BDEC Collaboration Opportunities in Russia

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July 16, 2015, Frankfurt, Germany

Файл Правка Вид Журнал Закладки Инструменты Справка

Russian Science Foundation | T... | RSF and DFG will support joint ...

www.рнф.рф/en/node/1398

RSF | Russian Science Foundation

TRANSPARENCY. COMPETENCE. RESULT.

ABOUT THE FOUNDATION | NEWS | INFORMATION FOR RESEARCHERS | DOCUMENTS | CONTACTS

RSF and DFG will support joint research teams under the terms of open public competition for grants

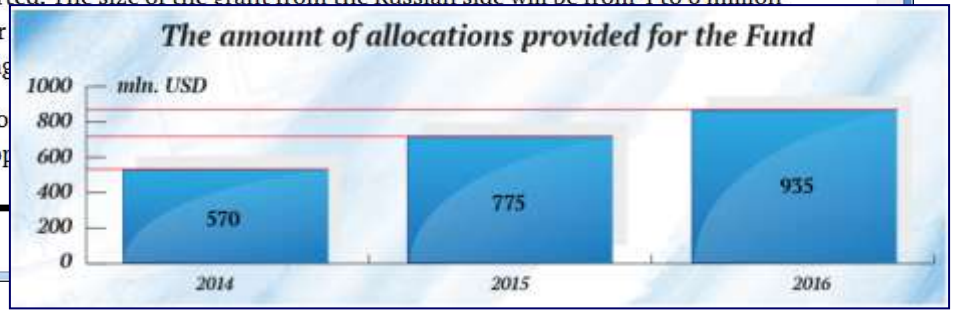
tags: RSF news

Public competition to receive grants from the Russian Science Foundation and German Research Foundation (DFG) for a joint research in mathematics and physics has been announced.

Russian Science Foundation started collecting applications for grants to support international research teams. This competition is held jointly with the German Research Foundation (DFG).

Under the terms of this competition the fundamental and exploratory research will be supported. The size of the grant from the Russian side will be from 4 to 6 million rubles per
partnering

Applicatio
information about the competition is available in the section "Calls for prop




International Supercomputing Conference
ISC High Performance
The HPC Event
30th Anniversary
18
BDEC
BDEC Collaboration Opportunities in Russia
Supercomputers
July 16, 2015, Frankfurt, Germany

Supercomputing Facilities of Moscow State University

(Lomonosov supercomputer)

Supercomputing Facilities of Moscow State University

(Lomonosov-2 supercomputer)

1 rack = 256 nodes: Intel + NVIDIA = 515 Tflop/s

"Lomonosov-2" supercomputer (5 racks) = 2.5 Pflop/s


JuRECA
JURECA
Jülich Research On Exa-Cluster Architectures
Prof. Dr. Dr. Thomas Lippert
Jülich Supercomputing Centre
JuREC
F4 PLATFORMS
ParTec
Cluster Competence Center

International Supercomputing Conference

BDEC Collaboration Opportunities in Russia

Fundamental Science and Large Scale Applications

Brief Stats on MSU Supercomputer Center

Users: 2511
Projects: 1607
Organizations: 302

MSU Faculties / Institutes: 20+

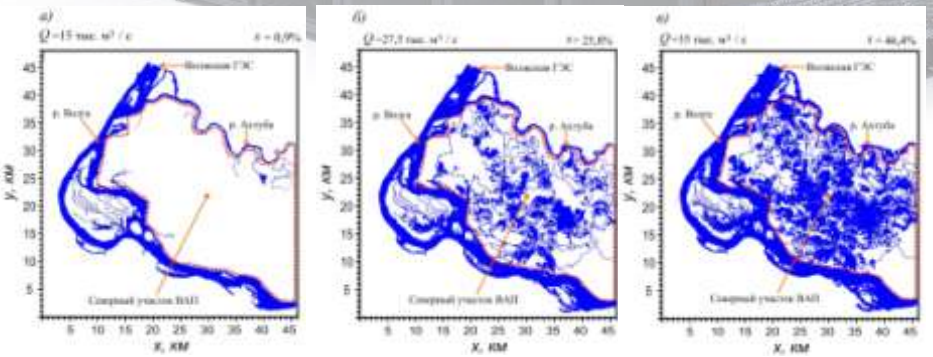
Research in almost all areas…

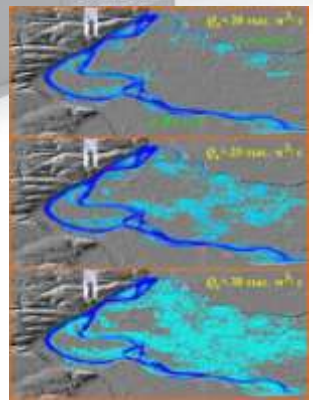
July 16, 2015, Frankfurt, Germany

Modeling of the dynamics of shallow waters on the northern part of Volga-Akhtuba floodplain

Khoperskov A., Khrapov S., Agafonnikova E., Pisarev A.

AREA. Mechanics, Geography and Land Hydrology
DRIVER. We solve the problem of software package creating for the seasonal flooding modeling on the northern part of the Volga-Akhtuba floodplain with the main physical and meteorological factors on the basis of parallel technologies.
STRATEGY. Model is based on numerical integration of Saint-Venant equations using a combined SPH-TVD method.
OBJECTIVE. The main goal of the project is to create a tool to predict of hydrological regime in the territory of northern part of the Volga-Akhtuba floodplain and the subsequent construction of the optimal hydrograph for the Volga Hydroelectric Power Station.
IMPACT. The method of constructing an optimal hydrograph will allow us to increase the flooding of area considering various features of the landscape.
USAGE. Analytical tool for environmental organizations and agencies, the Ministry of Emergency Situations.

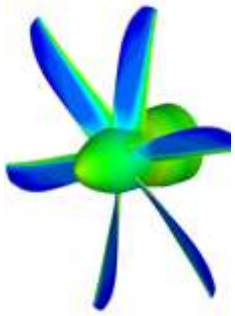


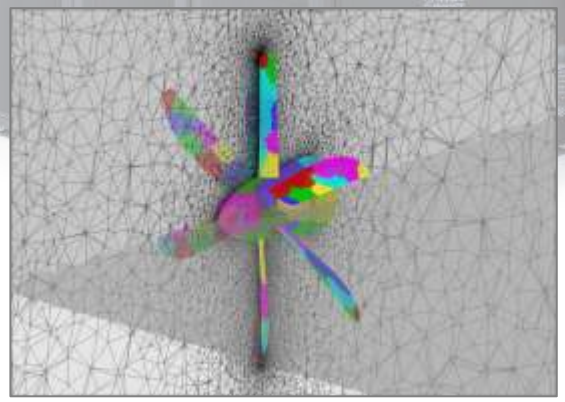


Modeling of acoustics of open rotors

Titarev V., Kopiev F., Belyaev I.

AREA. Mathematics, Informatics
DRIVER. Modeling of open rotors.
STRATEGY. Our approach is based on the combined use of computational physics, aeroacoustics as well as high-performance computing.
OBJECTIVE. The goal is to develop efficient computational tools for analyzing the aerodynamics and noise of open rotors.
IMPACT. The main expected result is the capability to given an expert opinion regarding perspective transport aircraft using open rotors.
USAGE. Main beneficiaries of the project will be aerospace industry as well as TsAGI.

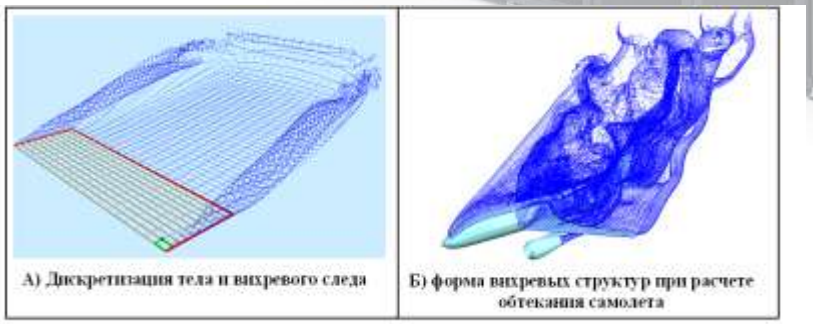




Numerical modeling of separated flows based on vortex approach

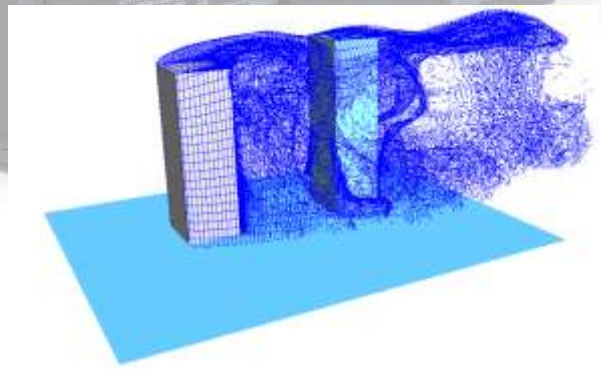
Setukha A.: Research Computer Center, Moscow State University;
Aparinov A.: NII Parachutostroeniya

AREA. Mathematics, Mechanics
DRIVER. Development and testing of parallel numerical algorithm for solving aerodynamic problems with vortex method.
STRATEGY. Applying efficient methods of big-size matrix approximation with paralleling of numerical algorithms at the same time.
OBJECTIVE. To analyse increased opportunities of aerodynamic vortex methods provided by supercomputer technologies.
IMPACT. The solution of complex aerodynamic and dynamic problems for air vehicles, modeling of non-stationary separated flows past group of objects with complicated geometry, for example, building and constructions or multi-cupolas parachute systems.
USAGE. Aerodynamics of air vehicles, aerodynamics and aeroelastics of parachutes, constructing aerodynamics.



А) Дискретизация тела и вихревого следа

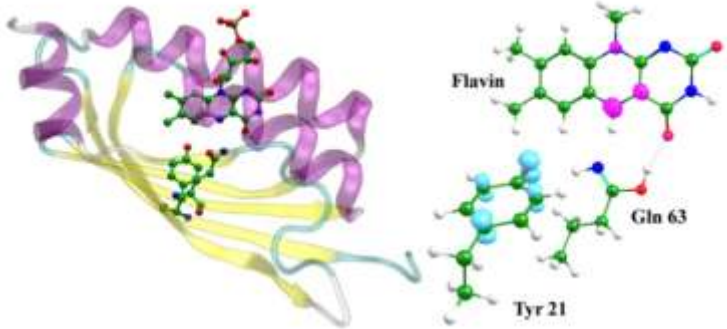
Б) форма вихревых структур при расчете обтекания самолета

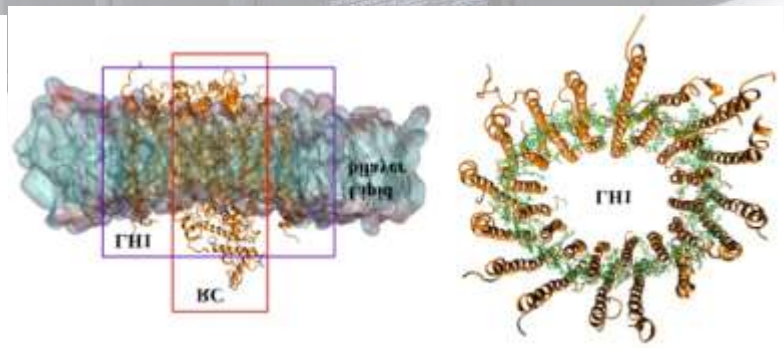


Modeling mechanisms of photochemical processes in photoreceptor and fluorescent proteins

Khrenova M., Bochenkova A., Mironov V., Andrijchenko N., Nikiforov A., Vasilevskaya T.:
M.V. Lomonosov Moscow State University, Chemistry Department

AREA. Structure and Dynamics of Atomic-Molecular Systems, Physicochemical Biology
DRIVER. Studying mechanisms of functioning of fluorescent proteins, flavin containing photoreceptor proteins and bacterial photosystem.
STRATEGY. Development and application of methods of computer molecular modeling for properties calculations of photoreceptor proteins and their chromophores.
OBJECTIVE. Establishment of mechanisms of functioning of fluorescent proteins, flavin containing photoreceptor proteins and bacterial using combined method of quantum mechanics/ molecular mechanics and modern methods of quantum chemistry of high level of accuracy.
IMPACT. Prediction of new fluorescent and photoreceptor proteins with the suggested properties, on the basis of mechanisms established in the project.
USAGE. Biosensor technologies, life sciences.

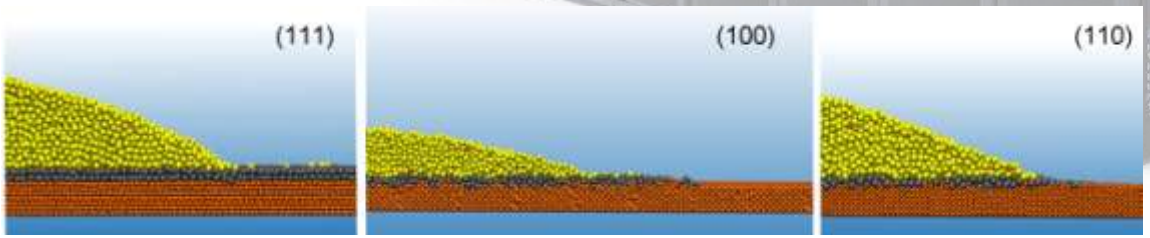


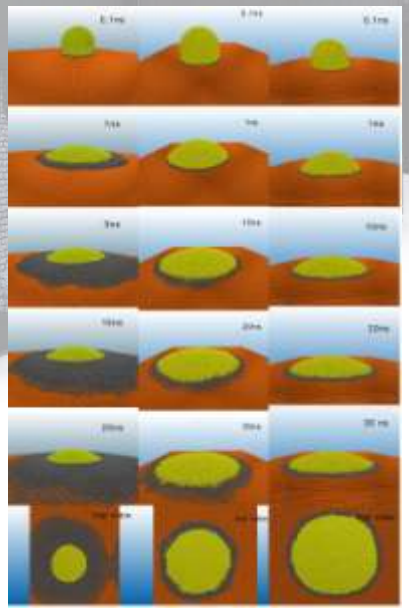


The kinetics of spreading of lead nanodroplets on monocrystalline copper surface

Timoshenko V., Protsenko P.

AREA. Physical Chemistry
DRIVER. The project aims to study the wetting characteristics of single-crystal metal surfaces using molecular dynamics simulation.
STRATEGY. Method of molecular dynamics is used to analyze the process of spreading droplets of lead on the surface of copper.
OBJECTIVE. The aim is to determine the effect of substrate orientation on the kinetics of the spreading melt of lead on the surface of single-crystal copper
IMPACT. Development of new and improvement of existing solders for microelectronic devices.
USAGE. Soldering processes.

