SOLUTION BRIEF

Simulation-Driven Design Has Never Been Easier

Access a complete HPC design environment in minutes for faster, smarter innovation.

Altair

Simpler and more powerful tools for simulation-based design are helping companies deliver higher quality products on faster timelines.

Simulation-driven design continues to increase in value, helping companies develop better products faster and at lower cost. One driver of this evolution is the availability of simpler and more affordable high-performance computing (HPC) options. Another is the emergence of easy-to-use tools for initial concept development. By providing simulation-driven insights at the earliest stage, these tools can improve the entire development life cycle, reducing the risk of missed milestones and failed prototypes.

Altair and Intel offer a simple, cost-effective on-ramp to a complete simulation-driven design platform. You can start with public cloud solutions to demonstrate value. You can then grow your capability in the public cloud, or you can transition to simple and powerful on-site solutions that give you tighter control over your systems and data.

Whichever path you choose, you gain unlimited access to the full Altair application and workload management portfolio, so you can support all your design and engineering efforts on a single, powerful, and unified platform. Altair and Intel work closely together to deliver optimized performance across a broad range of requirements. Whether you are developing consumer products, aeronautic solutions, or deep-sea oil recovery equipment, you can count on fast access to deep insights that help you achieve smarter designs more quickly and reliably.

Complete Solutions at Every Scale

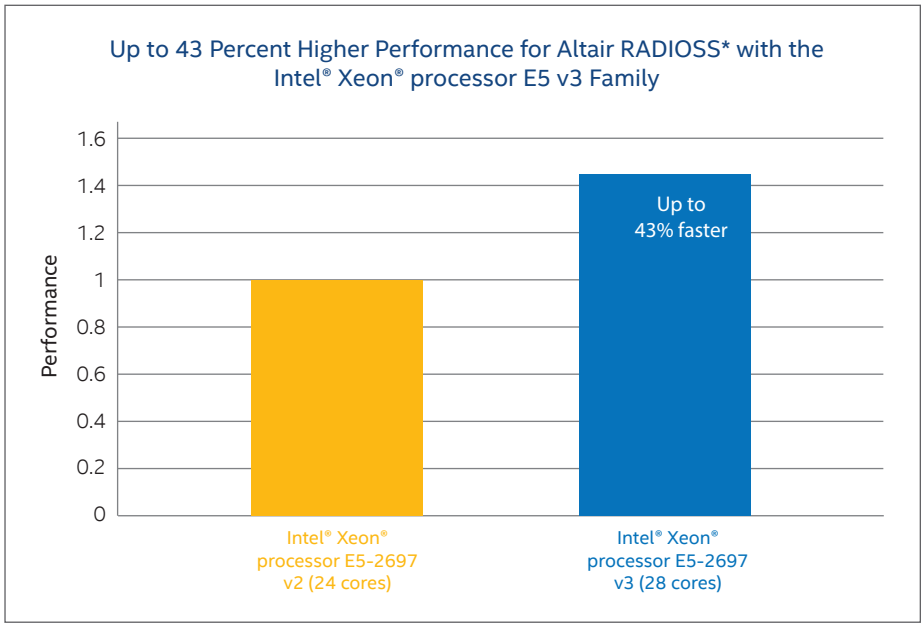
Altair and Intel offer unmatched flexibility for integrating simulation-based design into your workflows using the industry's most comprehensive set of proven software running on validated, high-performing servers, clusters, supercomputers, and clouds.

A Unified Platform for Simulation-Based Design

Altair HyperWorks* provides a complete software platform for computer-aided engineering (CAE) simulation to enable rapid, low-cost, virtual exploration. Your designers and engineers can explore concepts, create models, and then analyze, optimize, and test their designs to develop superior products on faster timelines.

Multiple Altair solvers are available to support static and dynamic analysis across structural, fluid, and electromagnetic domains, and they can be linked for advanced multiphysics analysis and design optimization. Powerful tools within the HyperWorks suite of desktop applications help to simplify pre- and post-simulation work, providing a faster path to deep, usable insights at every stage.

Performance for Altair simulations continues to climb with every new Intel® platform generation. For example, based on Altair benchmark tests, servers based on the latest Intel® Xeon® processor E5 family provide up to 43 percent higher simulation performance than previous-generation systems, which can dramatically improve time to results.[1]



Faster Performance for Complex Simulations. With up to 50 percent more cores, threads, and cache than prior-generation processors, plus faster memory, the Intel® Xeon® processor E5 v3 family can increase performance for Altair simulations by as much as 43 percent.[1]

Advanced Workload Management and Design Study System

Altair PBS Works* provides workload management and job scheduling for HPC resources, with policy-based automation, powerful analytics, and unmatched security. Whether you are running a small business cluster or a global HPC environment, you can simplify administration and optimize scheduling to improve productivity, utilization, and agility.

