# SKIF supercomputer series

First established in 2000, "SKIF" supercomputers were developed as a joint effort of Russian and Belarus scientists and engineers. 16 supercomputer samples were created in the years 2000 to 2004 during implementation of the SKIF project and over 60 installations were produced in the following period (2005–2007). SKIF supercomputers match technical capabilities of world-class high-performance computers, and even surpass them.

For example:

- **December 2007:** SKIF MSU supercomputer construction has been initiated, utilizing the most dense blade server technology for x86 64 processors, giving SKIF MSU 17% advantage in terms of FLOPS/rack ratio. SKIF MSU projected performance is 60 TFlops.
- **February, 2007**: According to independent review, the SKIF Cyberia supercomputer outperformed number of modern supercomputers (Cray XD1, HP XC, IBM p5-575 (Power5), SUN X2100):
  - the best (+8..13%) (coefficient of efficiency) = Linpack/Peak;
  - the best (x1,5..2) scalability (STAR-CD).
- **November, 2004:** SKIF K-1000 ranked the first in TopCrunch (collision of 3 cars)**.**

Most of supercomputers developed in Russia and ranked on the TOP500 list are the supercomputers of the SKIF family

Lipack, Gflops

Legend: Top1, Top10, Top100, Top200, Top300, Top400, Top500, Made in Russia →
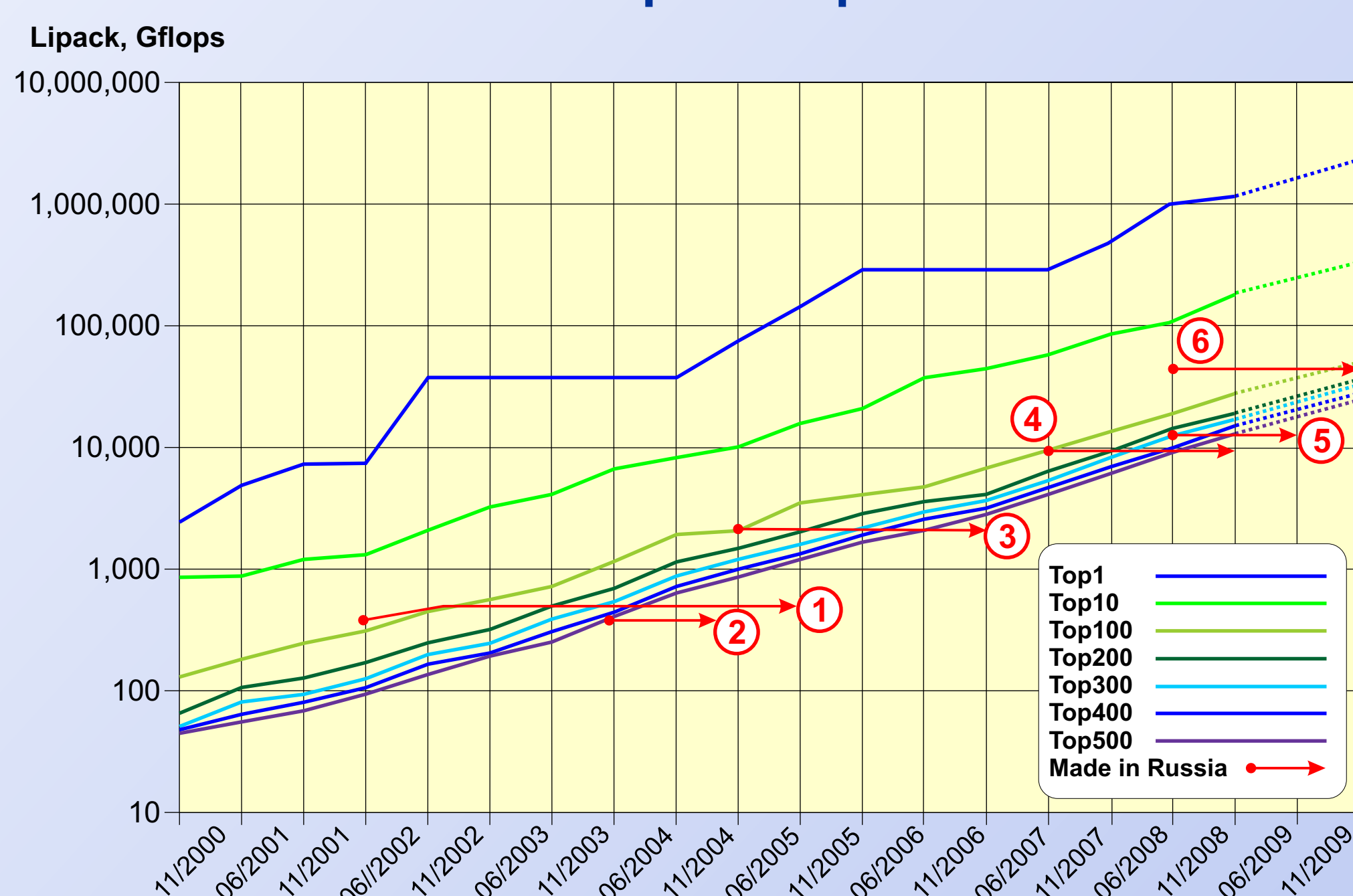
MBC1000M (2002)
- Peak/Linpack — 1,024/0,734 Tflops.
- Number of nodes/CPU — 384/768.
- Processor type — Alpha Ev67 667 MHz.
- Developers: Federal Government Unitary Enterprise "KVANT", M.V.Keldysh Institute of Applied Mathematics of the RAS, Joint Supercomputing Center of Russia.