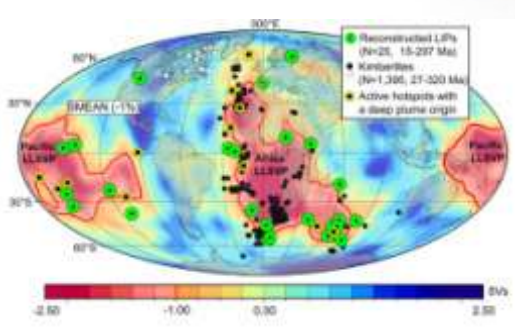


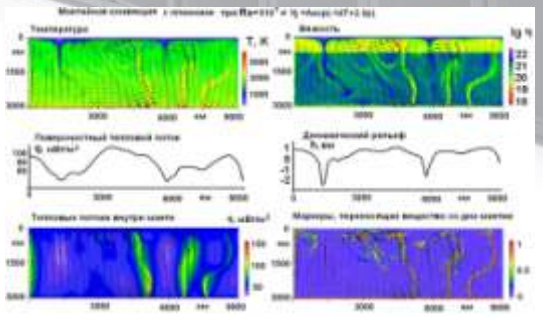


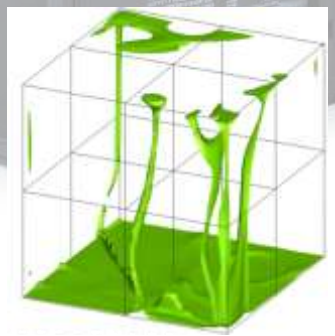
Mantle plumes in the models of quasi turbulent thermal convection

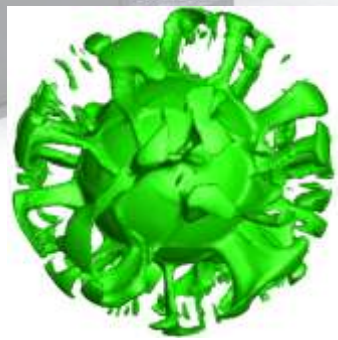
Evseev A., Trubitsyn V.: IPE RAS

AREA. Geophysics
DRIVER. Development of methods of numerical modeling of thermo-compositional convection in multi-component fluid with large viscosity variations.
STRATEGY. On the basis of numerical models of thermal convection in mantle a process of spontaneous multiple creation and lifting of hot plumes, generating volcanoes and ore fields, is investigated.
OBJECTIVE. Mantle convection modeling allows to recognize places of plumes origin and their lifting, and then to predict global volcanic disasters and ore deposit.
IMPACT. Prediction of possible large ore deposits, created during last billion years and future volcanic catastrophes.
USAGE. Prediction of possible large ore deposits, created during last billion years and future volcanic catastrophes.





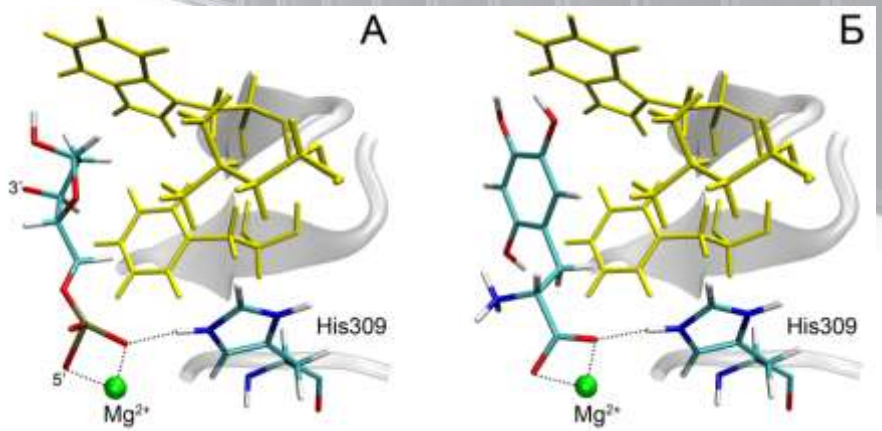


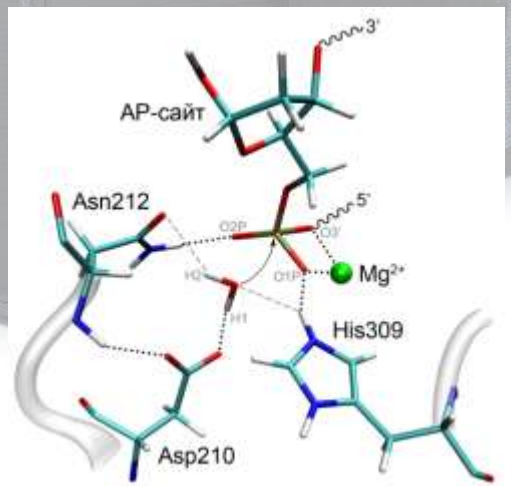


Molecular model of human apurinic/apyrimidinic endonuclease

Nilov D., Khaliullin I.: Belozersky Institute of Physicochemical Biology, MSU

AREA. Informatics, Fundamental Medicine and Physiology
DRIVER. Construct a full-atomic model of human apurinic/apyrimidinic endonuclease.
STRATEGY. Apply hybrid quantum mechanics/molecular mechanics simulation technique to calculate a full-atomic structure of an enzyme.
OBJECTIVE. Create a model of human apurinic/apyrimidinic endonuclease for virtual screening of novel inhibitors (potent anti-cancer drugs).
IMPACT. Development of novel inhibitors of human apurinic/apyrimidinic endonuclease using constructed enzyme model.
USAGE. Application of developed apurinic/apyrimidinic endonuclease inhibitors as anti-cancer drugs in medicine.

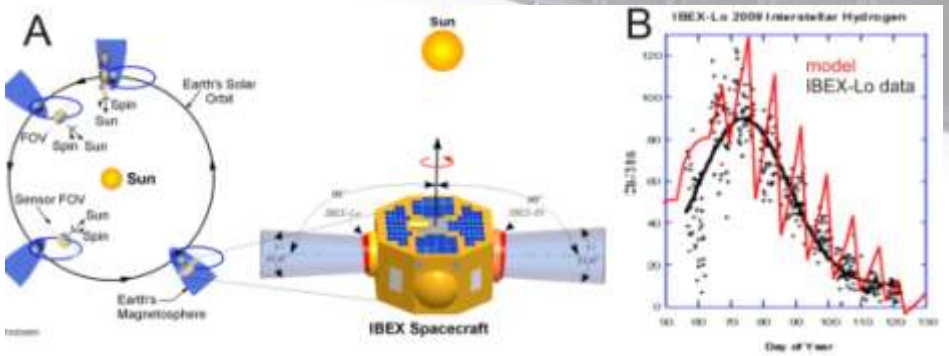


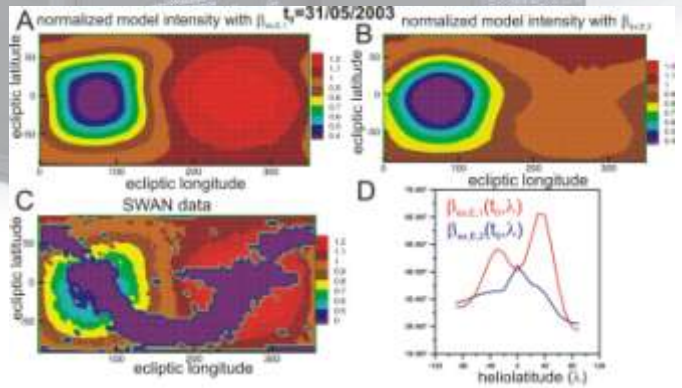


Investigation of the interstellar neutrals in the heliosphere

Katushkina O., Izmodenov V.: MSU, IKI RAN; Taghirova R.: IKI RAN

AREA. Mechanics, Astronomy
DRIVER. To develop a model of the interstellar hydrogen distribution in the heliosphere. To apply this model for the analysis of experimental data from different spacecraft.
STRATEGY. The main idea for the solving of this problem is to use the kinetic approach for the modeling of interstellar hydrogen distribution. To do this, we solve the 7-dimension kinetic equation in 3D time-dependent case.
OBJECTIVE. To develop the model of the interstellar hydrogen distribution inside the heliosphere. It is needed for explanation and interpretation of different experimental data. From this we can obtain additional restrictions for the parameters of the Local Interstellar Medium and properties of the heliospheric boundaries.
IMPACT. Scientific effect is the following: we are going to explain.
USAGE. The field of view - the investigation of the solar wind and the heliosphere.

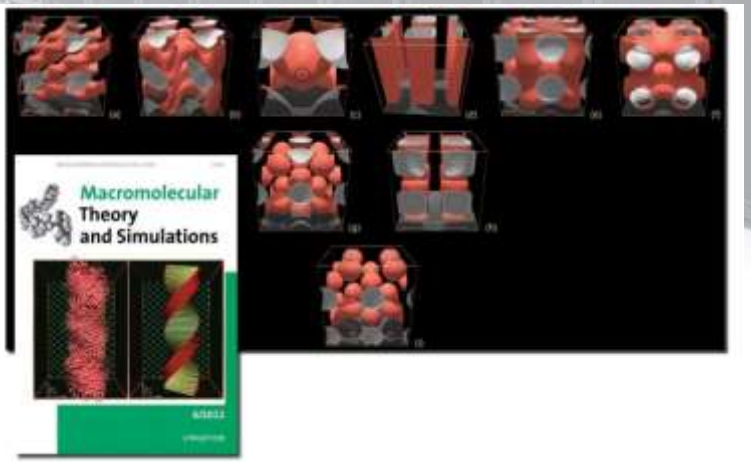


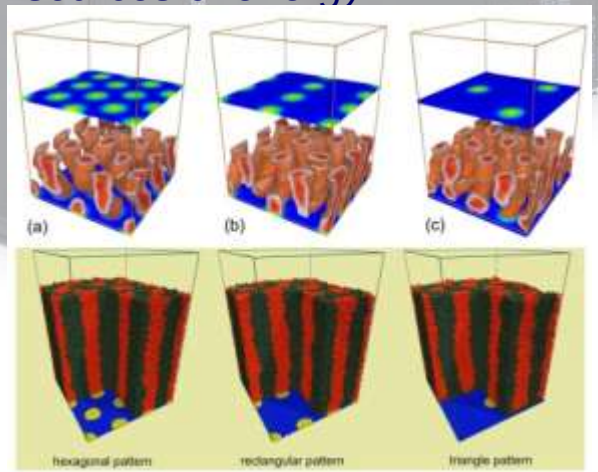


Selforganization of copolymers in nanosized films: Field-theoretic methods and computer simulation

Khalatur P.: INEOS RAS; Khokhlov A., Ivanov V.: MSU; Neratova I.: TSU

AREA. Condensed Matter Physics, High Molecular Weight Compounds
DRIVER. Development of new scientific and technological principles for designing the thin-film functional materials with controlled nanostructure, based on self-organizing polymers.
STRATEGY. The prediction of the structure and properties of ordered nanoscale polymer films using computer modeling techniques.
OBJECTIVE. A theoretical study of the fundamentals related to the formation of copolymer nanostructures in a situation when the system self-organizes in ultra-thin polymer films with a thickness of several tens of nanometers.
IMPACT. New strategies for designing block copolymer films and membranes for solar cells, fuel cells, and other advanced technologies.
USAGE. Nanosystems, molecular microelectronics, new sources of energy.

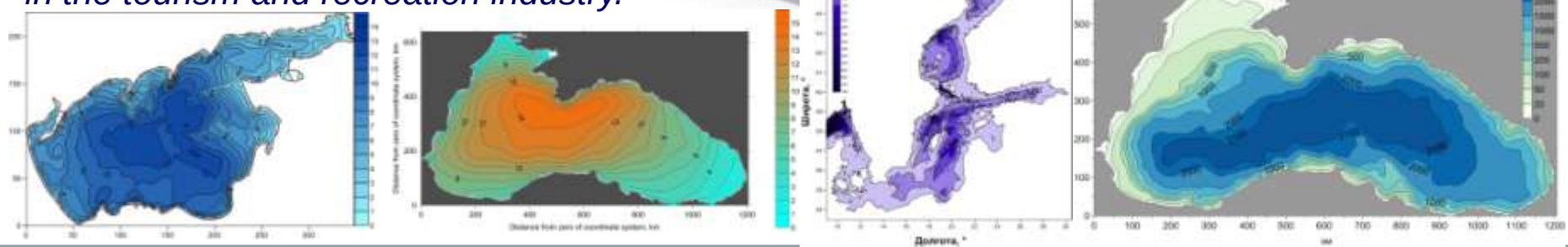




Retrospective forecast of high resolution storm waves and surges in coastal areas of European Russia

Arkhipkin V., Myslenkov S., Gippius F.: faculty of geography Lomonosov Moscow State University

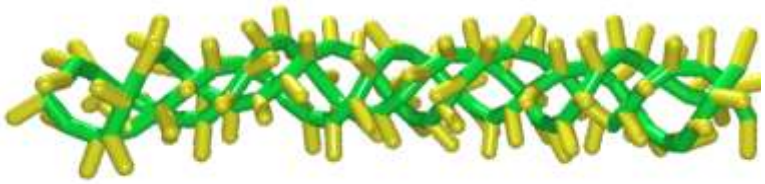
AREA. Marine Sciences, Aerophysics
DRIVER. Statistics and analysis of parameters of storm waves and surges in coastal areas of the Caspian, Black, Azov and Baltic Seas, based on the results of numerical modeling.
STRATEGY. To calculate the parameters of wind waves was applied spectral model wind-wave third-generation SWAN.
OBJECTIVE. Estimation of extreme values of regime characteristics of waves and surges in the coastal areas of the European Russia.
IMPACT. The project contributes to reduction of environmental risks in coastal areas of Russia. Long-term forecast of probable dangerous of hydrometeorological events and their intensity in the regional and macro-scale is important for risk assessment of storm surges and extreme waves and develop ways to minimize it.
USAGE. The results of the project can be used by the Ministry of Natural Resources, Ministry of Emergencies, Fisheries, Hydrometeorology, the Ministry of Transport, as well as in the tourism and recreation industry.

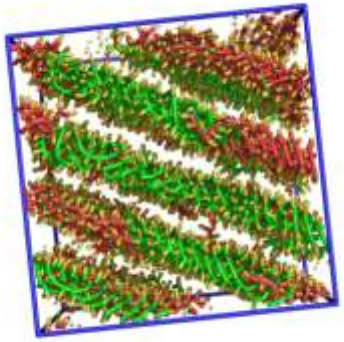


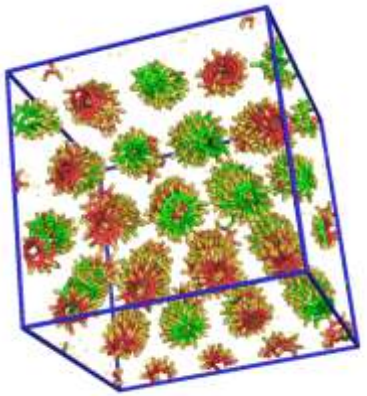
Self-Organization of Amphiphilic Macromolecules with Local Helix Structure in Concentrated Solutions

Khokhlov A.: Moscow State University, INEOS RAS; Vasilevskaya V., Glagolev M.: INEOS RAS

AREA. High Molecular Weight Compounds
DRIVER. Demand for understanding the interactions of helical macromolecules.
STRATEGY. We introduce a coarse-grained model of a polymer with helical secondary structure, and study self-organization of the polymer in concentrated solutions.
OBJECTIVE. The objective is to obtain the properties of the structure formed by helical polymer in concentrated solutions.
IMPACT. Understanding the interactions between helical macromolecules.
USAGE. Theory development, macromolecule design, fabrication of nanofibers.