PBS Works also simplifies sharing for large data sets and provides remote management and visualization tools for superior collaboration among distributed teams. As just one example, the integration of Altair HyperStudy*, a leading design decision system, allows end users to perform design of experiments (DOE), numerical optimization, and other advanced numerical studies seamlessly within the HPC environment. These studies can be launched directly from the applications and visualized using a web-based portal.

Affordable Access to All Altair Applications – and More

Altair's unique licensing model gives your organization instant access to the full range of Altair software—plus dozens of third-party applications that are part of the Altair Partner Alliance (APA)—all at no extra cost. This unique approach fuels exploration and experimentation throughout your organization, while increasing the utilization of your Altair software.

Multiple Paths for Simple, Low-Risk Implementation

Altair and Intel are working together to make simulation-driven design easier for organizations to adopt and scale. A number of high-value options are available today.

HPC in the Cloud

(Powered by the Intel® Xeon® processor E5 v3 family)

The HyperWorks Unlimited* Physical Appliance provides an optimized HPC private cloud that comes preconfigured with the full suite of Altair applications running on the Intel® Xeon® processor E5 v3 family (with up to 1536 total cores per system[2]). These powerful appliances can be wheeled into your data center and made ready for simulations within hours. Since they are leased and fully managed, you have no capital costs, and Altair provides a single-point of contact for all service and support.

Alternatively, you can access a HyperWorks Unlimited Virtual Appliance within minutes through Amazon Web Services (AWS) to meet your HPC requirements. This is an ideal way to demonstrate initial value in your design environment or to provide quick, affordable burst capacity as needed. To help businesses get started with this revolutionary new approach, Altair, Intel, and AWS recently offered the HPC Challenge, providing free access to these resources for qualified applicants (for details, visit http://www.altair.com/hpc-challenge/).

Efficient, Easy to Use HPC Clusters

(Based on Intel® Cluster Ready architecture)

For unlimited scalability and control, you can take advantage of Intel® Cluster Ready architecture to simplify deployment, management, and use of on-site HPC systems. Applications that are certified as Intel Cluster Ready can be counted on to launch and run reliably on any validated cluster of any size.[3] Altair is an award-winning member of the Intel Cluster Ready program and has certified PBS Professional* and all HyperWorks solvers (RADIOSS*, OptiStruct*, AcuSolve*, and FEKO*).

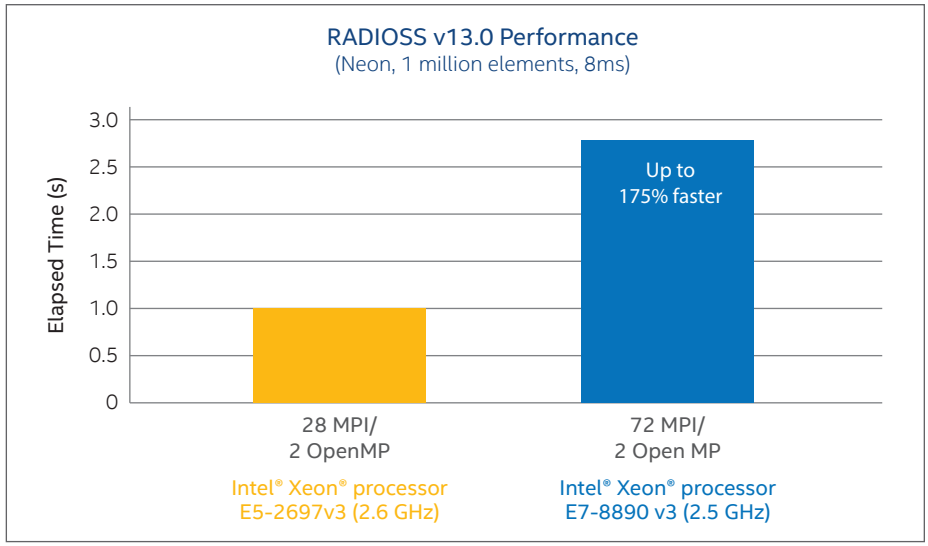
Altair has also validated both of the HyperWorks Unlimited appliances as Intel Cluster Ready. With this support—and with the large ecosystem of supporting vendors[4]—deploying, maintaining, using, and growing an HPC cluster has never been easier. For more information about Intel® Cluster Ready, visit https://clusterready.intel.com/

Single-System Supercomputers

(Powered by the Intel® Xeon® processor E7 v3 family)

Some organizations would like to implement on-site HPC without the complexity and interconnect costs associated with clustered architectures. Large servers based on the Intel® Xeon® processor E7 v3 family provide an option, delivering supercomputing-class performance with single-server simplicity. A single four-socket system provides up to 72 cores and 6 terabytes of memory.

