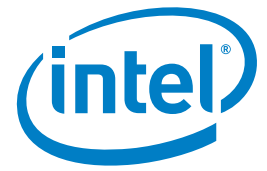


CASE STUDY

Intel® Xeon® Processor E5-2690

Intel® Xeon Phi™ Coprocessor

High-Performance Computing



Breaking records

Russian Joint Supercomputer Center raises the bar for performance and energy efficiency with Intel® Xeon Phi™ coprocessors

The Joint Supercomputer Center (JSCC) of the Russian Academy of Science was founded in 1999, with branches in St. Petersburg and Kazan. It is one of the most powerful supercomputing centers in Russia, providing high-performance computing (HPC) services to the scientific and educational communities. Leading local HPC solution provider RSC Group (www.rscgroup.ru/en) deployed an MVS-10P* supercomputer, based on RSC Tornado* architecture with the highest-performing Intel® Xeon® processor E5-2690 and Intel® Xeon Phi™ coprocessors, to help the JSCC offer its scientists the best computing tools. This is a prototype of a 10 petaflop-range supercomputing system that JSCC plans to build in the near future. The platform has set several records for Russia and the Commonwealth of Independent States (CIS), including for energy efficiency, which reached 1,949 megaflops per watt, 5.5 times better than the previous energy-efficiency record for the region. According to the worldwide Green500 list, JSCC's new HPC system is the most energy-efficient supercomputer in Russia/CIS, being ranked 30th overall (November 2012). It is the largest Intel Xeon Phi coprocessor-based system outside the U.S. to date.



“The powerful new supercomputer triples the performance of JSCC’s computing environment, enabling us to achieve unique levels of performance, energy efficiency and manageability. At the same time, we’re supporting research and helping JSCC solve urgent and fundamental scientific problems to further develop the scientific and economic potential of Russia.”

Gennady Savin,
Academician,
RAS Presidium Member,
RAS JSCC General Manager

CHALLENGES

- **Keep up with demand.** Large user base of scientists and researchers puts constant pressure on supercomputing team to deliver increasing levels of performance
- **Cut costs.** Anticipating huge advances in computing scalability, JSCC wanted to minimize energy consumption, data center space and total cost of ownership (TCO) while providing high computing performance and energy efficiency

SOLUTIONS

- **Pioneering platform.** RSC Group deployed a prototype of a 10-petaflop-range supercomputing platform based on the latest generation of the innovative RSC Tornado architecture with direct liquid cooling
- **Powerful components.** The platform features 208 nodes of Intel® server boards S2600JF, 3,328 cores of Intel Xeon processors E5-2690 and 25,376 cores of Intel Xeon Phi coprocessors; 24.8TB of storage using Intel® Solid State Drives (Intel® SSDs) and Fourteen Data Rate (FDR) Infiniband* interconnect technology

IMPACT

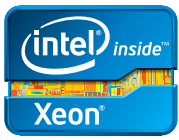
- **Performing well.** Current peak performance of the new JSCC prototype supercomputer is 523.8 teraflops, having delivered 375.7 teraflops in the LINPACK* benchmark test¹
- **Power savings.** Energy efficiency is 5.5 times better than the previous best in the Russia/CIS region, with energy costs cut by 60 percent
- **Big savings.** The platform’s TCO has been reduced by 25 percent

Ambitious goals

The JSCC tasks itself with delivering the very best computing resources in the region to its users. Its main objectives are:

- To provide modern computing resources to support scientific research in the Russian Academy of Sciences
- To offer methodologies to researchers who need high-performance computing systems and information-processing tools
- To equip users with access to modern digital libraries, archives and databases
- To perform system and application software development research, as well as solving highly complex scientific and research tasks

Over 100 scientific organizations use JSCC’s computing services, in addition to 181 research groups working on over 900 projects. This large user base constantly needs more computing performance to meet its needs, and JSCC urgently needed a new HPC platform to accommodate them, both now and in the future. At the same time, the organization must do what it can to save the space, power and costs associated with running its data center.



Leading Russian supercomputing center boosts performance and cuts TCO with Intel® technology

A groundbreaking platform

To achieve its objectives of increasing performance while cutting TCO, JSCC chose a powerful computing system based on 416 high-performing Intel Xeon processors E5-2690 (eight cores at 2.9 GHz each) and over 416 Intel Xeon Phi coprocessors (61 cores each), with connectivity provided by Fourteen Data Rate (FDR) Infiniband technology. The new platform is one of the best-performing² computing systems in the Russia/CIS region, achieving 375.7 teraflops in the LINPACK benchmark test. JSCC found the pairing of Intel Xeon processors E5 family and Intel Xeon Phi coprocessors to be the best platform for achieving advanced price/performance and performance/power ratios. It also valued the ability to use the same software development tools and methods with no need to redesign or rewrite the codes of its many existing applications.

The solution was based on the innovative RSC Tornado architecture from RSC Group, which uses advanced direct liquid cooling for precision heat removal to extend the service life of electronic components and increase fault tolerance across the whole solution. This has enabled JSCC to achieve the industry's highest computing density of 141 teraflops per m³ (or 181 teraflops

per 80x80cmx42U rack) – 3.8 times higher than the previous world record for x86 architectures.

This high density is essential for exaflop-range supercomputers like that at JSCC, which consist of hundreds of racks, each consuming over 100kW of power. The unique power and performance density achieved by the new RSC Tornado-based platform has proved the technical feasibility of building high-performance systems with the characteristics needed by these large-scale computing platforms.

The use of the Intel Xeon processors E5-2690 and Intel Xeon Phi coprocessors, together with the advanced direct liquid cooling system, has delivered energy cost savings of up to 60 percent. The energy efficiency of the new JSCC supercomputer – at 1,949 megaflops per watt – has broken the Russian record, showing a 5.5 times increase over the previous one. In total, when running at a peak performance of 523.8 teraflops, the new platform consumes just 222kW of power. The absence of moving parts, such as fans and traditional hard disk drives (Intel SSDs are used instead), makes the supercomputer virtually noiseless and prevents vibration, which significantly increases the system's reliability.

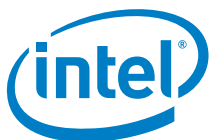
Lessons learned

Being ready for the challenges of tomorrow as well as those faced today is important in ensuring the continued success of any research institution. Knowing that the ongoing evolution of scientific research will drive demand for exaflop-range supercomputing platforms, JSCC has equipped itself to keep up. By implementing an energy-efficient HPC cluster, it has created a sustainable model for driving intensive scientific research over the long term.

The new supercomputer at JSCC is also equipped with RSC ECOsystem* technology for flexible power and energy management. This has helped reduce the TCO of the supercomputing platform by 25 percent.

The powerful new supercomputer has tripled the performance of JSCC's computing environment, enabling it to achieve unique levels of performance, energy efficiency and manageability. At the same time, it is supporting research and helping JSCC solve urgent and fundamental scientific problems to further develop the scientific and economic potential of Russia.

Find the solution that's right for your organization. Contact your Intel representative, visit Intel's Business Success Stories for IT Managers (www.intel.co.uk/Itcasestudies) or explore the Intel.co.uk IT Center (www.intel.co.uk/itcenter).



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¹ Intel does not control or audit the design or implementation of third party benchmark data or Web sites referenced in this document. Intel encourages all of its customers to visit the referenced Web sites or others where similar performance benchmark data are reported and confirm whether the referenced benchmark data are accurate and reflect performance of systems available for purchase.

² 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 <http://www.intel.com/performance>

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