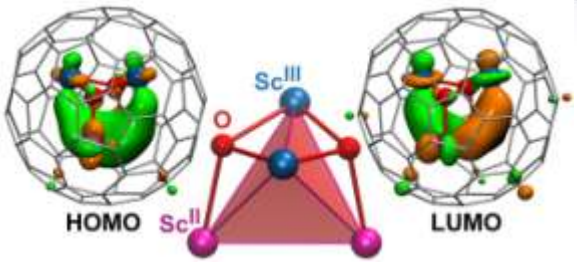


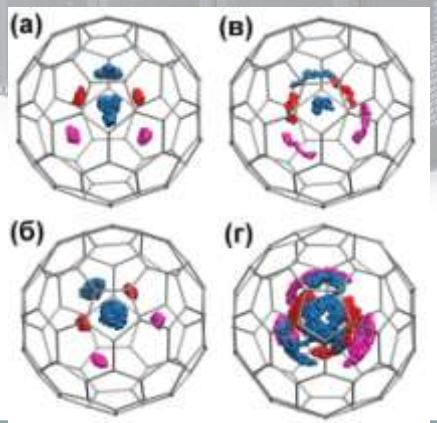


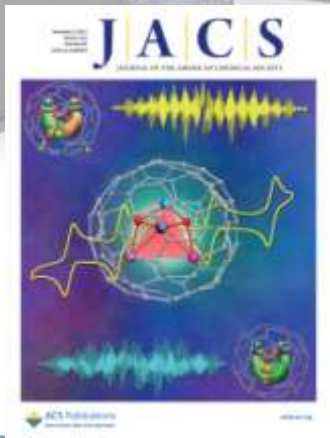
Molecular structure and internal dynamics of endohedral metallofullerenes in different charge states

Popov A.: Moscow State University and IFW Dresden

AREA. Structure and Dynamics of Atomic-Molecular Systems
DRIVER. Search of the stable isomers of endohedral metallofullerenes and their chemical derivatives.
STRATEGY. Optimization of the molecular structures of endohedral metallofullerenes (EMFs) and their derivatives in different charges states using density functional theory.
OBJECTIVE. Endohedral metallofullerenes exhibit unique electronic and magnetic properties, therefore, prediction of the possible products is important task which can be solved by means of computational studies.
IMPACT. Prediction of the most stable and hence experimentally accessible structure of EMFs.
USAGE. Further development of the molecular nanostructures based on EMFs



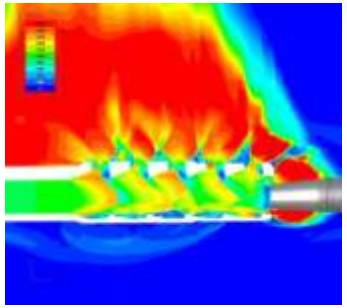
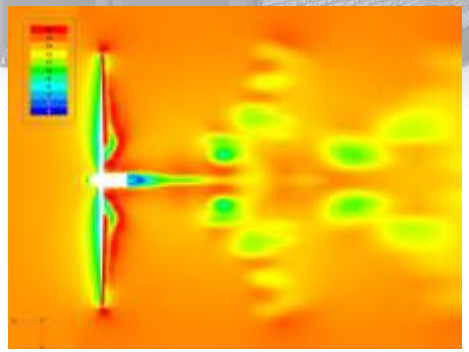
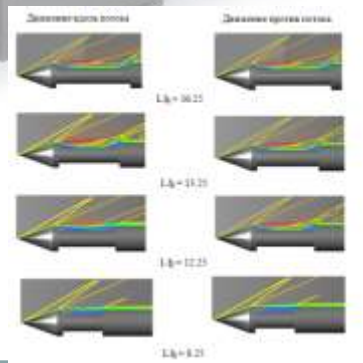




Development of FlowVision CFD Software

Aksenov A., Kharchenko S., Moskalev I., Dyadkin A., Pohilko V., Zhluktov S., Kutin V., Sazonova M., Kuznetsov K., Markova T., Karasev P., Shishaeva A.

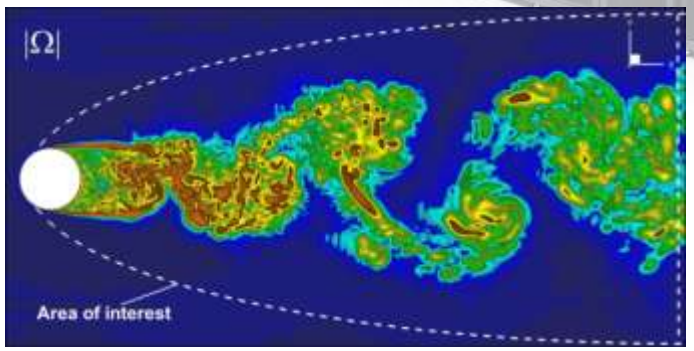
AREA. Heat and Mass Transfer Processes, Matter Properties, Other
DRIVER. Need for simulating large industrial problems with multiphase and multi-physics phenomena in computational domains with arbitrary complex shape and moving/deformable bodies.
STRATEGY. Automatic mesh generation with dynamic local adaptation, high accuracy implicit numerical schemes.
OBJECTIVE. Create powerful and extendable CFD computing platform for virtual fluid engineering of large and complex industrial design projects in areas of automotive, shipbuilding, atomic energy and aerospace.
IMPACT. Reduced simulation time and increased accuracy result in reducing design time and increasing design reliability.
USAGE. it is a base technology for design in industries: automotive, shipbuilding, nuclear power, wind turbines, etc.

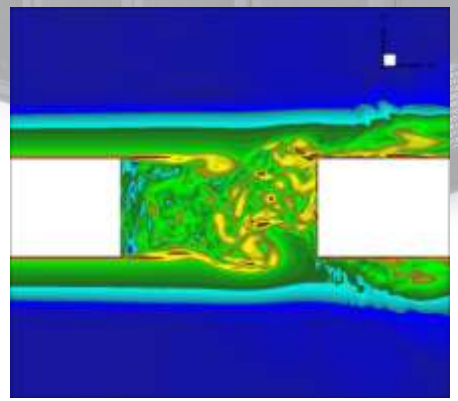





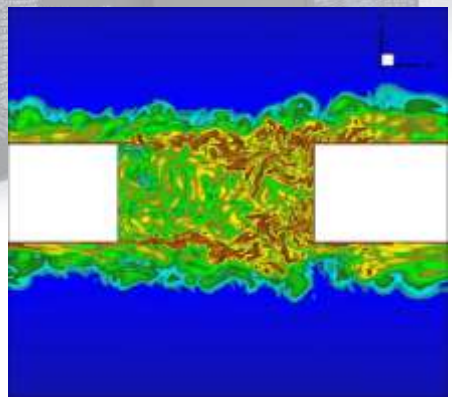
Simulation of complex turbulent flows using unstructured meshes

Duben A., Abalakin I., Gorobets A., Kozubskaya T., Lukianov N.: KIAM RAS; Bahvalov P.: MIPT.

AREA. Mathematics, Aerophysics
DRIVER. Numerical investigation of aerodynamic and aeroacoustic charateristics of bluff aircraft elements and complex turbulent flows.
STRATEGY. Identification of optimal configurations in aerodynamic and aeroacoustic characteristics, design of better noise prediction tools for development of quieter aircrafts.
OBJECTIVE. Investigation and improvement of aerodynamic and aeroacoustic characteristics of aircraft elements and complex turbulent flows.
IMPACT. Improvement of aircraft aerodynamic characteristics; reduce of airframe noise in near and far field.
USAGE. Aircraft industry; computational mathematics; computer science.



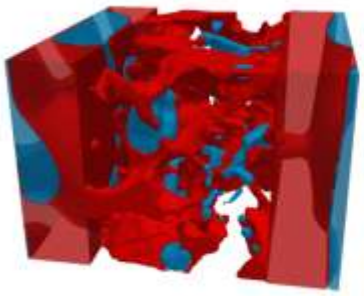
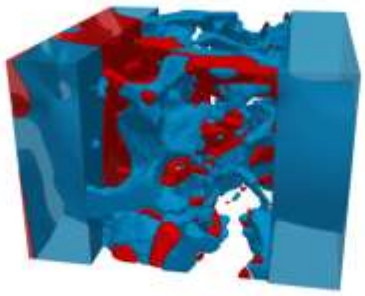
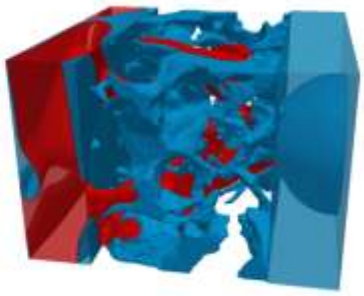
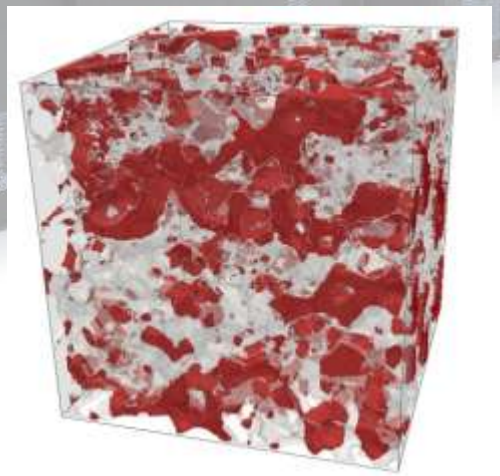




Modeling of single- and multi-component fluid flows using Lattice-Boltzmann Method on hybrid multi-GPU supercomputers

Bikulov D., Senin D.: Moscow State University Physics Faculty

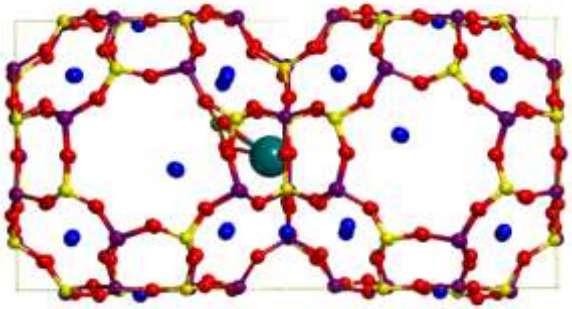
AREA. Geology, Geophysics
DRIVER. Modeling of single- and multi-component filtration in porous medium using Lattice Boltzmann Method on hybrid Multi-GPU supercomputers.
STRATEGY. We use Lattice-Boltzmann method for modeling of single- and two-component fluids in complex geometries.
OBJECTIVE. Objective is to obtain filtration parameters of geological samples (cores) in numerical experiment using computer tomography of them.
IMPACT. Replacement of expensive and time-consuming laboratory experiments on hydrodynamic studies of geological samples by computational experiments in order to reduce costs and time for research.
USAGE. Oil Gas sector, Hydrodynamics.

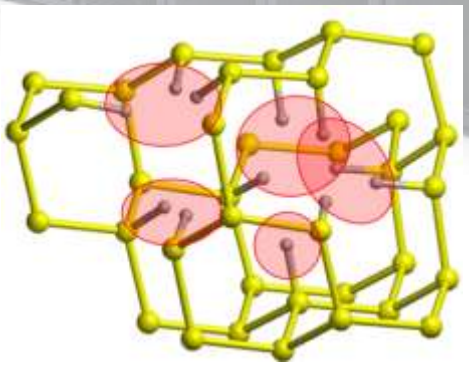





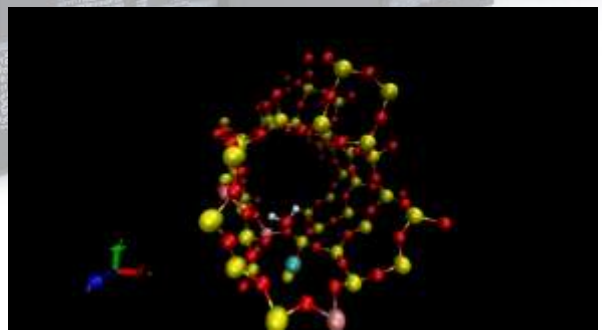
Modeling of molecular systems containing d-metals

Larin A., Bryukhanov I., Rybakov A., Buchachenko A., Bezrukov D.: Moscow State University

AREA. Inorganic Chemistry, Physical Chemistry
DRIVER. Optimal choice of cationic and zeolite framework for methanol carbonylation, definition of optimal regime of ALD techniques for achieving available passivation of Si and hydrogenated Si.
STRATEGY. Quantum chemical approaches using isolated clusters and periodic boundaries.
OBJECTIVE. Development of catalytic cycle for CO2 utilization from atmosphere on the basis of alkali earth and transition metals, modeling of oxide deposition on the surface of Si and hydrogenated Si, control over the extent of Si passivation.
IMPACT. Scientific and commercial.
USAGE. Development of catalytic cycle for CO2 utilization from atmosphere on the basis of alkali earth and transition metals, modeling of oxide deposition on the surface of Si and hydrogenated Si, control over the extent of Si passivation.



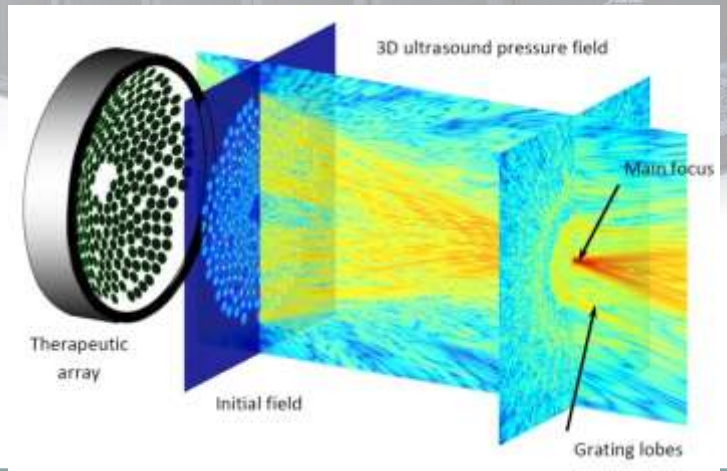


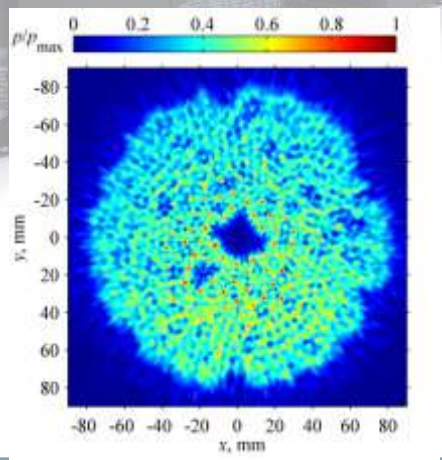


Calibration of nonlinear acoustic fields of therapeutic multi-element arrays of modern ultrasound surgery systems

Sapozhnikov O., Yuldashev P., Ilyin S., Annenkova E.

AREA. Radiophysics, Electronics and Acoustics
DRIVER. Development of a combined method to evaluate characteristic of acoustic fields produced by modern therapeutic ultrasound arrays.
STRATEGY. At a low power output level of the array, measure the pressure field over a plane near the source to construct initial conditions for a numerical model.
OBJECTIVE. Develop original numerical algorithms to simulate the effects of nonlinearity, diffraction, and absorption in the three-dimensional focused fields produced by multi element arrays used in noninvasive ultrasound surgery.
IMPACT. Development of high power multi-element transducers for ultrasound surgery systems, calculation of the characteristics of their fields, assessment of the impact of nonlinear effects in instrument calibration, quality control and planning of treatment protocols.
USAGE. Application of high intensity ultrasound in medicine and bioengineering.