Tests performed by Altair and Intel showed that a four-socket server based on the Intel Xeon processor E7 family can provide up to 2.75 times the performance of a two-socket server based on the Intel Xeon processor E5 family.[5] With eight-socket and larger servers available from leading vendors, this is a powerful option for running large, complex simulations on a single server, without the cost and complexity of multi-node architectures and HPC interconnects.



Supercomputer in a box. Four-socket, eight-socket, and larger servers based on the Intel® Xeon® processor E7 family offer a powerful option for high-performance computing, without the complexity of a clustered architecture.

Expert Consulting Services for Faster Time to Value

Expert guidance can be essential for optimizing simulation-driven design strategies. Altair brings 30 years of experience and global resources to address this need, including more than 800 consulting engineers working in over 45 offices worldwide.

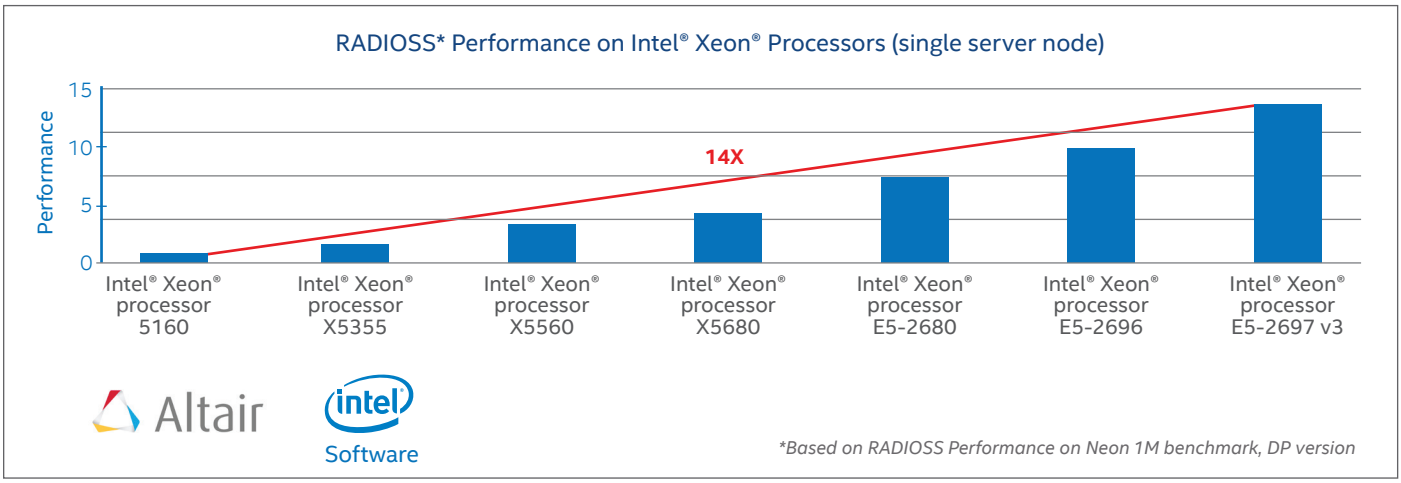
Altair consulting teams offer deep expertise in simulation and HPC across numerous verticals, including the automotive, energy, aerospace, and consumer goods industries. They can help you define a high-value, low-risk path for accelerating your workflows and solving your most critical design challenges. No other vendor provides this depth of expertise and experience in both CAE and HPC.

Breaking Down Barriers through Collaborative Engineering

The computing demands of large, complex simulations are extreme. To deliver fast response times with superior cost models, Altair and Intel work together to optimize performance for each new Intel® Xeon® processor generation. Intel provides pre-launch hardware, along with engineering assistance to identify the most effective strategies for optimizing software code for Intel® architecture.