SKIF K-500 (2003)
- Peak/Linpack — 0,717/0,423 Tflops.
- Number of nodes/CPU — 64/128.
- Processor type — Pentium IV Xeon 2,8 GHz.
- Developers: United Institute of Informatics Problems of the National Academy of Sciences of Belarus, Computer Research Institute "NIIEVM", Program Systems Institute Russian Academy of Sciences (PSI RAS), T-Platforms.

SKIF K-1000 (2004)
- Peak/Linpack — 2,534/2,032 Tflops.
- Number of nodes/CPU — 288/576.
- Processor type — Opteron 248 2,2 GHz.
- Developers: United Institute of Informatics Problems of the National Academy of Sciences of Belarus, Computer Research Institute "NIIEVM", PSI RAS, T-Platforms.

SKIF Cyberia (2007)
- Peak/Linpack — 12,002/9,013 Tflops.
- Number of nodes/CPU — 282/564.
- Processor type — Intel Xeon 5150 2,667 GHz.
- Developers: T-Platforms (PSI RAS partner).

SKIF Ural (2008)
- Peak/Linpack — 15,936/12,2 Tflops.
- Number of nodes/CPU — 166/332.
- Form factor of the node — blade.
- Processor type — Intel Xeon E5472 3,0 GHz.
- Developers: T-Platforms (PSI RAS partner).

SKIF MSU (2008)
- Peak/Linpack — 60/47,17 Tflops.
- Number of nodes/CPU — 633/1250.
- Form factor of the node — blade.
- Processor type — Intel Xeon E5472 3,0 GHz.
- Developers: — PSI RAS, T-Platforms, Moscow State University.

## The SKIF-GRID is a Scientific and Technical Project of the Union of Russia and Belarus

The SKIF-GRID Project goal is to foster development of original technologies of high-performance computing in Russia and Belarus. The Project has been launched in 2007, it's planned duration is 4 years.. The Project is comprised of four directions: grid technologies, supercomputers, security and pilot High Performance Computing application projects.

The lead organization of the Project on the Russian side is the Program Systems Institute of the Russian Academy of Sciences (PSI RAS); from Belarus' side it is United Institute of Informatics problems of the National Academy of Sciences of Belarus (UIIP NAS of Belarus). The Project is being implemented by collaboration of more than 20 research and engineering organizations.