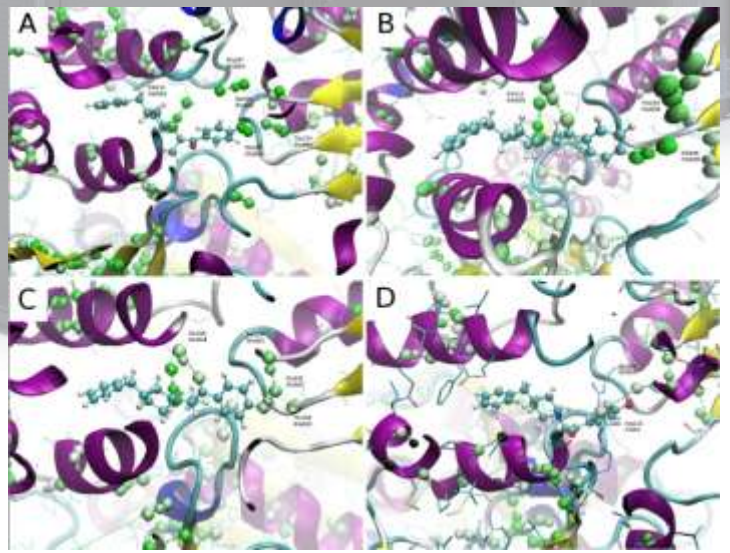




Investigation of GluN1/GluN2B aminoterminal domain allosteric modulators' binding features

Karlov D., Radchenko E., Palyulin V.: Lomonosov Moscow State University, Chemistry Department

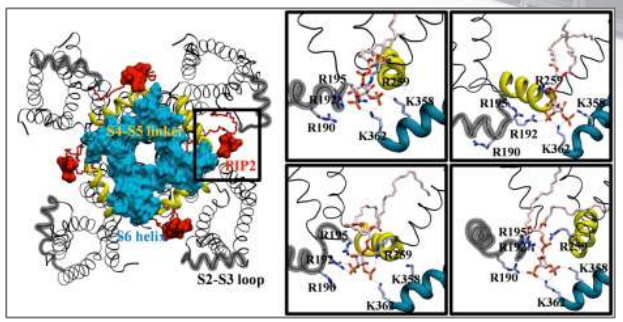
AREA. Organic Chemistry, Physicochemical Biology
DRIVER. Examination of conformational transformation in aminoterminal domains during molecular dynamics.
STRATEGY. Molecular dynamics modeling of GluN1/GluN2B complex; ifenprodil molecular docking in structure of GluN1/GluN2A, GluN1/GluN2C, GluN1/GluN2D.
OBJECTIVE. Assessment of per residue contribution values in modulators' binding enthalpy. Rationalize the essence of conformational transformation occurred without bound ligand.
IMPACT. Development of new scaffolds in design of NMDA receptor aminoterminal domain modulators.
USAGE. Medicine, Pharmacology.

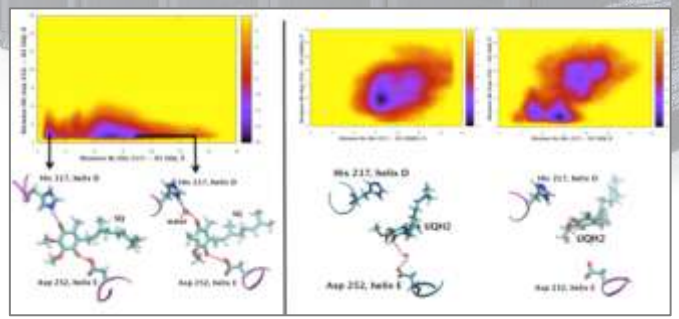


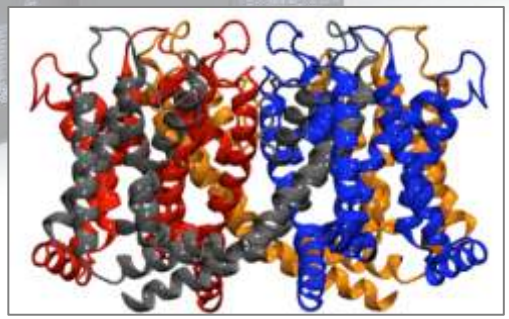
Multi-scale molecular simulations of membrane proteins

Shaitan K., Shaytan A., Kasimova M., Orekhov P.: Moscow State University, Biology Faculty

AREA: Biology, Medicine
DRIVER: Understanding functioning of membrane proteins at molecular level.
STRATEGY: Use multi-scale molecular modeling techniques.
OBJECTIVE: Study of membrane protein dynamics and its dependence on internal and external factors.
IMPACT: Understanding the fundamentals of living systems, drug design.
USAGE: Pharmacology, Medicine.

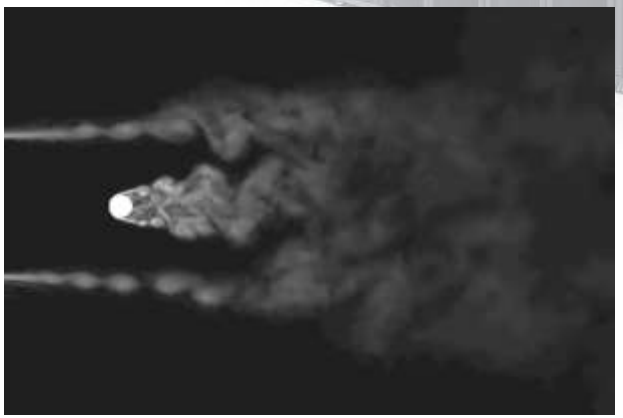


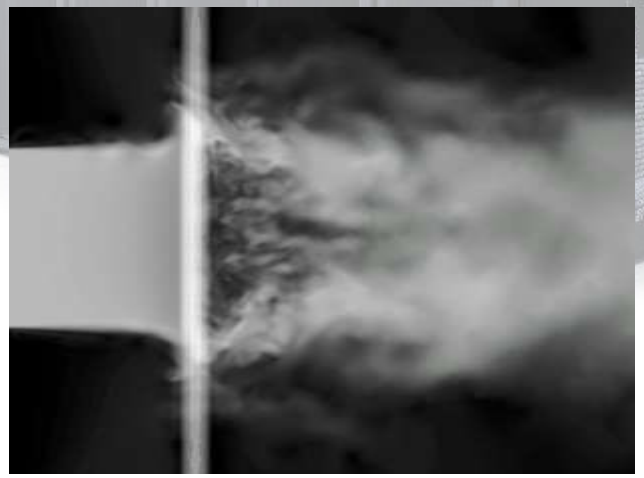


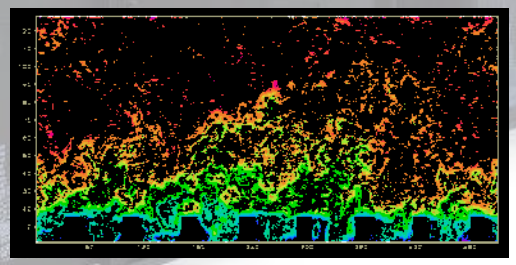


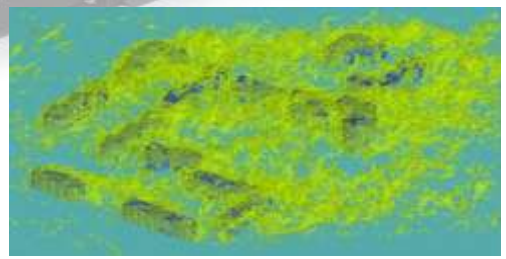
Turbulence Modeling

DRIVER. Find a new way to reduce turbulent friction drag in gas or liquid flows near solid surface.
STRATEGY. Use direct numerical simulation for fundamental studies of the microphysics of turbulent flows with different boundary conditions.
OBJECTIVE. Make an assumption about mechanism of turbulent energy production in wall-bounded flows.
IMPACT. Better and more clear understanding of mysterious phenomenon - turbulence.
USAGE: Aerospace, Construction industry









World Ocean modeling

Ibrayev R.: INM RAS; Ushakov K., Khabeev R., Orekhova M.: IO RAS, Kalmykov V.: MSU

AREA. Marine Sciences

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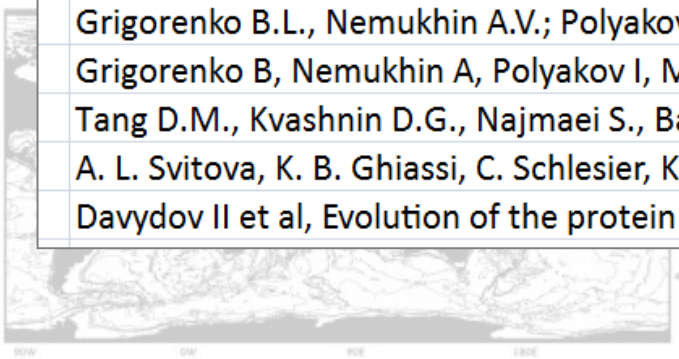
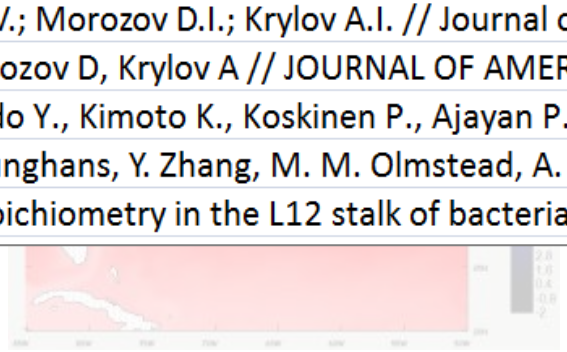
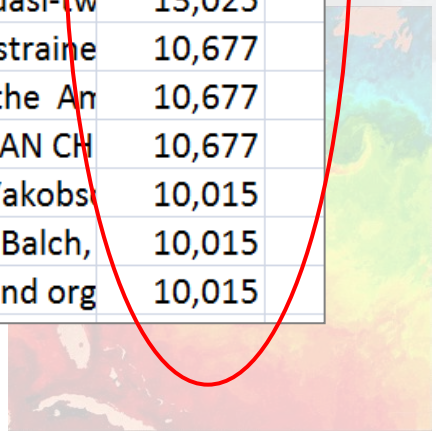






International Supercomputing Conference

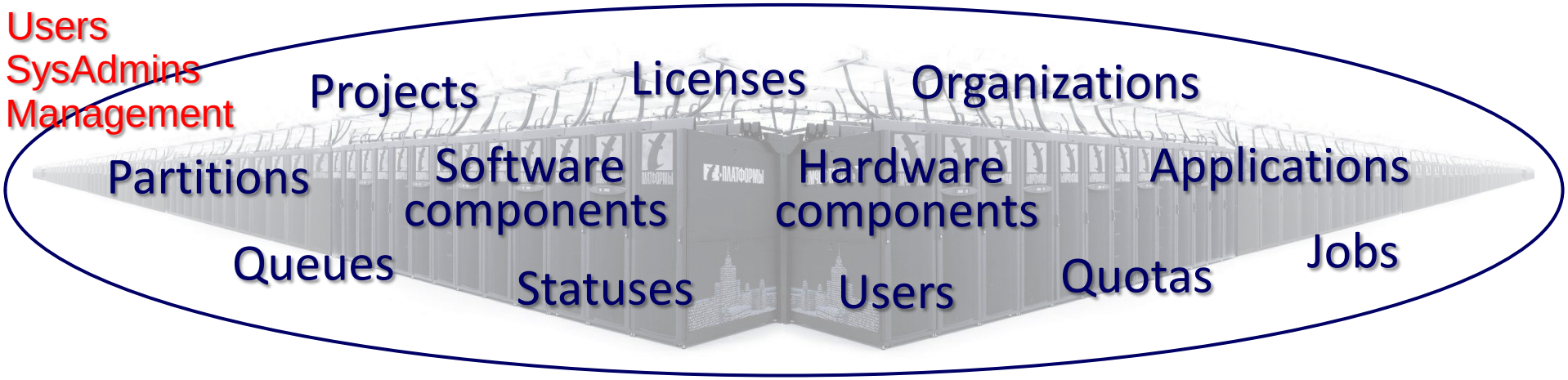
BDEC Collaboration Opportunities in Russia

Efficiency of Supercomputing Centers: OctoSet of Tools

July 16, 2015, Frankfurt, Germany

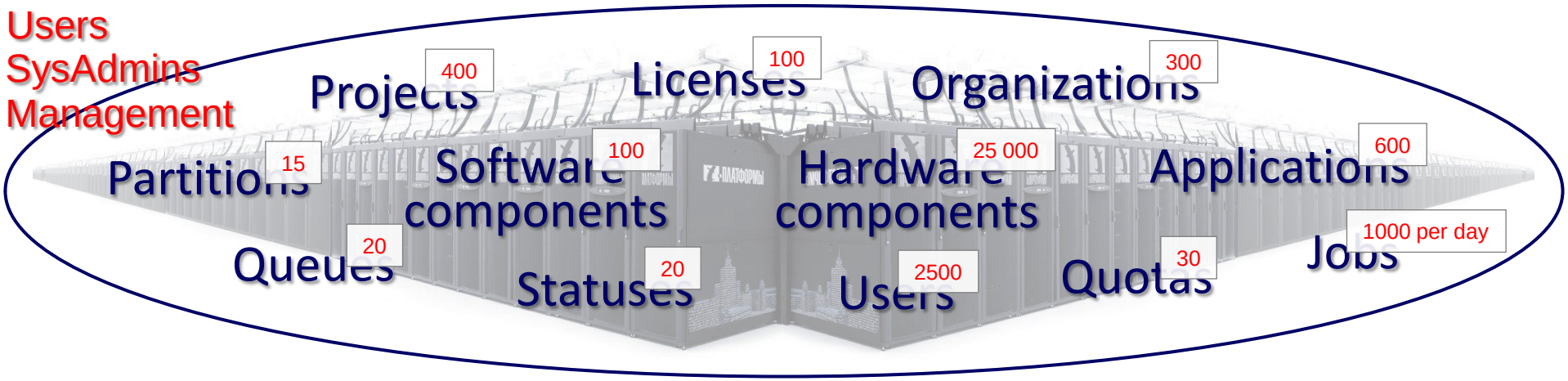
What do we need to know to control efficiency of supercomputer centers ?

Is it difficult to control few components ? *A few ?..*



A few? Info on MSU "Lomonosov" Supercomputer :

(1.7 Pflops, 6000 computing nodes, 12K CPUs, 2K GPUs…)



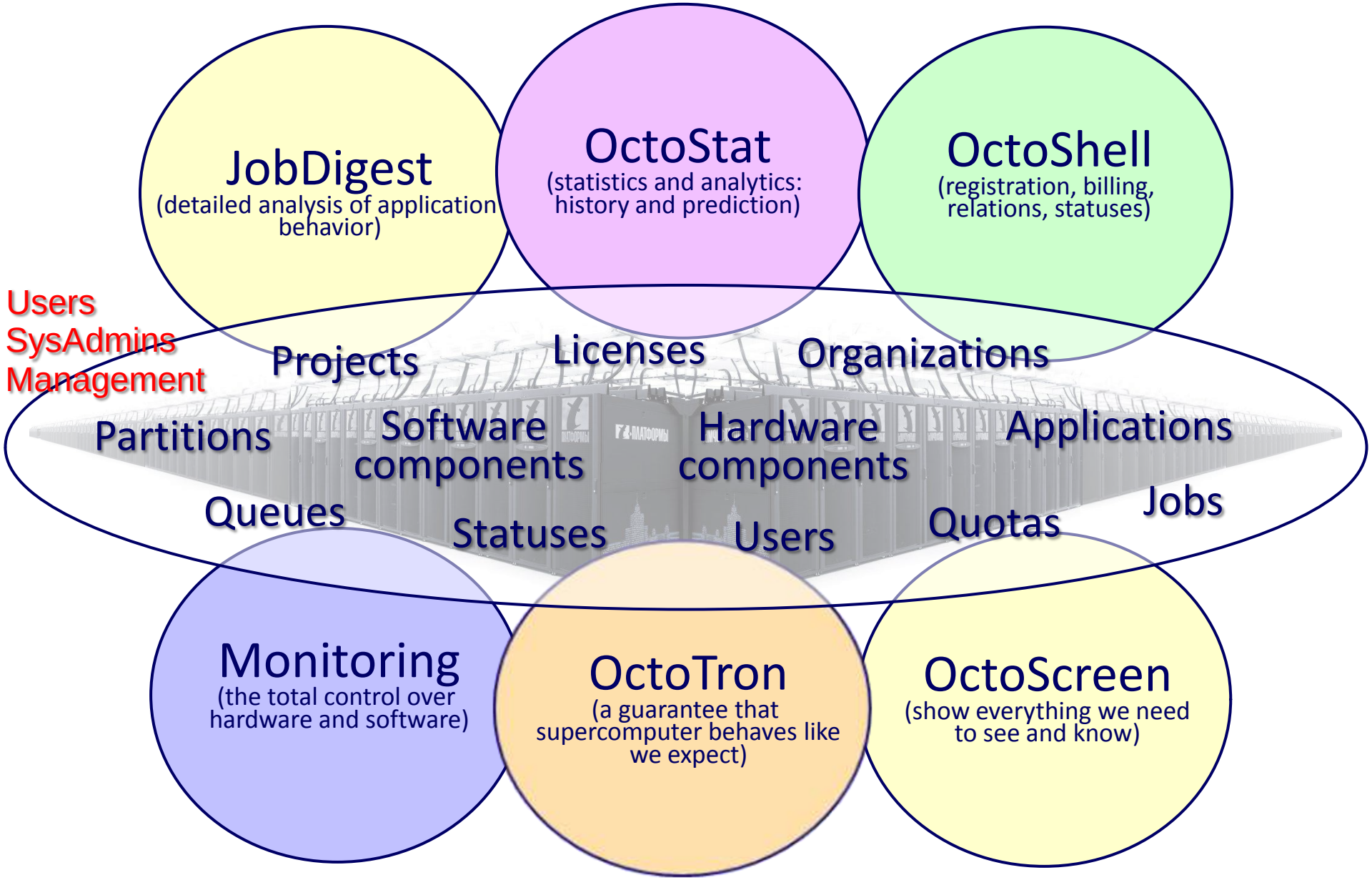
Current trend: all these numbers grow extremely fast !