To maximize the value of these efforts, Altair uses Intel® Parallel Studio XE as a key component of its software development environment. This suite of tools includes Intel® Compilers, Intel® MPI Library, Intel® Math Kernel Library, and a number of additional applications for analyzing and optimizing code more quickly and efficiently. Intel updates these software development tools regularly to take advantage of the latest hardware innovations. By using the most recent versions, Altair gains automatic performance advantages as Intel processor and platform capabilities continue to evolve.

These tools and collaborative efforts have helped Altair increase solver performance per two-socket server by as much as 14 times for Intel Xeon processor-based systems since 2006.[6] They have also helped improve performance on clustered architectures, enabling scalability up to thousands of cores.



Ever-Higher Performance on Intel® Architecture. Through synchronized hardware and software innovation, Altair and Intel have increased performance per server by up to 14 times in just six generations of Intel® Xeon® processors.[6]

DRIVING THE NEXT ERA OF HPC

High-performance computing (HPC) is becoming indispensable in almost every engineering and scientific discipline—and the world is taking note. For example, the United States recently established a national strategic computing initiative (NCSI) to drive more coordinated innovation among industry, academia, and government, with the goal of increasing current HPC performance levels by a factor of 100.

See the Executive Order at:
https://www.whitehouse.gov/the-press-office/2015/07/29/executive-order-creating-national-strategic-computing-initiative

Major New Performance Gains on the Way

To take performance and scalability to even higher levels, Altair and Intel have begun to extend their joint engineering efforts across the broader Intel® solution stack. Most importantly, Altair has done groundbreaking work to support many-core Intel® Xeon Phi™ coprocessors. With up to 61 cores, 244 threads, and 1.2 teraflops of double-precision performance,[7] these coprocessors provide extreme throughput for highly parallel applications.

PBS Professional was one of the first workload managers to support Intel Xeon Phi coprocessors, and, according to Altair, early work with the RADIOSS implicit solver has demonstrated that performance gains of up to 2.5X can be achieved by adding a single coprocessor to a two-socket, 12-core host server.[8] According to Eric Lequiniou, Altair's director of high performance computing, "Through our tight collaboration with Intel, we were able to test first-generation Intel Xeon Phi coprocessors at a very early stage and learned a great deal about how to optimize our solvers for Intel's many-core architecture. We are eager to port our HPC solvers, such as RADIOSS, to the next-generation Intel Xeon Phi processor, which looks really promising for delivering cutting-edge, high performance to our customers."

Delivering Innovation at All Points

Altair and Intel are pioneers in HPC and continue to lead the industry forward to deliver new capabilities, simplify use, and drive ever higher performance. Intel is working to fundamentally transform the building blocks of HPC with a variety of current and future technologies.

- **Next-generation Intel Xeon Phi processors** (code-named Knights Landing) will include integrated high-bandwidth memory and an integrated high-speed fabric. These highly-parallel processors are expected to provide up to three times the performance of current Intel Xeon Phi coprocessors[9] and will be able to function either as coprocessors or standalone processors.
- **Intel® Solid-State Drives, Intel® Manager for Lustre* solutions**, and future **3DXPoint technology** offer extreme performance and value for local and centralized storage, which is essential for taking full advantage of increasing core densities.
- **Intel® True Scale Fabric architecture** offers affordable and higher-performing cluster interconnects across the full range of HPC requirements. Next-generation Intel® Omni-Path Architecture takes these benefits to new heights, enabling cost-effective fabric solutions for tens of thousands of cluster nodes today and hundreds of thousands in the future.

Intel is also integrating more cores and cache into Intel Xeon processors, along with advanced functionality, such as high-speed graphics processing units for fast, interactive visualization from both local and remote locations. Future options will include more powerful vector support and integrated memory and fabric technologies. These innovations will drive ever-higher performance and scalability for optimized software, while helping to reduce total costs through lower power consumption and tighter integration.

Altair is already working with Intel to validate many of these new technologies for Altair environments, and to optimize Altair solvers to turn increasing Intel platform capability into higher-performing simulation tools. With these advances, engineering and design teams will be able to model larger and more complex designs with greater fidelity—and with more coupled physics variables—all while maintaining or even accelerating time to results.

Get Started Today

The power of simulation-based design continues to grow, providing organizations with increasingly valuable insights across the entire product development cycle. Altair and Intel offer exceptionally simple, cost-effective paths to adoption, with unlimited access to the full portfolio of Altair applications and middleware. There has never been a better time, or a better way, to improve and accelerate product development through simulation-driven insight. And you could be up and running in a matter of minutes.