Grid technologies

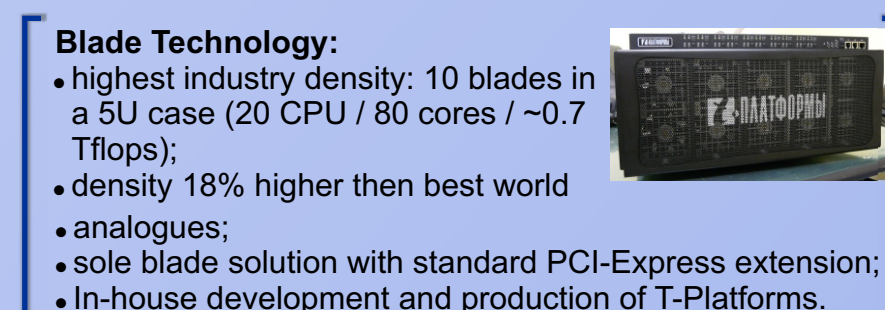**Middleware software, software organizing grid compu-ting, grid database, etc.**
- RDIG gateway — SKIF Testbed — Skobeltsyn Institute of Nuclear Physics of Moscow State University.
- Monitoring, resources accounting — Joint Institute for Nuclear Research.
- SKIF@Home — PSI RAS.
- OpenTS for distributed heterogeneous environments — PSI RAS.
- DVM for distributed heterogeneous environments — M.V.Keldysh Institute of Applied Mathematics of the RAS.
- CDM-based data storage service — Geophysical Center of the Russian Academy of Science.
- Grid beans for engineering packages — South Ural State University.
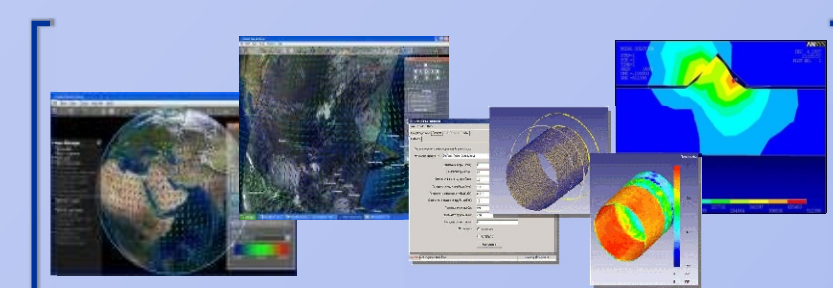
SKIF supercomputer of Series 3 and 4

Hardware. Modules, components, hardware solutions of SKIF supercomputers.
- Original blade solutions, cooling infrastructure, power supply, data storage — T-Platforms.
- Digital signal processing modules — "Elvees" SPC.
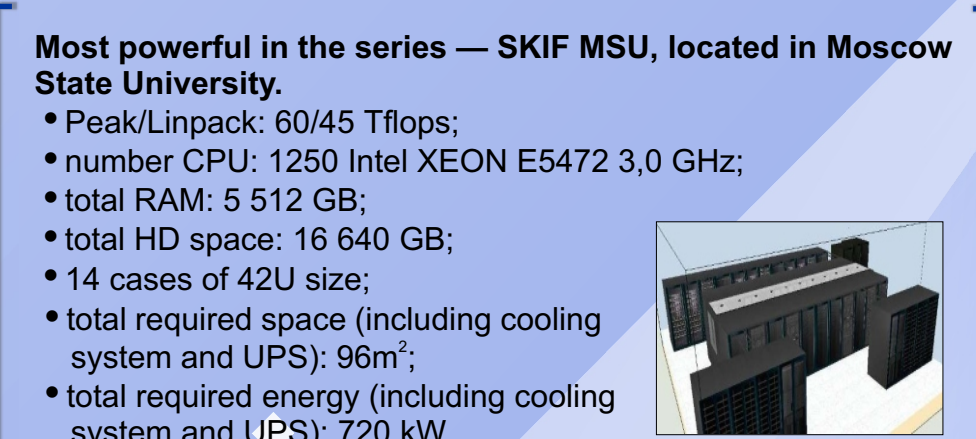- Accelerators and modules of non-standard architecture.