⇩

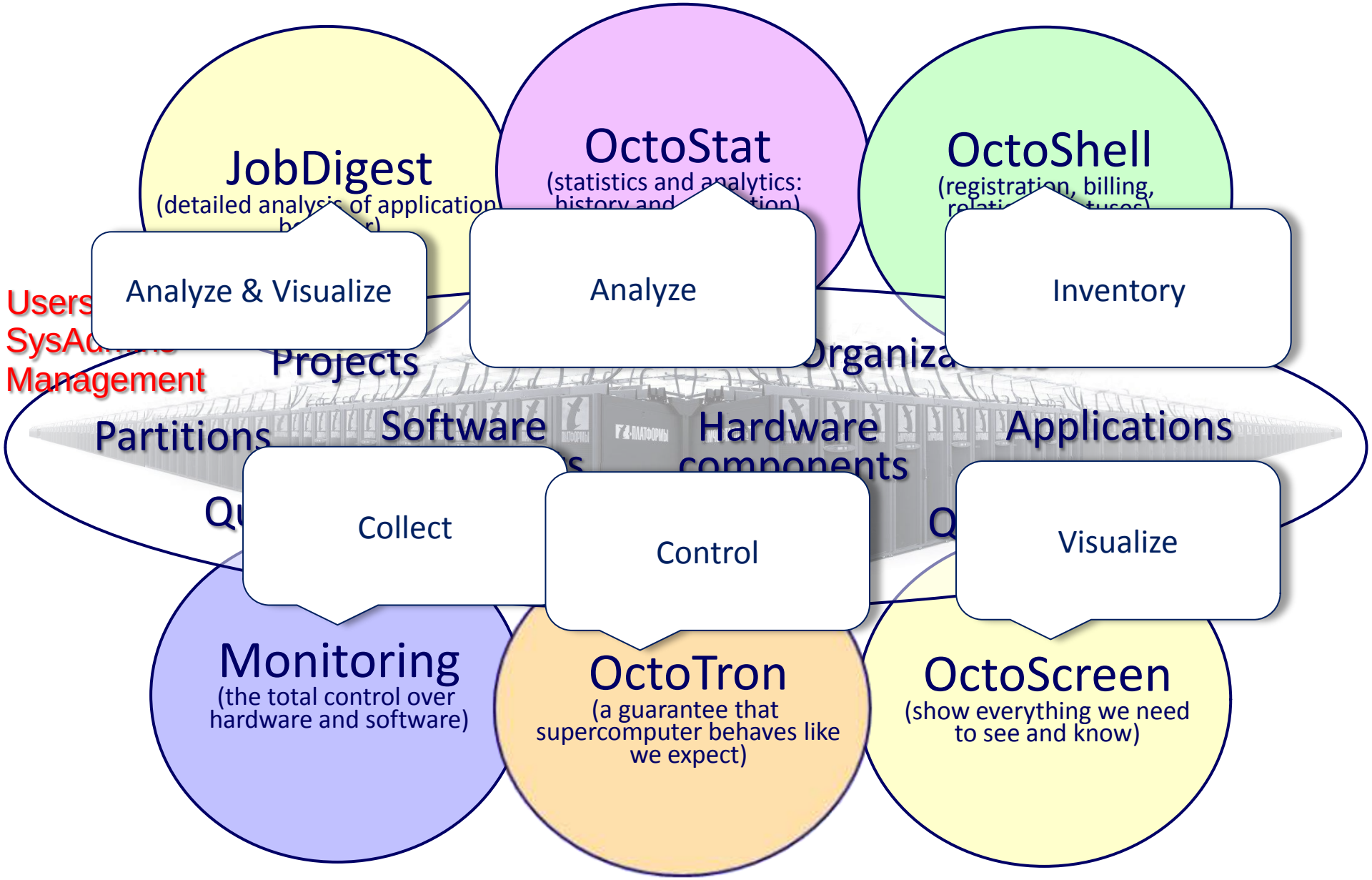
It's impossible to predict/describe state of a supercomputer…

We have almost lost control over supercomputers…

What is our approach to control efficiency of supercomputer centers ?

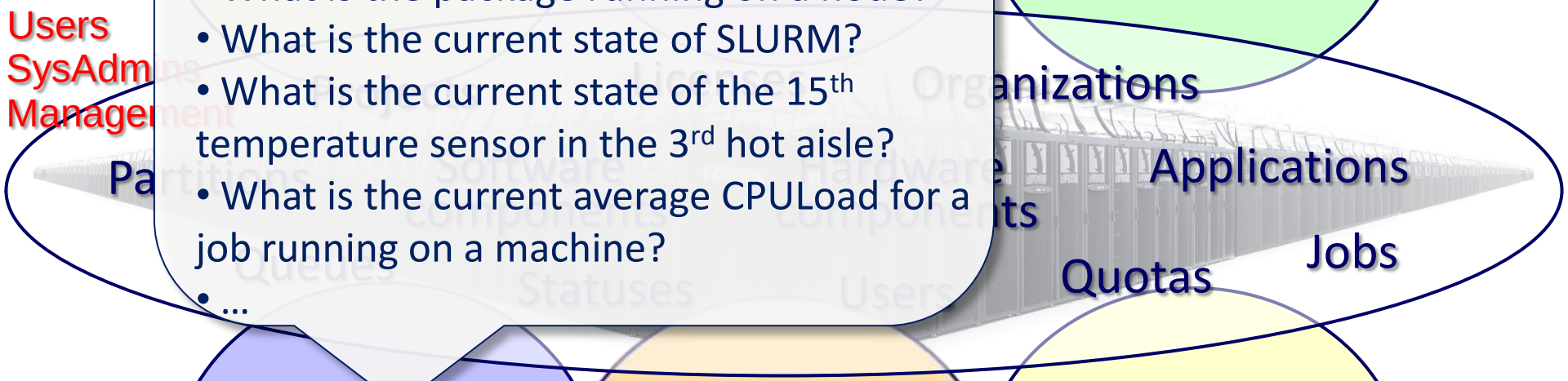


What are these systems designed for?
(in one word)



Some typical questions these systems address…

- What is the current CPULoad / LoadAVG / Flops / energy consumption for a computing node?
- What is the current amount of free memory on a node?
- What is the package running on a node?
- What is the current state of SLURM?
- What is the current state of the 15th temperature sensor in the 3rd hot aisle?
- What is the current average CPULoad for a job running on a machine?
- …



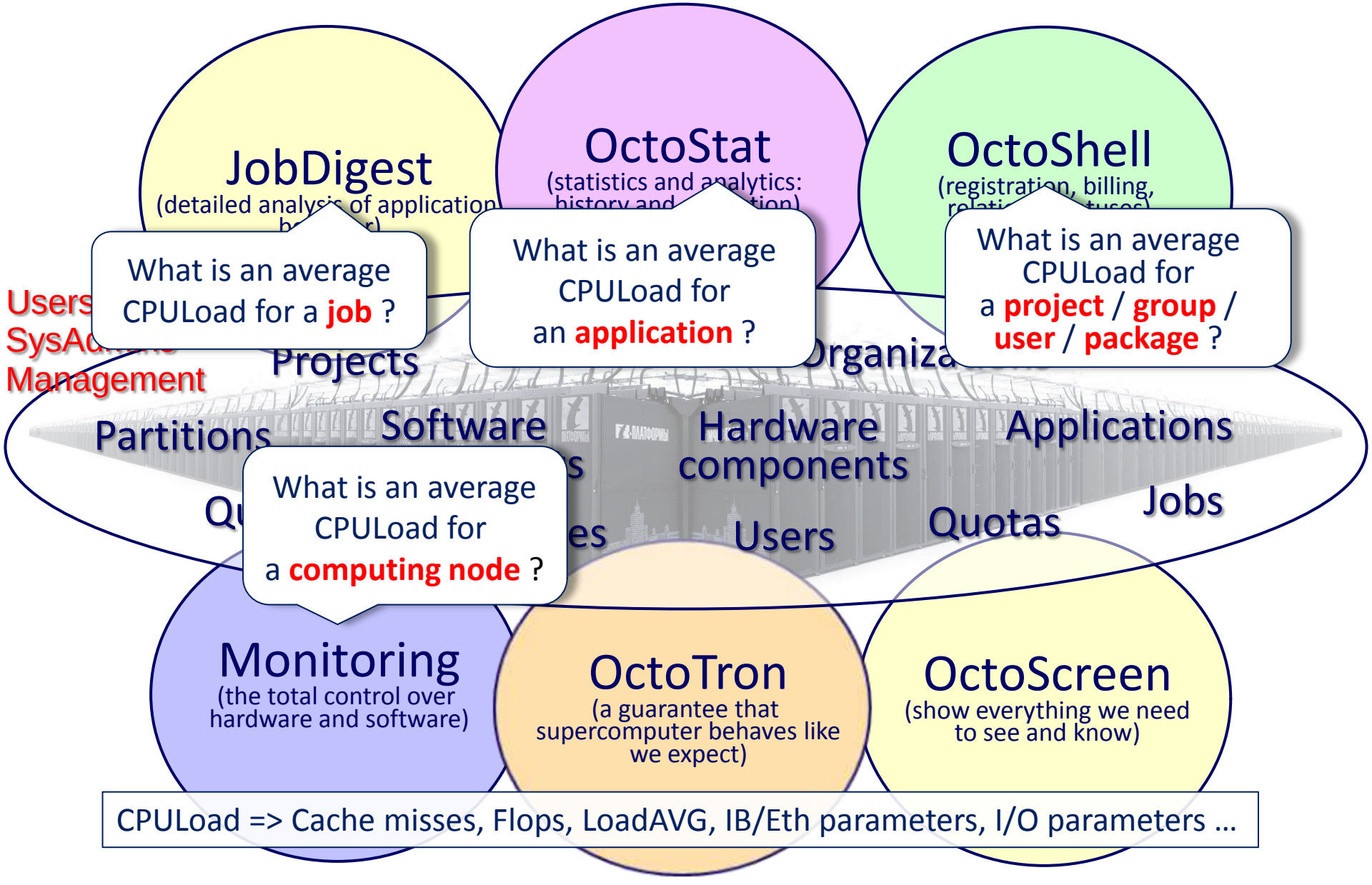
OctoShell
(registration, billing, relations, statuses)

Monitoring
(the total control over hardware and software)

OctoTron
(a guarantee that supercomputer behaves like we expect)

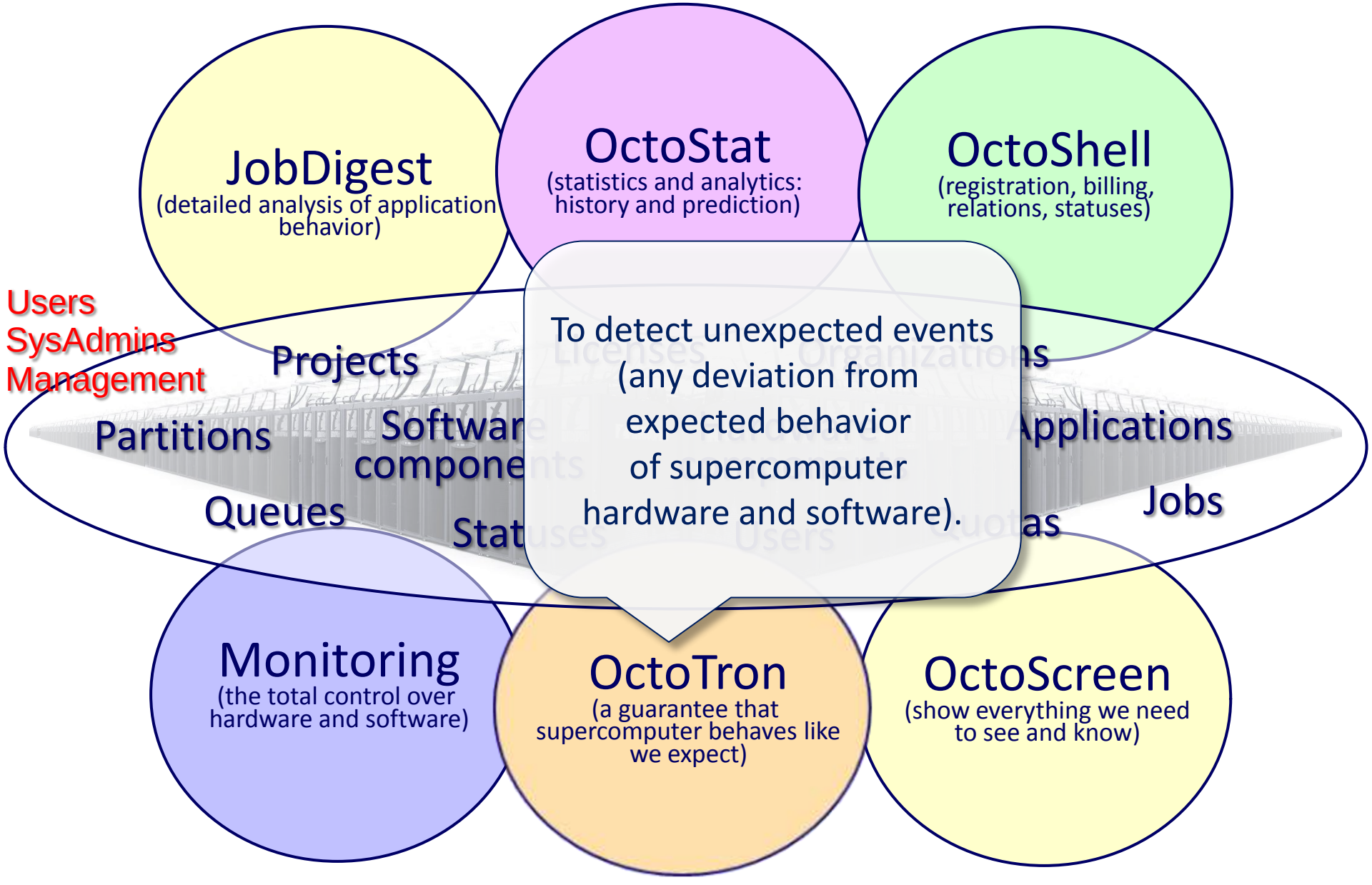
OctoScreen
(show everything we need to see and know)

What is an average CPULoad for … ?



