Performance Brief

Transform Your Workflows

Transform Your Product Development Workflows

With Quad-Core Intel® Xeon® Processor-Based Workstations and ANSYS® 11.0 Software Solutions

Workstations powered by the second-generation Quad-Core Intel® Xeon® processor 5400 series[1] enable users of ANSYS 11.0 software to work differently, doing more work in parallel and delivering superior product designs faster.

1. Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See http://www.intel.com/products/processor_number for details.

Next-Generation Workstation Technology for Your ANSYS® 11.0 Workflows

Intel's advances in quad-core technology raise the bar for compute performance across the computing spectrum. Second-generation Quad-Core Intel® Xeon® processor 5400 series technology delivers up to a 34 percent performance increase over previous quad-core processors on bandwidth-intensive benchmarks.[2] It also provides up to twice as much performance as dual-core Intel processors,[3] and up to five times more performance[4] than the single-core technology that's on many engineers' desktops today.

For workstation users, the latest Intel quad-core technology can put up to 8 cores and upwards of 100 GFLOPS of peak performance at your fingertips;[5] along with two independent 1600 MHz front-side buses and up to 12 MB of on-die Level 2 cache.

What does that mean for you as a user of ANSYS® 11.0 software solutions?

It means great performance on your current ANSYS 11.0 workloads.

It means the ability to run jobs at your desk that previously required a clustered supercomputer—and enjoy great performance while you work interactively on other tasks.

And it means the power to work differently—to perform more work in parallel and evolve from serial to simultaneous workflows. This evolution enhances your personal productivity, while helping you accelerate the development cycle, increase product quality, and improve engineering decision-making.

This performance brief discusses what it means to work differently. Providing an example of how next-generation workstations can transform your workflows and your productivity, it describes benchmarks showing that with two Quad-Core Intel Xeon processor 5400 series powering your engineering workstation, you can:[6]

- Use the ANSYS 11.0 iterative solver to solve a problem with **5.8 million degrees of freedom (DOF) on your workstation** and experience **virtually no impact (less than 1 percent)** as you continue an interactive workload (in this case represented by SolidWorks* 2007).
- **Complete up to 4.4 times more runs per day** on that workload compared to using a workstation with two single-core Intel® Xeon® processors 3.4 GHz (Intel® NetBurst® microarchitecture).

Working Differently to Meet Rising Demands

Who needs to work differently? Who needs this level of performance? Ask practically any company that manufactures complex products for a demanding market. From automotive and aerospace to electronics and consumer products, manufacturing industries are caught in a powerful squeeze play. It's not enough to design more robust and innovative products that meet tougher regulatory requirements. To keep pace with market and business demands, you must also do it faster and at lower cost.

It's hard to keep up if you're using sequential, "design followed by analysis" workflows, particularly given the number of iterations required to create today's increasingly sophisticated products.

That's why ANSYS, Inc., a global innovator of simulation software and technologies designed to optimize product development processes, is making Simulation Driven Product Development™ a reality. The ANSYS 11.0 software portfolio tightly integrates and iterates the design/analysis process for maximum efficiency. Using this software portfolio from ANSYS, you can employ an interactive feedback loop in which analytical results influence the design earlier in the development cycle.

2. Based on measured result on SPECfp_rate2006* benchmark. SPEC binaries built with Intel® Compiler 10.1 for 64-bit Linux* Servers are configured with 64-Bit SUSE Linux Enterprise Server* 10 and 16 GB (8x2 GB) of memory. Intel® server pre-production platform with two Quad-Core Intel® Xeon® processor X5365 (3.00 GHz) w/ 2x4M L2 Cache, 1333 MHz FSB, 5000p "Blackford" Chipset. All measurements use FB DDR2-667 MHz memory. Intel server pre-production platform with two Quad-Core Intel® Xeon® processor X5472 (3.0 GHz) w/ 2x6M L2 Cache, 1600 MHz FSB, 400 "Seaburg" Chipset. All measurements use FB DDR2-800 MHz memory.
3. Dual-Core Intel® Xeon® processor 5100 Series ("WDC"). Up to 119% (2.19x) higher performance X5460 vs 5160 –published/measured results on SPECjbb2005* – Oct 2, 07.
4. Single-Core 64-bit Intel Xeon processor 3.80GHz. Up to 443% (5.43x) higher performance X5460 vs Xeon 3.80 - published/measured results on SPECint_rate_base2006* – Oct 2, 07.
5. Two processors * 4 cores * 4 floating point operations/sec * frequency; 2*4*4*3.2 = 102.4 peak GFLOPS.
6. Tests performed November 7, 2007 by Intel. See the last page of this document for benchmark description and configuration information.

