of hardware limitations and system bottlenecks that slow performance of these larger and more complex simulation runs.

Solution Architecture Highlights

Intel Select Solutions for Simulation and Modeling combine the latest Intel® hardware innovations to provide a high level of performance and scalability. The solution delivers turnkey infrastructure that integrates hardware and software and provides end-to-end management capabilities. The solution spans on-premises, public clouds, and the edge.

The Intel Select Solutions’ design is a scalable performance cluster based on 3rd Gen Intel Xeon Scalable processors (see Figure 1), which have many performance enhancements compared to previous-generation processors. The cluster consists of a single front-end node managing all cluster functions, four compute nodes for processing, an internal management network, and a high-performance message fabric. Intel architects and engineers have used the following additional components to optimize the solution’s performance: Intel® HPC Platform Specification 2.0; Software stack based on OpenHPC v2; Intel® oneAPI, including the Intel® oneAPI HPC Toolkit runtimes; and Intel® Cluster Checker suite.

Other important aspects of the solution include acceleration technology such as Intel® Advanced Vector Extensions 512 (Intel® AVX-512) and the Intel® oneAPI Toolkit, which simplifies development and deployment of data-centric workloads across CPUs, GPUs, FPGAs, and other accelerators.

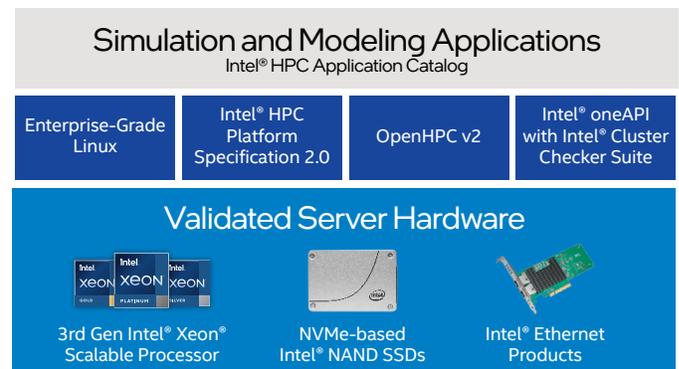


Figure 1. Intel® hardware and software combine to create a performance-optimized platform that is ideal for simulation and modeling workloads.

Results and Use Cases

Intel Select Solutions for Simulation and Modeling can be used across a wide range of HPC workloads, including computational fluid dynamics (CFD), structural analysis, finite element analysis, and mechanical engineering. In tests using the Intel Cluster Checker suite, the new Intel Select Solutions for Simulation and Modeling out-performed the previous-generation solution across a number of workloads, including High-Performance Linpack (HPL), High-Performance Conjugate Gradients (HPCG), and Stream² (see Figure 2).³

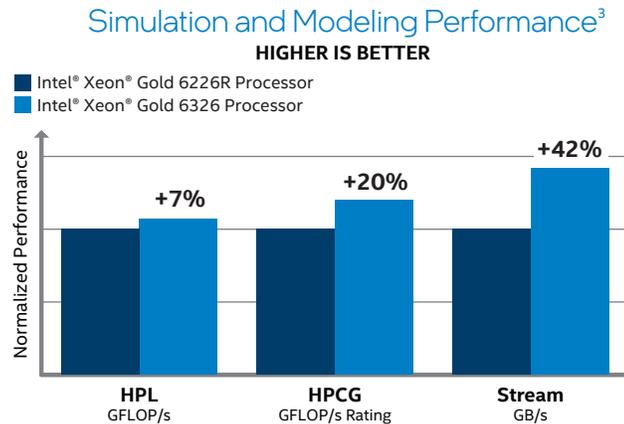


Figure 2. By investing in the latest Intel® Select Solutions for Simulation and Modeling, customers can improve performance across a broad variety of HPC workloads.³

Learn More

- [Intel® Select Solutions for Simulation and Modeling](#)
- [3rd Gen Intel® Xeon® Scalable processors](#)
- [Intel® Ethernet products](#)
- [Intel® HPC Platform Specification](#)
- [Intel's HPC Hub Page](#)

What Are Intel® Select Solutions?

Intel® Select Solutions are predefined, workload-optimized solutions designed to minimize the challenges of infrastructure evaluation and deployment.

These solutions are validated by OEM/ODMs, certified by ISVs, and verified by Intel.

All Intel Select Solutions are a tailored combination of Intel® data center compute, memory, storage, and network technologies that deliver predictable, trusted, and compelling performance. Each solution offers assurance that the workload will work as expected, if not better, which can save individual businesses from investing the resources that might otherwise be used to evaluate, select, and purchase the hardware components to gain that assurance themselves.



¹ Global Industry Analysts, June 2021, "Computer Aided Engineering (CAE): Global Market Trajectory and Analytics."

² Stream is a simple synthetic benchmark program that measures sustainable memory bandwidth (in MB/s) and the corresponding computation rate for simple vector calculations.

³ **2nd Generation Intel® Xeon® Scalable Processor Configuration:** Test by Intel as of 1/21/2020. 4 nodes, 2x Intel® Xeon® Gold 6226R processor; 1x Intel® Server Board S2600WFT; total memory 192 GB, 12 slots/16 GB/2933 MT/s DDR4 DRAM memory; Intel® Hyper-Threading Technology = ON; Intel® Turbo Boost Technology = ON; storage (boot): Intel® SSD DC 53520 Series; 1x one-port, low-profile Intel® Omni-Path Host Fabric Interface Adapter 100 Series (100HFA016LS) x16, PCIe; 24-port Intel Omni-Path Edge Switch 100 Series; 16-port 1 Gbps Ethernet switch. BIOS version: SE5C620.86B.02.01.0009.092820190230, microcode: 0x5000029, CentOS 7.7 (3.10.0-1062.9.1.el7.x86_64), Intel® Cluster Checker 2019 Update 6, compilers_and_libraries_2020.0.166, psxe_runtime_2020. CPU governor set to "performance."

3rd Generation Intel® Xeon® Scalable Processor Configuration: Test by Intel as of 6/11/2021. 4 compute nodes, systems M50CYP25B-003, configuration per node: 2x Intel® Xeon® Gold 6326 processor (16 cores), Intel® Hyper-Threading Technology = ON, Intel® Turbo Boost Technology = ON, total memory 256 GB (16 slots/16 GB/3200 MHz); BIOS version: 21D40, date: 04/13/2021; BMC 2.66, SDR 0.31, CPLD 3p0; uCode: 0x0b000280; CentOS Linux installation ISO (minimal or full) 8 build 2011; storage - boot 1x Intel® SSD DC P4500 (4.0 TB, 2.5 in PCIe 3.1 x4, 3D1, TLC); 1x NIC (management network) Intel® Ethernet Network Adapter X710-DA2 for OCP 3.0 dual @10 GbE, model X710DA2OCPV3; 1x NIC/fabric (high-performance network) Intel® Ethernet Network Adapter E810-CQDA2 dual QSFP28 @100GbE; PCH Intel C621A; network switch: Arista 7170 100 GbE Ethernet (with IEEE 802.1Qbb priority flow control).

Performance varies by use, configuration and other factors. Learn more at [intel.com/PerformanceIndex](https://www.intel.com/PerformanceIndex). 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. Your costs and results may vary. Intel technologies may require enabled hardware, software or service activation. Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy. Intel, the Intel logo, and other Intel marks are trademarks of Intel Corporation or its subsidiaries. Other names and brands may be claimed as the property of others. © Intel Corporation 0921/GMCK/KC/PDF