CPULoad => Cache misses, Flops, LoadAVG, IB/Eth parameters, I/O parameters …

Systems and Challenges



Guarantee, Predictability and Autonomous Life of Supercomputers

What is now? *We hope a component works until we get an evidence that it has failed.*

What do we need?

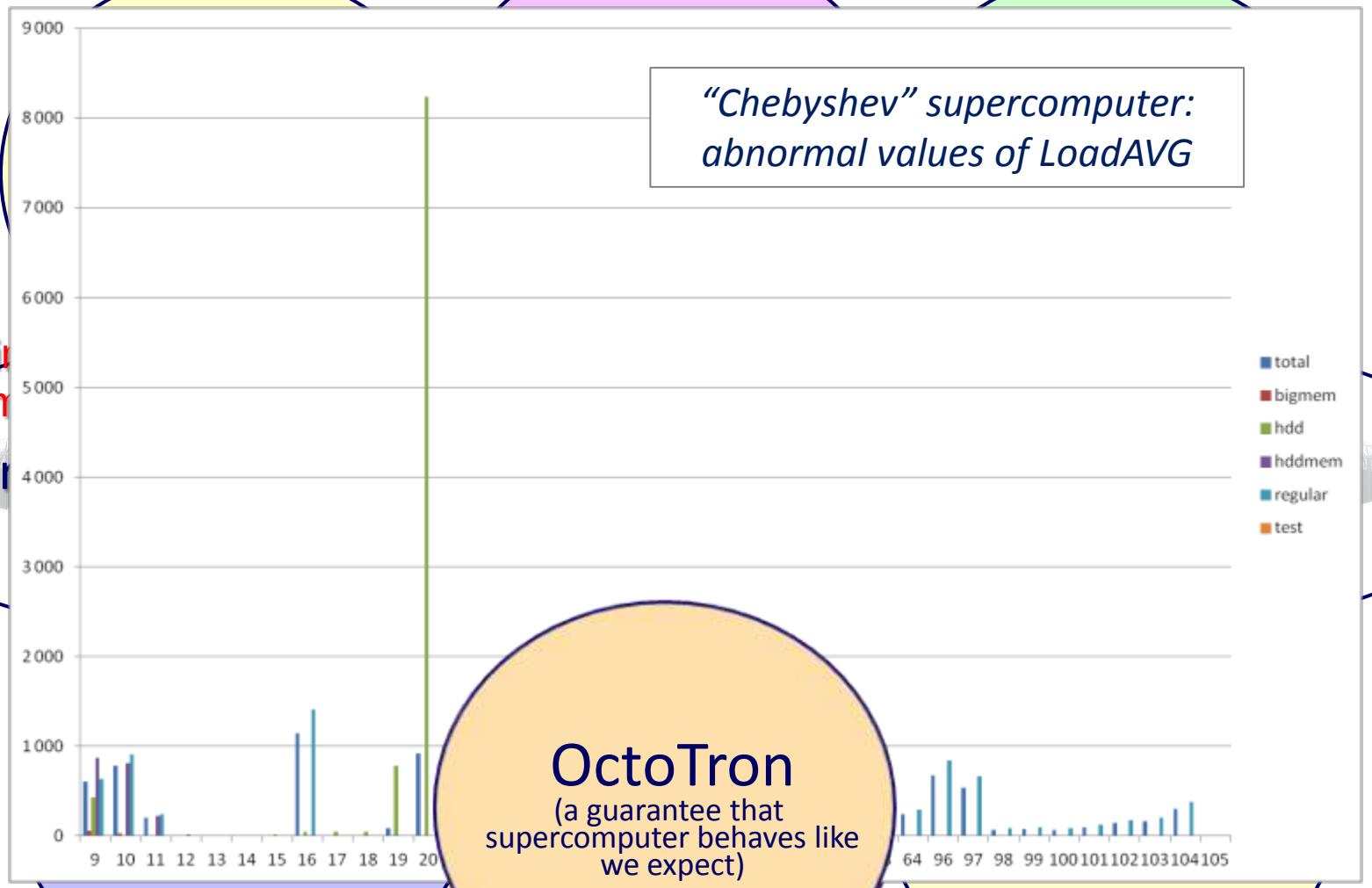
Our expectations = Reality

We need a guarantee*:*
if something goes wrong inside a supercomputer we shall be notified immediately.

We want a system behaves in a way we expect it should behave.

Efficiency of Supercomputing Centers
(practice, practice, practice)

Users
SysAdmi
Managem
Par



"Chebyshev" supercomputer: abnormal values of LoadAVG

OctoTron
(a guarantee that supercomputer behaves like we expect)

Guarantee, Predictability and Autonomous Life of Supercomputers

Supercomputers should be autonomous in self-control.

Moreover:
The larger supercomputers, the more autonomous they should be.

Guarantee, Predictability and Autonomous Life of Supercomputers

A guarantee of "our expectations = reality", how this can be done?

- *a formal model of supercomputers (**model is a graph**),*
- *a set of formal rules,*
- *a set of reactions,*

Autonomous life and control of MSU supercomputers:

*-**"Chebyshev"** supercomputer, 60 Tflops, 625 CPUs:*
10 228 nodes, 24 698 edges, 205 044 attributes, 160 rules, 100 reactions;
*- **"Lomonosov"** supercomputer, 1.7 Pflops, 12K CPUs, 2K GPU:*
116 000 nodes, 332 000 edges, 2 400 000 attributes,...

Initial deployment, Detection of faults, critical and emergency situations, Turning off minimum amount of hardware, Self diagnostics, Previous accidents, etc. are done according to a model and rules.

Current trend: many decisions about control over HW&SW of supercomputers must be taken automatically.

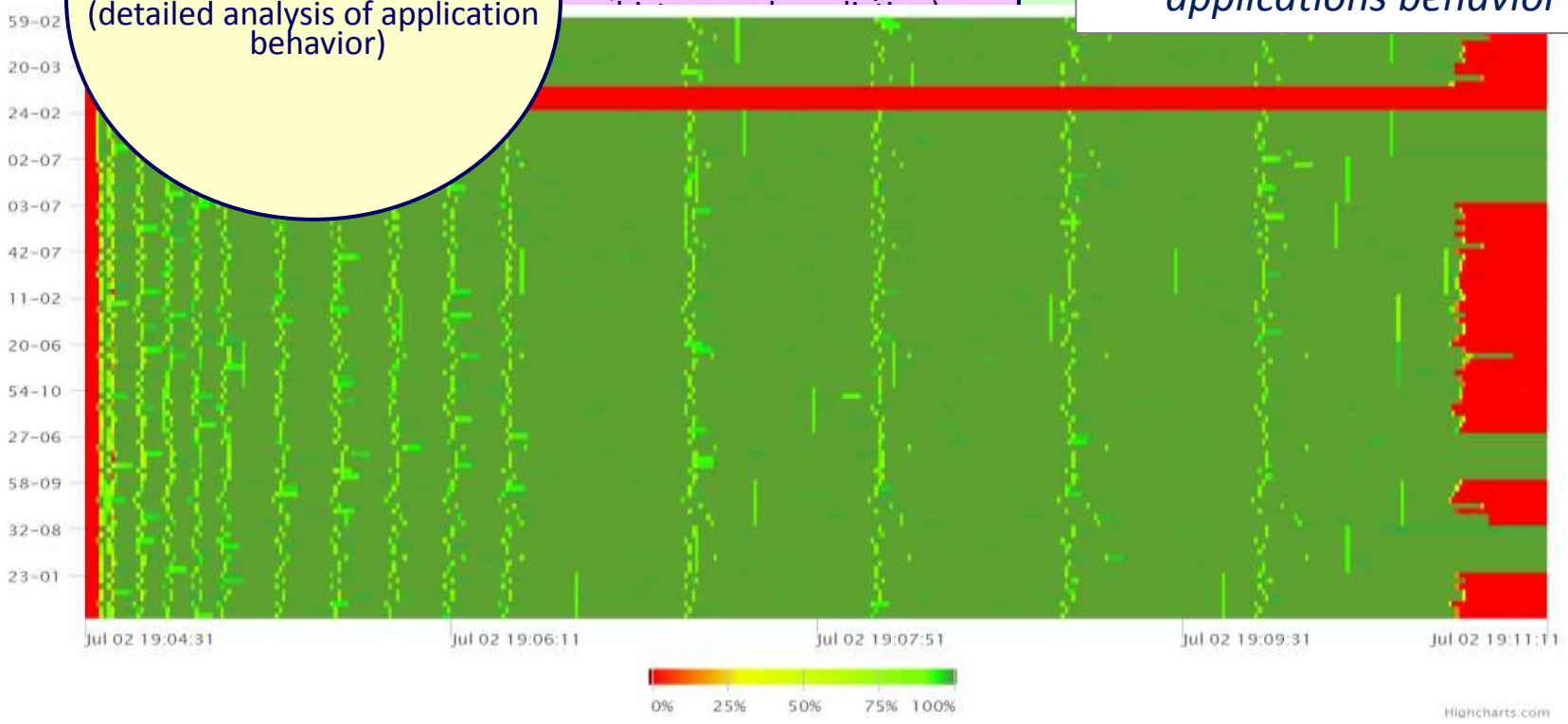
Efficiency of Supercomputing Centers
(practice, practice, practice)

JobDigest
(detailed analysis of application behavior)

OctoStat
(statistics and analytics:

Fine analysis of applications behavior

User
SysA
Mana

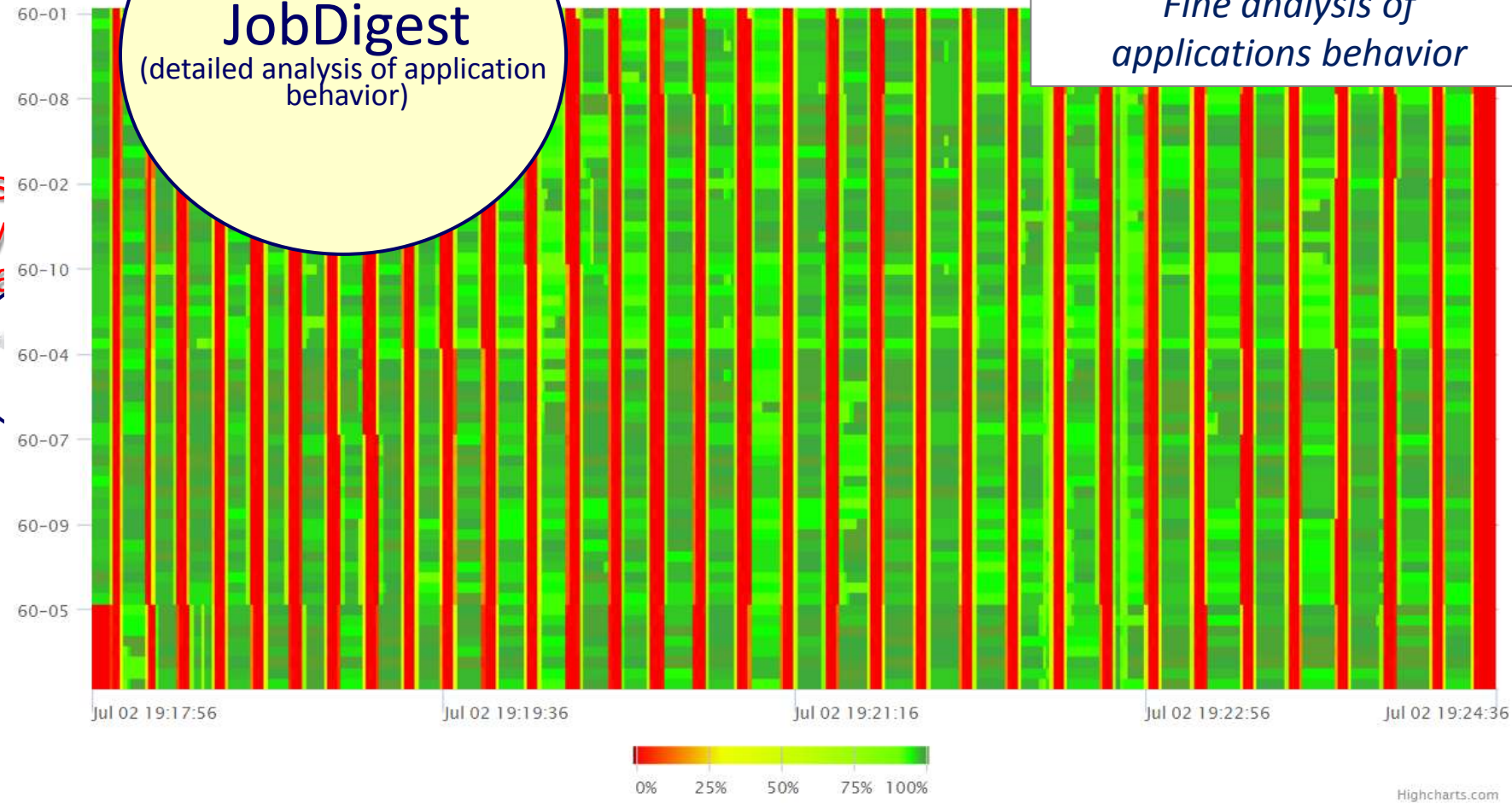


we expect)

Efficiency of Supercomputing Centers
(practice, practice, practice)

JobDigest
(detailed analysis of application behavior)

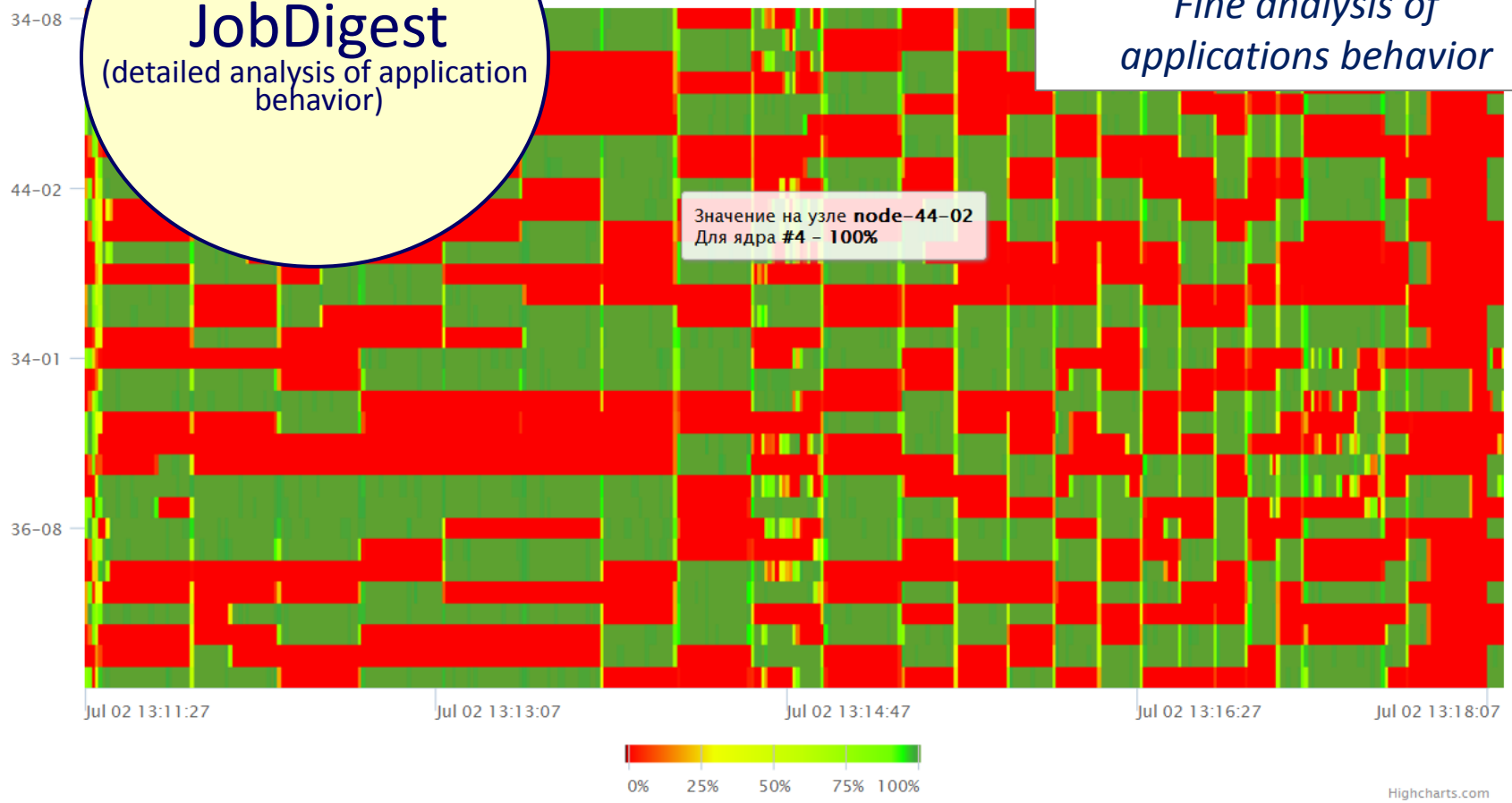
Fine analysis of applications behavior



Efficiency of Supercomputing Centers
(practice, practice, practice)