It's why Intel drives its processor technologies to continue fulfilling Moore's Law. And it's why Intel and ANSYS, Inc. collaborate closely to ensure optimal solutions for engineering design and analysis.

Running ANSYS 11.0 software solutions on the latest Intel quad-core-based workstations amplifies the benefits of Simulation Driven Product Development. Together, these technologies give you a variety of ways to change your workflow and your productivity—and transform product development.

The Power to Work Differently

By combining ANSYS 11.0 software with the revolutionary performance of Quad-Core Intel Xeon processor 5400 series-based workstations, engineers and designers can increase design optimization, enhance innovation, accelerate time to market, and drive costs out of product design and manufacturing. If you're an engineer, you can use Intel quad-core technology to transform your desktop into a virtual design optimization laboratory. If you're an analyst, you can locally run large-scale finite element analysis that, just a few years ago, would have required a large cluster or supercomputer.

Using software from ANSYS with a workstation based on two Quad-Core Intel Xeon processor 5400 series, you can:

- Run larger ANSYS simulations locally, increasing accuracy and reliability and enhancing throughput.
- Simultaneously preprocess and postprocess models while also solving a previous model.
- Perform more analyses in same amount of time, to improve throughput and optimize your designs.
- Check larger models before sending them to a cluster, improving productivity and time-to-solution and relieving strain on departmental resources.

With the outstanding performance and memory capacity of an Intel-based quad-core workstation, you can also multitask far more effectively, working differently by running multiple applications in parallel on your workstation. You might run ANSYS® Mechanical™ software alongside other design, simulation or office productivity applications. Or run the ANSYS solver in the background as you interactively visualize your analytical results, generate a video to communicate the results to vendors or team members, or perform office duties such as e-mail, word processing, and spreadsheets.

Intel's multi-core performance means you enjoy great interactivity and responsiveness as you perform these tasks in parallel. The potential business impact can include faster design decisions, leading to higher-quality designs in less time with lower risk of failures, greater innovation, and lower design cost.

Performing design and analysis in parallel on new Intel quad-core technology delivered the ability to accomplish up to 4.4 times more jobs per day with minimal decline in responsiveness for the interactive workload.[7]

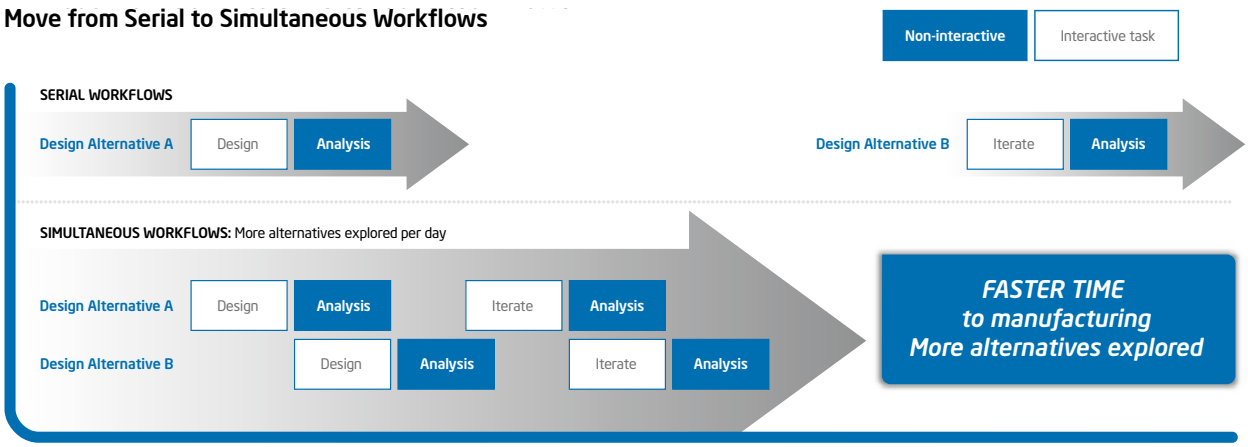


Figure 1. Adding more computing cores lets you interleave design and analysis—to shorten overall development time and generate more robust designs.

7. Tests performed in November 7, 2007 by Intel. See the last page of this document for benchmark description and configuration information.

Putting Performance to the Test

Intel and ANSYS, Inc. collaborated to demonstrate how workstations built on the Quad-Core Intel Xeon processor 5400 series would empower ANSYS 11.0 users to deliver more work in less time by working differently.[8] Clearly, the new technologies should speed up performance compared to earlier solutions, but by how much? How big an improvement would we see performing an analytical and design workload in serial, sequential fashion on older and newer processor technology? What further speedup would we get when we performed that workload simultaneously? And how would the analytical process impact the responsiveness of our interactive workload when we ran them simultaneously?

