# Case Study
## Northern (Arctic) Federal University

»We are delighted that the university now has a powerful tool for high-performance computing. There are not many universities in Russia that can boast computer systems of this level. The supercomputer, built on Fujitsu server solutions, will be primarily designed for training undergraduates and masters students and will also help in complex scientific research«

**Professor Elena Kudryashova, Rector of the M.V. Lomonosov, NARFU**

### The customer

Country: Russia
Sector: Higher education
Founded in: 2010
Website: www.narfu.ru

### The challenge

The M.V. Lomonosov NARFU was in need of a computing system to perform complex scientific research in mathematics, informatics and space technologies.

### The solution

The university heads decided to create an additional computer cluster in their data center, the basis of which was formed by server solutions from the world's leading vendors. The department for programming and high-performance computing of the Institute of Mathematics, Information and Space Technologies, NARFU, was the initiator of the purchase, choosing servers and data storage systems by Fujitsu. Fujitsu's rich Russian and international experience in the building of such clusters served as the decisive factor in the final choice of supplier for the equipment to be used in the project.

### The customer

The M.V. Lomonosov Northern (Arctic) Federal University (NARFU) is a new research and educational innovation center in the Russian system for higher professional education. It was founded by Russian Federation Presidential Decree No. 1172 of 21 October 2009 and began operating in June 2010 when its Certificate of State Registration was received. NARFU trains specialists in engineering, technical, mathematical, natural science and humanities subjects. The scientific potential of the university includes 114 doctors, 787 candidates of science, 14 PhD students, 333 postgraduates and 436 masters' students.

The strategic objective of NARFU is to ensure innovative scientific and human resources support for protection of Russia's economic interests in the North Arctic region, by creating a system of continuous professional education, integration of education, science and production and strategic partnerships with the business community.

### The challenge

NARFU was in need of a computing system to perform complex scientific research in mathematics, informatics and space technologies. The university heads decided to create an additional computer cluster in their data center, the basis of which was formed by server solutions from the world's leading vendors.

When choosing a supplier to build its supercomputer, NARFU set strict requirements on power, quality and reliability of components, required to create the computing cluster.

### The solution

Fujitsu specialists created a cluster that includes 20 computing nodes (PRIMERGY servers), two management servers, a data transfer network and ETERNUS DX data storage systems. The latest computer architecture is based on Intel Xeon Phi coprocessors. In addition to the hardware, a graphic cluster management interface and a FEFS (Fujitsu Exabyte File System) parallel file-based data storage system was introduced, both developed by Fujitsu.

## The benefit

- Effective horizontal scaling
- A reduction in energy consumption and a drop in operating expenditure
- Backup of components and RAID-based protection ensure enhanced reliability
- A flexibility in memory configuration means that the system can be used for the most varied of application fields
- Coprocessor support increases the performance of every server node in the HPC computing environment by a factor of 10
- Increased input-output throughput capacity by 60% compared with systems of the previous generation

## Products and services

- FUJITSU Server PRIMERGY RX300 S8, CX250 S2, CX270 S2
- FUJITSU Storage ETERNUS DX80 S2

During the course of the project, 12 computing nodes were launched on the basis of PRIMERGY CX250 S2 servers, and eight nodes on PRIMERGY CX270 S2 servers with Intel Xeon E5-2680 v2 (2.8 GHz) processors 64 GB RAM. Eight Intel Xeon Phi 5110P coprocessors were installed in the PRIMERGY CX270 S2 servers. The Intel coprocessors make the servers in the PRIMERGY CX270 series the ideal choice for such application areas as the processing of large volumes of scientific data, modelling complex natural and anthropomorphic systems, processing signals and other tasks that require the use of high-performance computations.

The computing nodes are united into a single complex using InfiniBand switch systems and they provide access to ETERNUS DX80 S2 data storage systems through the PRIMERGY RX300 servers. Cluster management is also performed using two PRIMERGY RX300 servers. They have a rapid system for automatic recovery and flexible allocation of available resources to IT services on demand.

In the event of any faults, the ETERNUS data storage system protects valuable information resources, implementing remote copying of data onto other RAIDs. The ETERNUS DX80 S2 data storage system has FC, FCoE, iSCSI or SAS interfaces, which can be applied in the course of operation, while the new FCoE 10 Gbps interface facilitates the easy merging of different infrastructures. For the simultaneous connection to various types of networks, the ETERNUS DX80 S2 system may use interfaces in a mixed configuration.

### The benefit

Practical lessons on the computer commenced in March 2014. Active work is underway with the institutes of NARFU on training for work on the supercomputer. The university's Centre for Innovative Training of the Institute of Mathematics, Information and Space Technologies (IMIKT) has organized a number of workshops for the Institute of Shipbuilding and Marine Arctic Equipment (packages for high-performance computing). Furthermore, the team in the department for programming and high-performance computing has drawn up a program of further education courses - "Application of Supercomputer Technologies". The IMIKT, NARFU, is implementing this program as part of the international scientific and practical school for young people, "High-performance Computing on Grid Systems".

### Conclusion

The supercomputer, built on the basis of Fujitsu solutions, will help the university to conduct scientific research in applied mathematics, information and space technologies and will enable the development of in-depth mathematical models, which more accurately describe the objects of the real world.

"The arrival of a supercomputer at the university opens up new potential for the development of scientific research work for teachers and students alike. We are working actively to master its capabilities, holding lectures and master classes on working with high-performance computations and in future we plan to increase the number of lines of scientific activity in which the resources of the supercomputer may be deployed."

Olga Yufryakova, Director of the Centre for Innovative Training at the M.V. Lomonosov, NARFU

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