JobDigest
(detailed analysis of application behavior)

Fine analysis of applications behavior

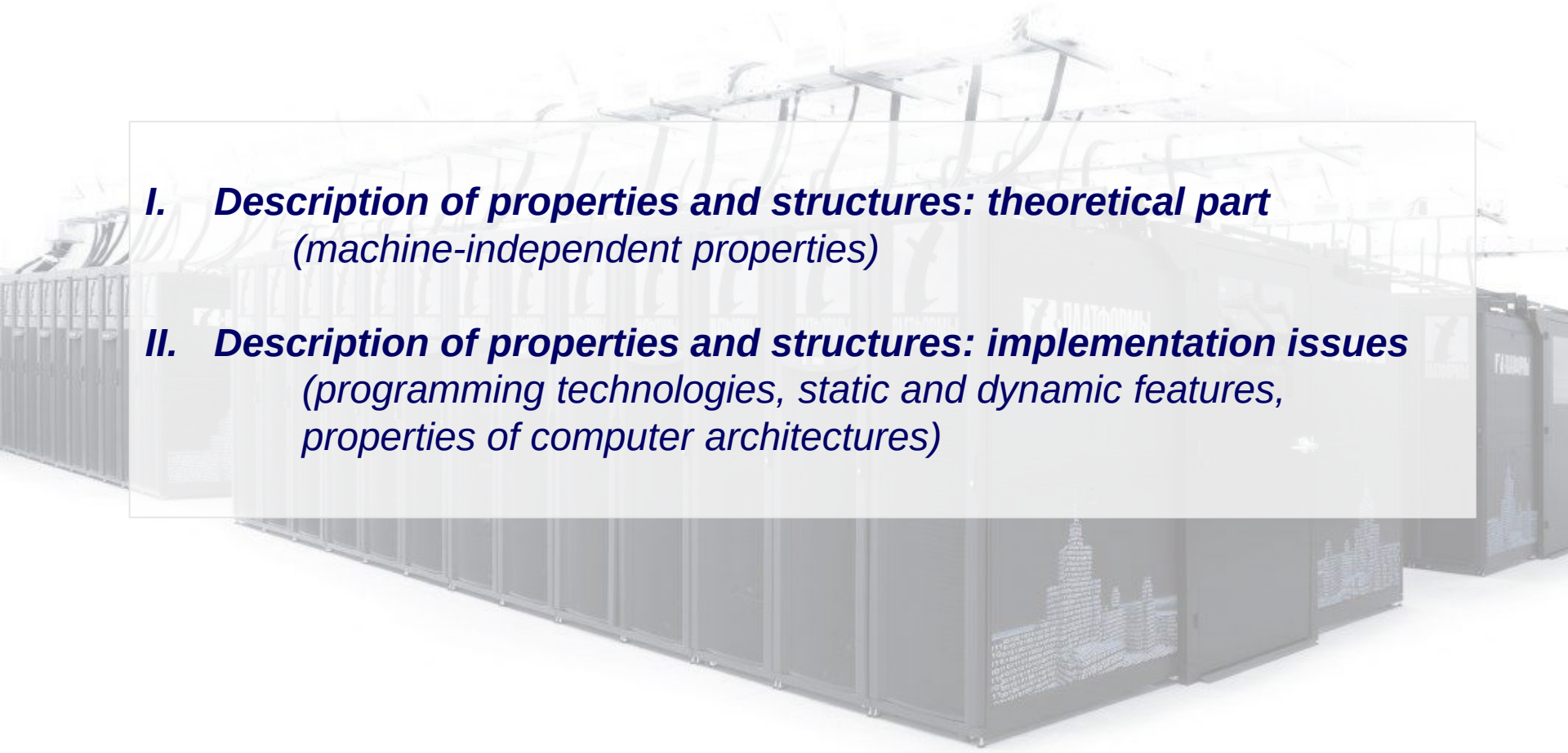


Use
Sys
Man


International Supercomputing Conference
ISC High Performance
The HPC Event
30th Anniversary
18
BDEC
BDEC Collaboration Opportunities in Russia
Parallel Properties of Algorithms (AlgoWiki)
July 16, 2015, Frankfurt, Germany

Algorithms: description of properties and structures

(from mobile platforms to exascale supercomputers)



I. Description of properties and structures: theoretical part

(machine-independent properties)

II. Description of properties and structures: implementation issues

(programming technologies, static and dynamic features, properties of computer architectures)

AlgoWiki

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Welcome! Join us!

AlgoWiki is an open encyclopedia of **algorithms' properties** and **features of their implementations** on different hardware and software platforms from mobile to extreme scale, which allows for collaboration with the worldwide computing community on algorithm descriptions.

AlgoWiki provides an exhaustive description of an algorithm. In addition to classical algorithm properties such as serial complexity, AlgoWiki also presents additional information, which together provides a complete description of the algorithm: its parallel complexity, parallel structure, determinacy, data locality, performance and scalability estimates, communication profiles for specific implementations, and many others.

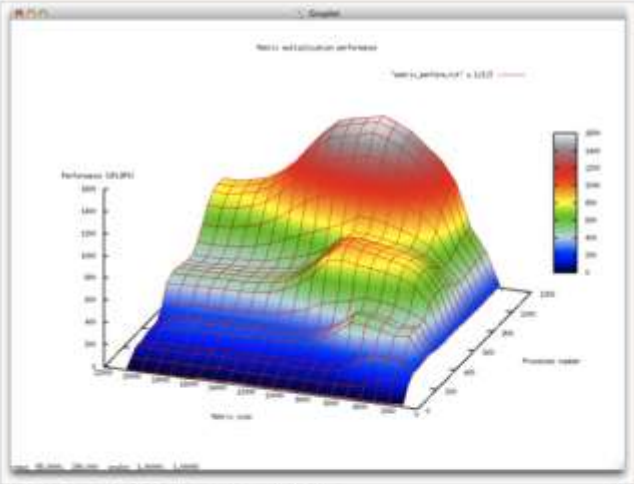
Read more: About project.

Project structure

Algorithm classification — the main section of AlgoWiki which contains descriptions of all algorithms. Algorithms are added to the appropriate category of the classification, and classification is expanded with new sections if necessary.

Featured article

Today's featured picture



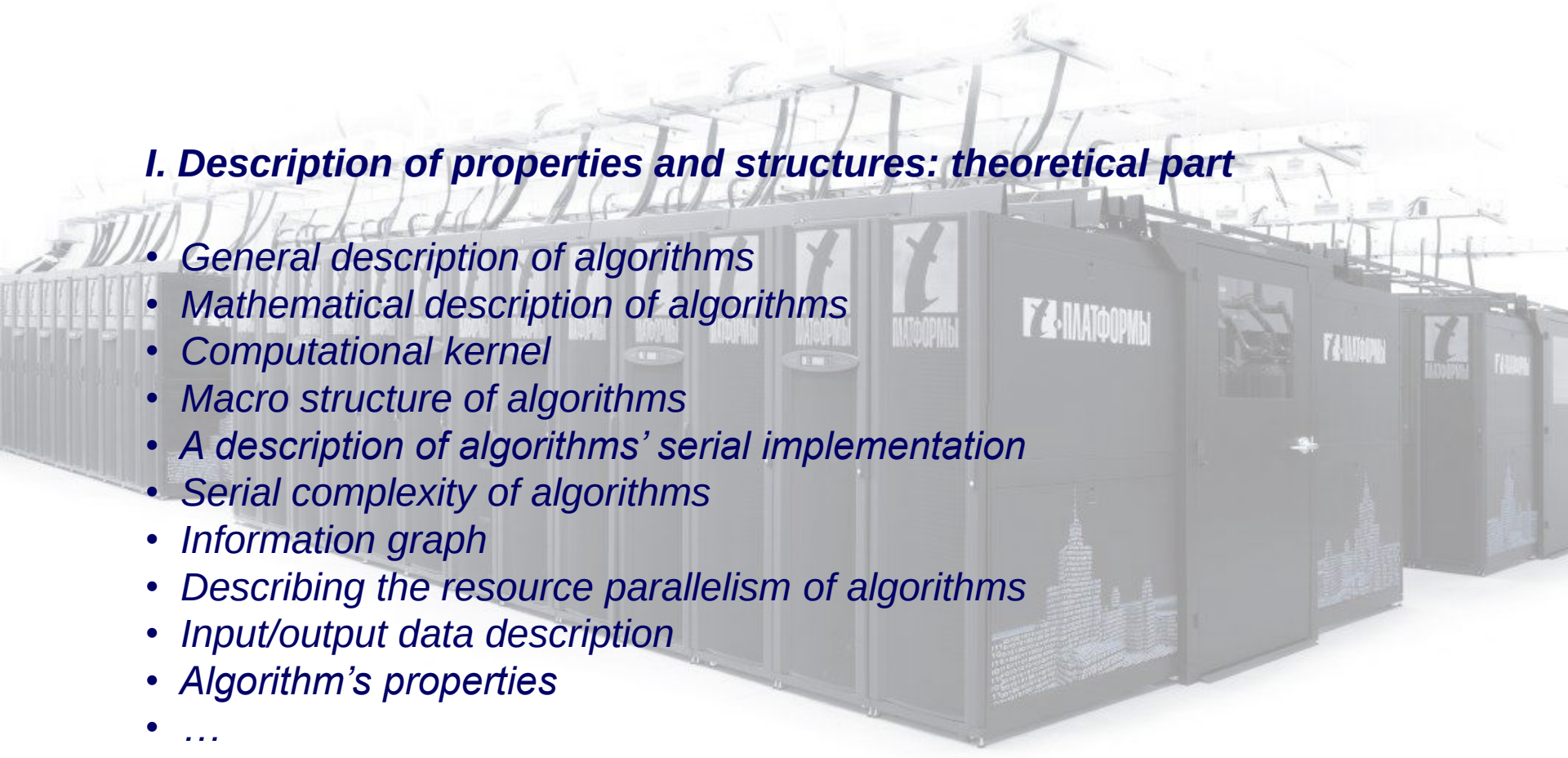
Performance for dense matrix multiplication

Work organization

Description of algorithm properties and structure

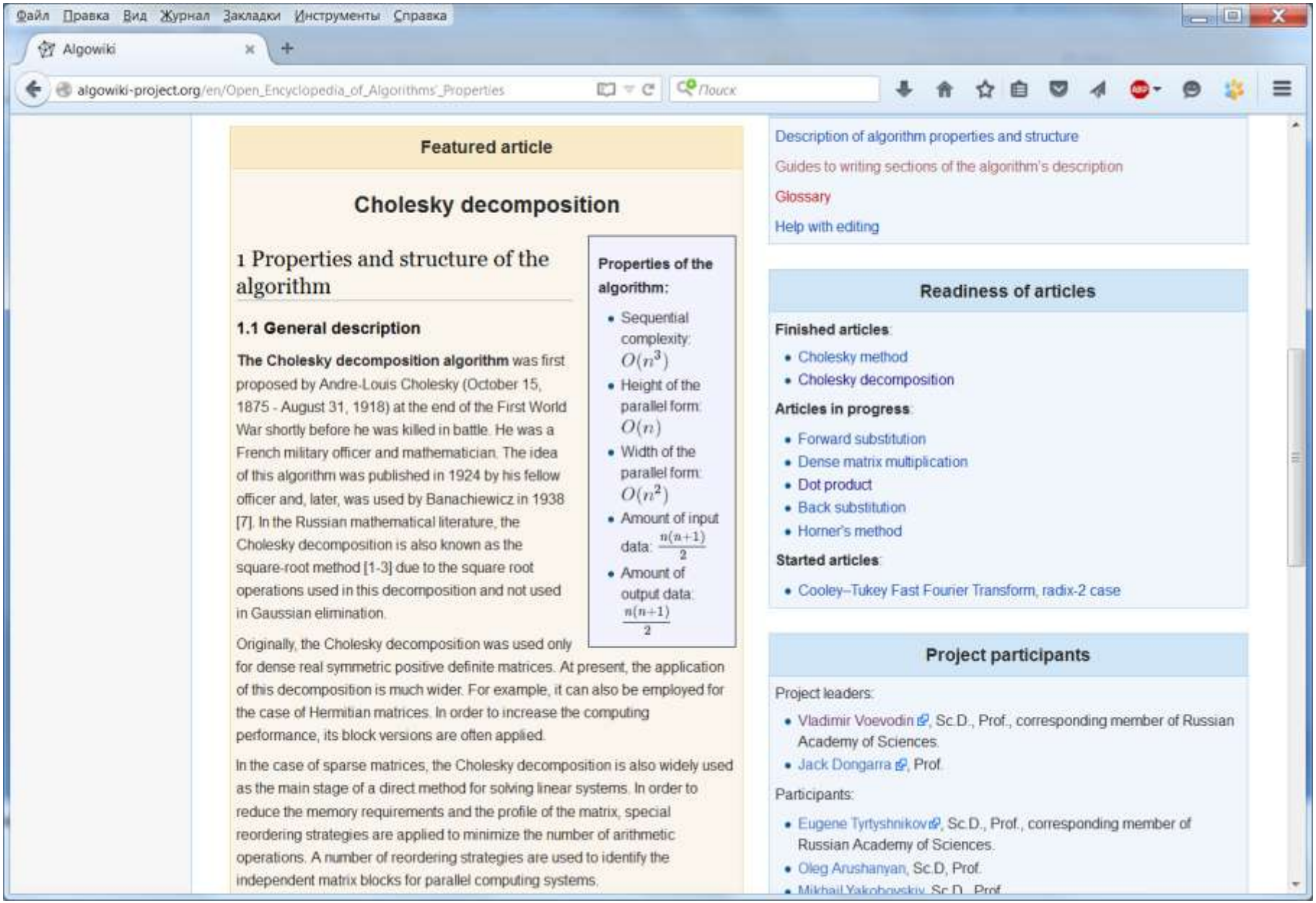
Guides to writing sections of the algorithm's description