Reflecting the opportunities to work differently during the product development cycle, we chose a workload that consisted of design and analysis tasks and that could be represented by widely used benchmarks. To represent an interactive design workload, we used the SPECapc* benchmark for SolidWorks 2007. For analysis, we used the ANSYS Mechanical Distributed Benchmark 5 (BMD5), part of the standard ANSYS benchmark set. This benchmark solves a static structural analysis with 5.8 million degrees of freedom using the ANSYS 11.0 Preconditioned Conjugate Gradient (PCG) iterative solver.

Many product developers still use workstations based on older, single-core Intel Xeon processor technology and Intel NetBurst microarchitecture, so we compared an HP xw8200* workstation with two single-core Intel Xeon processor 3.40 GHz (code-named Nocona), with an HP xw8600* workstation powered by two Quad-Core Intel Xeon processor 5400 series. Figures 2 and 3 illustrate our results. Tests were performed November 7, 2007 by Intel. For more detailed benchmark description and configuration information, see the last page of this document.

Breakthrough Performance with the Newest Quad-Core Intel® Xeon® Processor Technology

Since early 2006, workstations based on multi-core Intel® processor technology have provided breakthrough performance and energy efficiency for a wide range of workstation applications. Now, the newest quad-core processors, built with Intel's 45nm manufacturing technology, take performance to the next level.

Leveraging enhanced Intel® Core® microarchitecture, workstations based on the 45nm Quad-Core Intel Xeon processor 5400 series help you transform complex data into actionable information faster than previous Intel Xeon processor-based solutions, freeing you to simulate more, discover faster, and innovate more creatively.

Optimized for multi-tasking environments, these next-generation workstations feature a 1600 MHz front-side bus, dual x16PCIe* second-generation graphic support, and clock speeds of up to 3.2 GHz. Intel Core microarchitecture has been enhanced with 47 new Intel® Streaming SIMD Extensions 4 (SSE4) instructions, designed to help improve the performance of high-performance computing and media applications. With more cores, a larger L2 cache, and enhanced dynamic execution engines, you can render faster, analyze and display more data with higher fidelity, and speed visual comparison.

Serial to Serial: 2.6x More Jobs per Day

The left side of Figure 2 shows the results of running the workload serially (design followed by analysis) on both workstations. It shows that the newest Quad-Core Intel Xeon processor 5400 series provided a significant speedup, allowing our hypothetical user to accomplish **2.6 times more runs over the course of an 8-hour day.**

Serial to Simultaneous: An Additional 40 Percent More Jobs per Day

Figure 2 also shows that shifting to a simultaneous workflow and performing design and analysis in parallel provides an even more dramatic productivity benefit. On the older, two-core workstation, the simultaneous workflow produces a speedup of just 7 percent. The newest Intel quad-core technology provides the performance to work differently, producing an **additional 40 percent speedup** in the simultaneous workload. This results in the ability to accomplish **4.1 times more jobs per day** over the serial performance of the 8200 workstation and **4.4 times more jobs per day** than the serial workflow on the older workstation.

Impact on Interactive Performance: Negligible

A workstation is primarily an interactive tool, so we wanted to see how much performance impact our hypothetical user would experience on his or her interactive workload as the CPG solver ran in the background. Figure 3 shows those results. On the older workstation with two-processor, single-core technology, the solver slowed interactive performance by 5 percent. On the workstation with two Quad-Core Intel Xeon processor 5400 series technology, the impact was less than one percent—small enough to be considered noise.

Together, the tests demonstrate the ability to **run complex jobs simultaneously and interactively on a quad-core workstation without having the background task impact system responsiveness.**

8. Tests performed November 7, 2007 by Intel. See the last page of this document for benchmark description and configuration information.