LEARN MORE

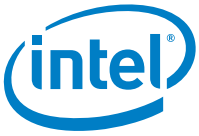
Altair HyperWorks: **www.altairhyperworks.com**

PBS Works: **www.pbsworks.com**

Altair Cloud Solutions: **www.altair.com/cloud**

Intel High Performance Computing Solutions:
www.intel.com/content/www/us/en/high-performance-computing/server-reliability.html

Intel Xeon Phi Software Optimization Resources: **https://software.intel.com/en-us/mic-developer**



[1] Source: Benchmark testing for Altair RADIOSS* running on the Intel® Xeon® processor E5 v3 family versus the Intel® Xeon® processor E5 v2 family using a Chrysler Neon* model car crash 80ms simulation. Baseline configuration: Altair RADIOSS on Red Hat* Enterprise Linux* 6.5 with 2 x Intel® Xeon® processor E5-2697 v2 (12-core, 2.7 GHz), 64 GB of 1866 LVDIMM/regular DIMM memory. New configuration: Altair RADIOSS on Red Hat Enterprise Linux 6.5 with 2 x Intel Xeon processor E5-2697 v3 (18-core, 2.7 GHz), 64 GB of 2133 regular DIMM memory. Tests conducted by Intel as of August 31, 2014.

[2] Due to networking constraints, a single job cannot utilize all the cores in a 1,536-core HyperWorks* Unlimited Physical Appliance. However, two jobs, each running on 768 cores, could run simultaneously,

[3] Some of the world's largest supercomputers have been certified as Intel® Cluster Ready to simplify deployment, management, and use. For an example, see the Intel Cluster Ready case study, "World-Class Supercomputing on a Flexible, Standards-based Cluster" at https://software.intel.com/sites/default/files/40907.pdf

[4] For a list of vendors offering Intel® Cluster Ready certified systems, visit https://clusterready.intel.com/find-platform-suppliers/

[5] Source: RADIOSS* benchmark performed by Altair using a modified, publicly available crash simulation model (1 million elements) of a Chrysler Neon* passenger car. Base platform: Two-socket server with 2 x Intel® Xeon® processor E5-2695 v2 (12 core, 30 MB cache, 2.5 GHz), 128 GB 1600 DDR3 memory. Platform under test: Four-socket server with 4 x Intel® Xeon® processor E7-4890 v2 (15 core, 37.5 MB cache, 2.8 GHz), 256 GB 1600 DDR3 memory. For more information, see the Intel and Altair solution brief at http://www.intel.com/content/dam/www/public/us/en/documents/solution-briefs/xeon-processor-e7-radioss-analysis-solution-brief.pdf

[6] Source: Benchmark testing for Altair RADIOSS* running on the Intel® Xeon® processor E5 v3 family versus the Intel® Xeon® processor 5100 Series using a Chrysler Neon* model car crash 80ms simulation, DP version. Baseline configuration: Altair RADIOSS on Red Hat Enterprise Linux* 4 with 2 x Intel® Xeon® processor 5160, (2-core, 3.00 GHz), 4 x 1 GB of FBD DIMM memory. New configuration: Altair RADIOSS on Red Hat Enterprise Linux 6.5 with 2 x Intel® Xeon® processor E5-2697 v3 (18-core, 2.7 GHz), 64 GB of 2133 regular DIMM memory. Tests conducted by Intel as of December, 2006 and August, 2014, respectively.

[7] The claim of up to 1.2 teraflops of performance per coprocessor is based on Intel calculations of theoretical peak double precision performance capability for a single coprocessor (16 DP FLOPS/clock/core × 61 cores × 1.238 Hz = 1.208 teraflop/s).

[8] Source: Eric Lequiniou, Altair director of high performance computing, in an interview at the SC12 conference in Salt Lake City, Utah, November 28, 2012. View the video at https://www.youtube.com/watch?v=OQ7gFaG_LK4

[9] Next-generation Intel® Xeon Phi™ coprocessors (code-named Knights Landing) are expected to deliver more than 3 teraflops of double-precision performance based on internal and preliminary Intel projections of theoretical double-precision performance measured by Linpack* and on current expectations of Knights Landing's cores, clock frequency, and floating point operations per cycle. They are also expected to deliver three times the single-threaded performance of the current generation, based on projected peak theoretical single-thread performance relative to first generation Intel Xeon Phi coprocessor 7120P (formerly code-named Knights Corner).

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