Blade Technology:
- highest industry density: 10 blades in a 5U case (20 CPU / 80 cores / ~0.7 Tflops);
- density 18% higher then best world analogues;
- sole blade solution with standard PCI-Express extension;
- In-house development and production of T-Platforms.

Base software stack. Software of SKIF supercom-puters: OS, distribution kit, administration means, means for development of application software.
- SKIF software distribution kit — "ALT Linux" Ltd.
- Parallel program performance analysis tools — Research Computing Centre of Moscow State University.
- DVM for SKIF supercomputers — M.V.Keldysh Institute of Applied Mathematics of the RAS.
- OpenTS & T-Sim for SKIF supercomputers — PSI RAS.

Prototype SKIF supercomputers of
- 2007 - 2008: MSU SKIF (60 Tflops), SKIF Ural (15 Tflops).
- 2009-2010: SKIF hybrid architecture (including accelera-tors).

Most powerful in the series — SKIF MSU, located in Moscow State University.
- Peak/Linpack: 60/45 Tflops;
- number CPU: 1250 Intel XEON E5472 3,0 GHz;
- total RAM: 5 512 GB;
- total HD space: 16 640 GB;
- 14 cases of 42U size;
- total required space (including cooling system and UPS): 96m²;
- total required energy (including cooling system and UPS): 720 kW.

Information security
- Active security audit system in (a Grid network)a grid compu-ting system — PSI RAS.

Pilot projects

Goal is to demonstrate advantages, effectiveness and efficiency of new supercomputer samples, as well as new technologies for high-performance computing.
- SKIF-Testbed system is being organized, as a federation of supercomputing centers across Russia — PSI RAS, Moscow State University, Tomsk State University, University of Nizhniy Novgorod, South Ural State University, TSNIIMASH. New partners are expected to join.

Pilot high-performance computing application systems.
- Grid service for medical and biological data — Semenov Institute of Chemical Physics of the RAS.
- Grid system for solving electromagnetic wave diffraction problems — Penza State University, Research Computing Centre of Moscow State University.
- Grid systems for molecular modeling — A.N.Belozersky Institute of Physico-Chemical Biology of MSU, Institue of Problems of Chemical Physics of the RAS, Faculty of Chemistry of MSU, Chelyabinsk State University, Research Computing Centre of MSU.
- Genome data analysis — Institute for information transmission problems of the RAS.
- Grid technologies for processing Earth remote sensing data — Space Research Institue of the RAS.
- Calculation of radioactive contamination escape and diffusion — St. Petersburg Atom Energo Project.
- Simulation of digital information transmission system — Space Systems Research Institute.
- Simulation for microcircuit engineering. — "UniqueICs" Ltd.
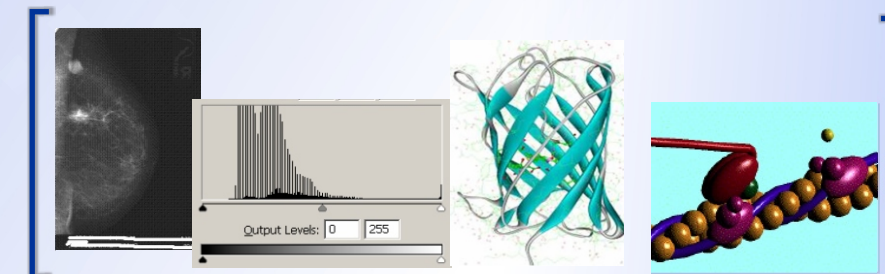
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