Figure 2. Accelerate ANSYS® 11.0 and SolidWorks* 2007 Performance on a Quad-Core Intel® Xeon® Processor 5472-Based Workstation Supercomputer

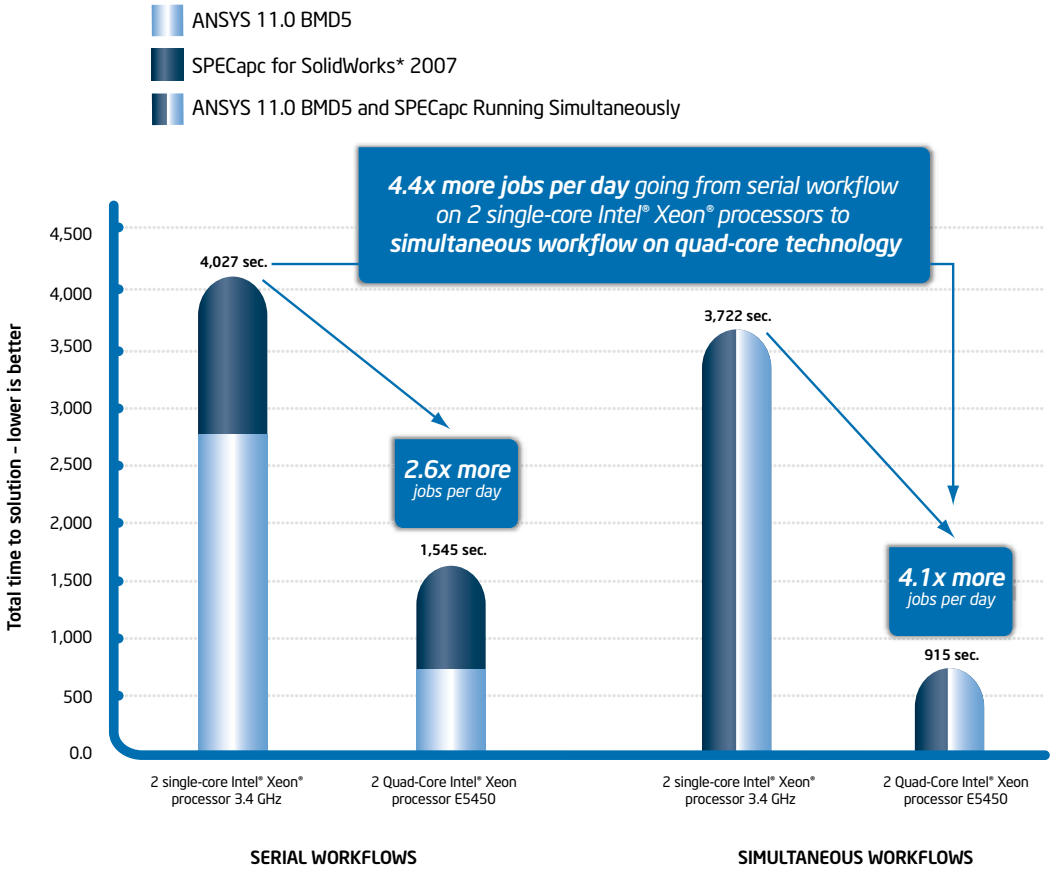


Figure 2. . Simultaneous workflows on the Quad-Core Intel Xeon processor 5400 series made it possible to complete 4.4 times more jobs per day than when running the same workload serially on a two-processor single-core Intel Xeon processor. (See the last page of this document for benchmark description and configuration information. Tests performed November 7, 2007 by Intel.)

Figure 3. Maintain Interactive Performance While ANSYS® 11.0 Solves a 5.8 M DOF Problem

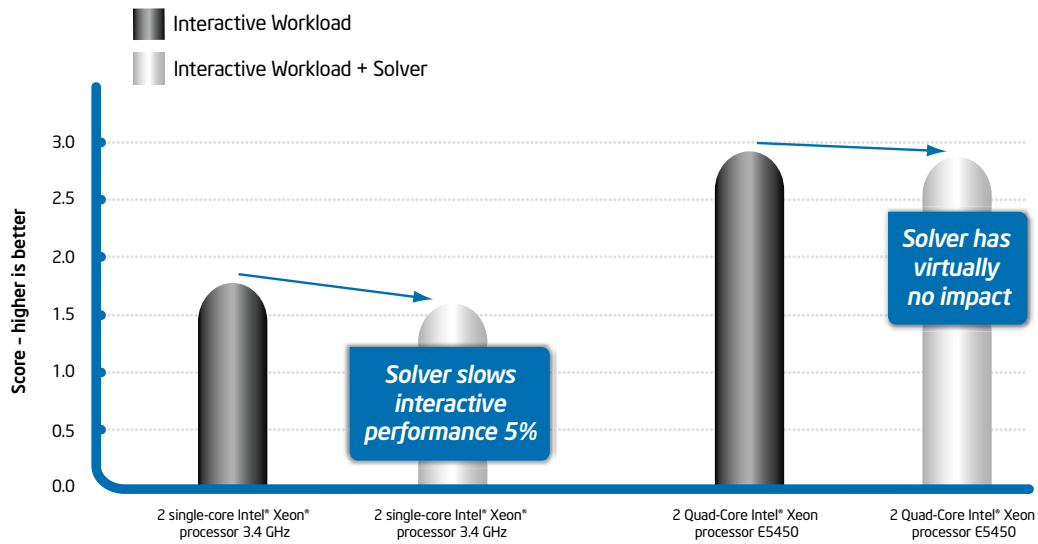
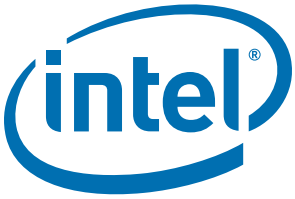


Figure 3. The Quad-Core Intel Xeon processor 5400 series maintains interactive performance even when solving a problem with 5.8 million degrees of freedom. (See the last page of this document for benchmark description and configuration information. Tests performed November 7, 2007 by Intel.)



www.intel.com

Superior Designs, Faster and at Lower Cost

Software solutions from ANSYS and workstations powered by the Quad-Core Intel Xeon processor 5400 series can help your engineering organization stand up to the demands of challenging CAD/CAM modeling environments. With outstanding performance and flexibility, you can run more ANSYS jobs in parallel and perform significant analysis and simulation in the background while maintaining productivity on interactive tasks. This evolution from serial to simultaneous processing can help your engineering organization:

- **Deliver superior product designs** by exploring more innovations in features and functions in a given timeframe.
- **Improve time to market** by performing analysis faster and earlier in the product development lifecycle.
- **Reduce product development costs** by getting the design right earlier in the process, avoiding last-minute fixes that drive up costs and introduce delays.

Talk to representatives of Intel and ANSYS, Inc. today to learn more about how efficient and scalable computer-aided engineering simulation solutions from ANSYS, running on workstations powered by the Quad-Core Intel Xeon processor, can help you transform your workflows, accelerate productivity, and deliver a competitive advantage. And visit us on the web at:

www.intel.com
www.ansys.com

Relative performance for each benchmark is calculated by taking the actual benchmark result for the first platform tested and assigning it a value of 1.0 as a baseline. Relative performance for the remaining platforms tested was calculated by dividing the actual benchmark result for the baseline platform into each of the specific benchmark results of each of the other platforms and assigning them a relative performance number that correlates with the performance improvements reported.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, reference http://www.intel.com/performance/resources/benchmark_limitations.htm or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

64-bit computing on Intel architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel® 64 architecture. Processors will not operate (including 32-bit operation) without an Intel® 64 architecture-enabled BIOS. Performance will vary depending on your hardware and software configurations. Consult with your system vendor for more information.

Benchmark Description and Configuration Information

Performance comparison of two Quad-Core Intel Xeon processor X5460 (3.16 GHz, 12 MB L2 cache, 1333 MHz FSB, 45nm) compared to two Intel Xeon processor 3.40 GHz with 800 MHz bus on the manufacturing workflow of SPECapc SolidWorks 2007 and Ansys 11 BMD5 analysis run five times either serially or in parallel (working differently). Actual performance may vary.

Benchmark description for manufacturing workflow #2: SPECapc for SolidWorks 2007 is an interactive benchmark comparing graphics, I/O, and CPU-centric components; results are reported as time and normalized score. ANSYS 11 is a structural analysis software package with standard distributed benchmarks available to download. The BMD5 PCG solver is used and run either after the SolidWorks* interactive component or—for the working differently scenario—in parallel. Results are reported as Elapsed Time and are converted to jobs/day using the 28,800 seconds in an 8-hour day divided by the Elapsed Time for a throughput metric where higher is better. Benchmark depicted in Figure 3 uses the SolidWorks* 2007 best score on SPECapc workload responsiveness. Results measured by Intel, November 2007.

System configuration details:

- Intel Xeon 3.40 GHz: HP xw8200 workstation using two Intel Xeon processor 3.40 GHz (single core) with 800 MHz bus (formerly code-named Nocona), 4 GB DDR-400 memory, NVIDIA* Quadro* FX1300 graphics, Microsoft Windows* XP Professional SP2.
- Quad-Core Intel Xeon 5472 (3.16 GHz): Intel 5400 Chipset reference workstation using two Quad-Core Intel Xeon processor 5472 (3.16 GHz, 12 MB L2 cache, 1333 MHz FSB, 90nm), 8 GB FBD-667 memory, NVIDIA* Quadro* FX4500 PCIe x16 graphics, Microsoft Windows* XP Professional x64-Edition SP2.

Printed in the United States. 0408/WES/HBD/PG/50 319642-001US