Algorithms: description of properties and structures
(from mobile platforms to exascale supercomputers)



I. Description of properties and structures: theoretical part

- *General description of algorithms*
- *Mathematical description of algorithms*
- *Computational kernel*
- *Macro structure of algorithms*
- *A description of algorithms' serial implementation*
- *Serial complexity of algorithms*
- *Information graph*
- *Describing the resource parallelism of algorithms*
- *Input/output data description*
- *Algorithm's properties*
- *…*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Algowiki
algowiki-project.org/en/Open_Encyclopedia_of_Algorithms'_Properties
Поиск
Featured article
Cholesky decomposition
1 Properties and structure of the algorithm
1.1 General description
The Cholesky decomposition algorithm was first proposed by Andre-Louis Cholesky (October 15, 1875 - August 31, 1918) at the end of the First World War shortly before he was killed in battle. He was a French military officer and mathematician. The idea of this algorithm was published in 1924 by his fellow officer and, later, was used by Banachiewicz in 1938 [7]. In the Russian mathematical literature, the Cholesky decomposition is also known as the square-root method [1-3] due to the square root operations used in this decomposition and not used in Gaussian elimination.
Originally, the Cholesky decomposition was used only for dense real symmetric positive definite matrices. At present, the application of this decomposition is much wider. For example, it can also be employed for the case of Hermitian matrices. In order to increase the computing performance, its block versions are often applied.
In the case of sparse matrices, the Cholesky decomposition is also widely used as the main stage of a direct method for solving linear systems. In order to reduce the memory requirements and the profile of the matrix, special reordering strategies are applied to minimize the number of arithmetic operations. A number of reordering strategies are used to identify the independent matrix blocks for parallel computing systems.
Properties of the algorithm:
Sequential complexity: $O(n^3)$
Height of the parallel form: $O(n)$
Width of the parallel form: $O(n^2)$
Amount of input data: $\frac{n(n+1)}{2}$
Amount of output data: $\frac{n(n+1)}{2}$
Description of algorithm properties and structure
Guides to writing sections of the algorithm's description
Glossary
Help with editing
Readiness of articles
Finished articles:
Cholesky method
Cholesky decomposition
Articles in progress:
Forward substitution
Dense matrix multiplication
Dot product
Back substitution
Horner's method
Started articles:
Cooley–Tukey Fast Fourier Transform, radix-2 case
Project participants
Project leaders:
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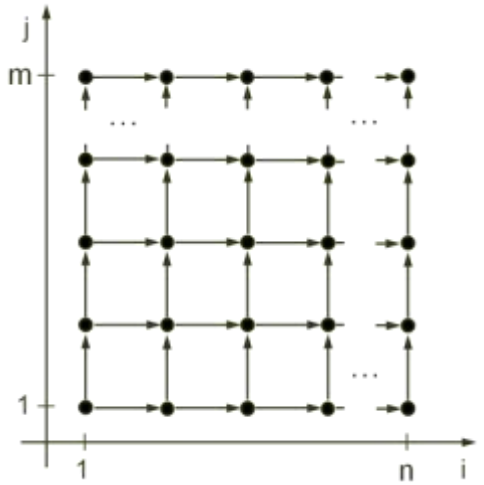
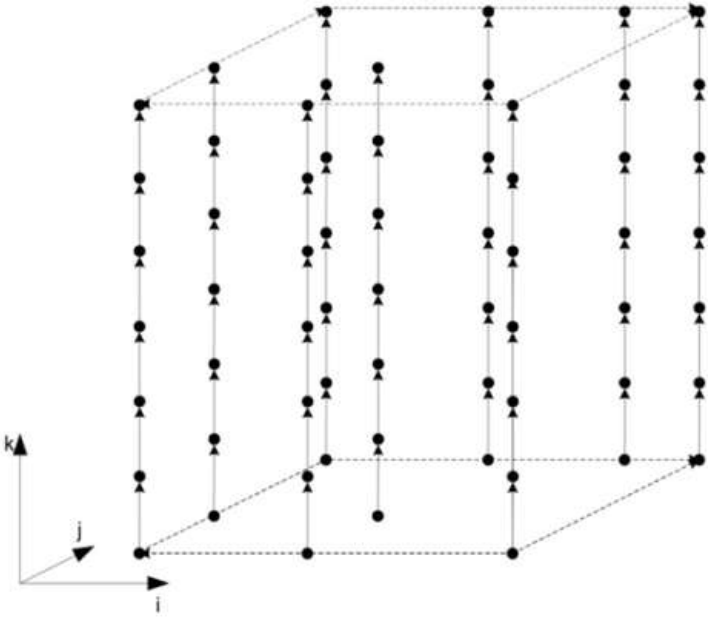
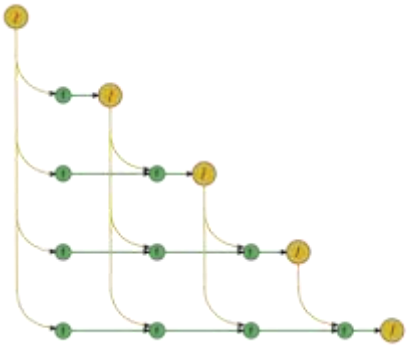
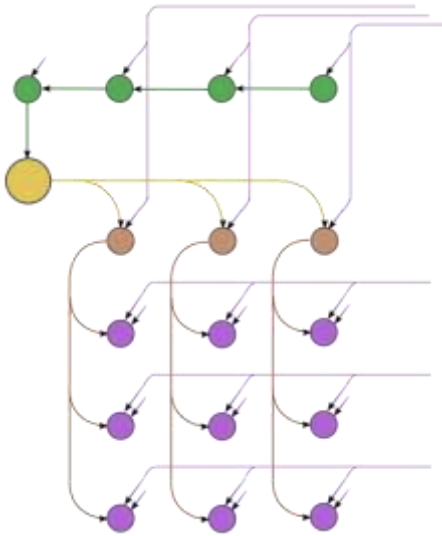
Jack Dongarra, Prof.
Participants:
Eugene Tyrtyshnikov, Sc.D., Prof., corresponding member of Russian Academy of Sciences
Oleg Arushanyan, Sc.D, Prof.
Mikhail Yakobovskiy, Sc.D., Prof.

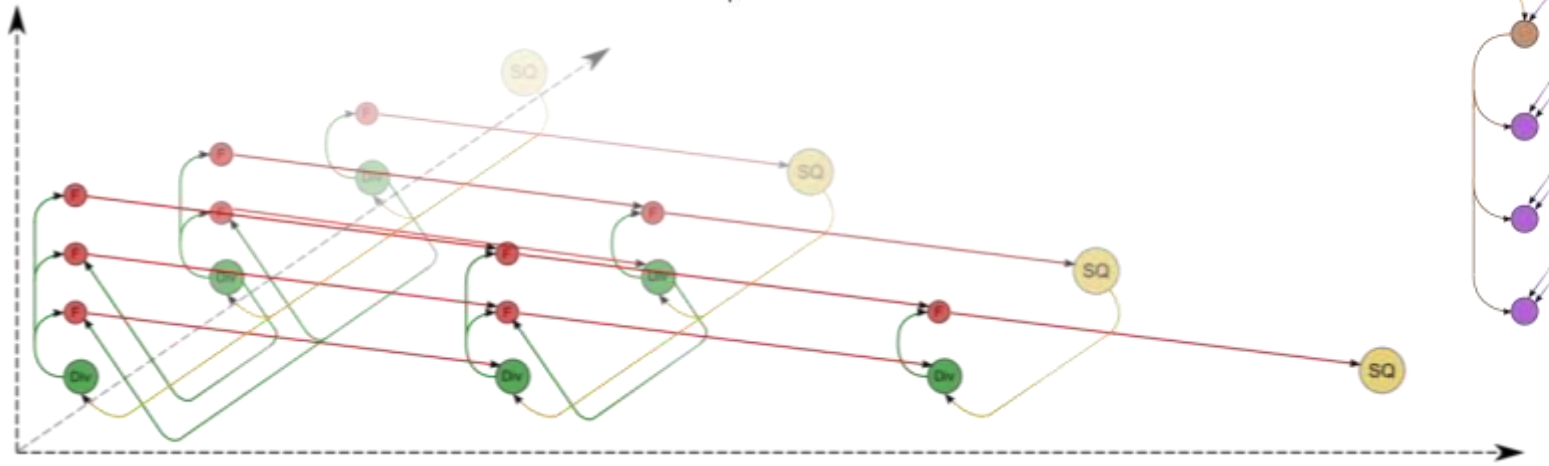
Algorithms: description of properties and structures
(information graph)



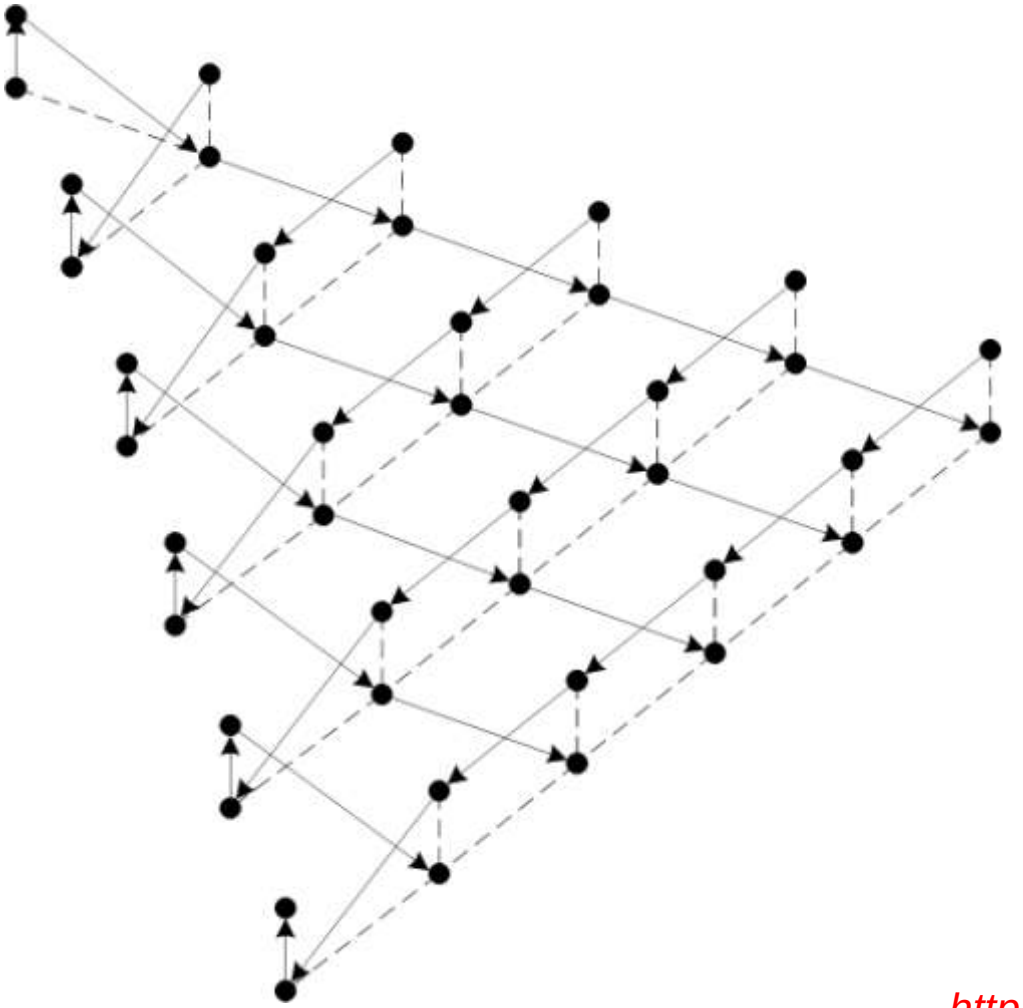




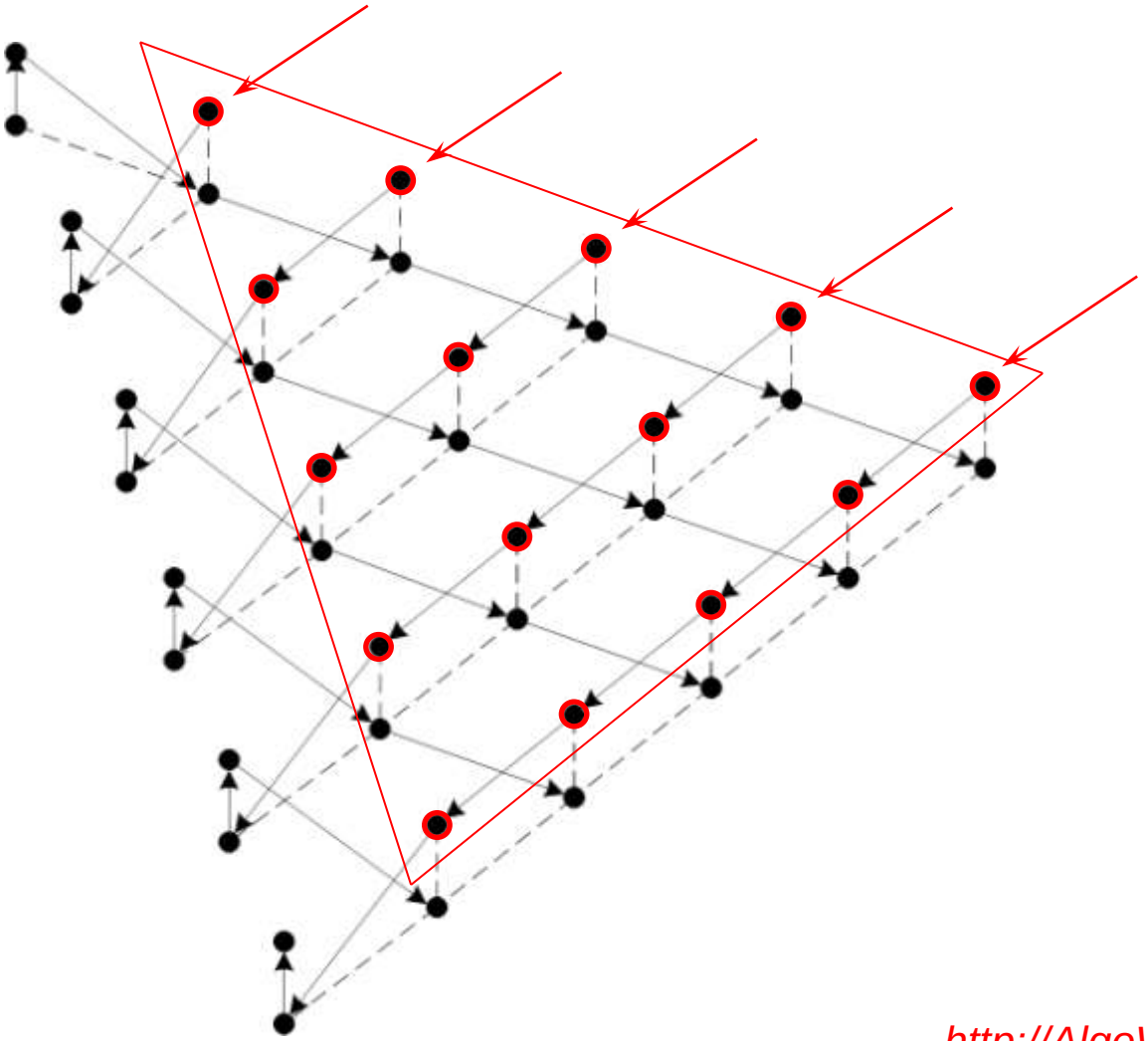




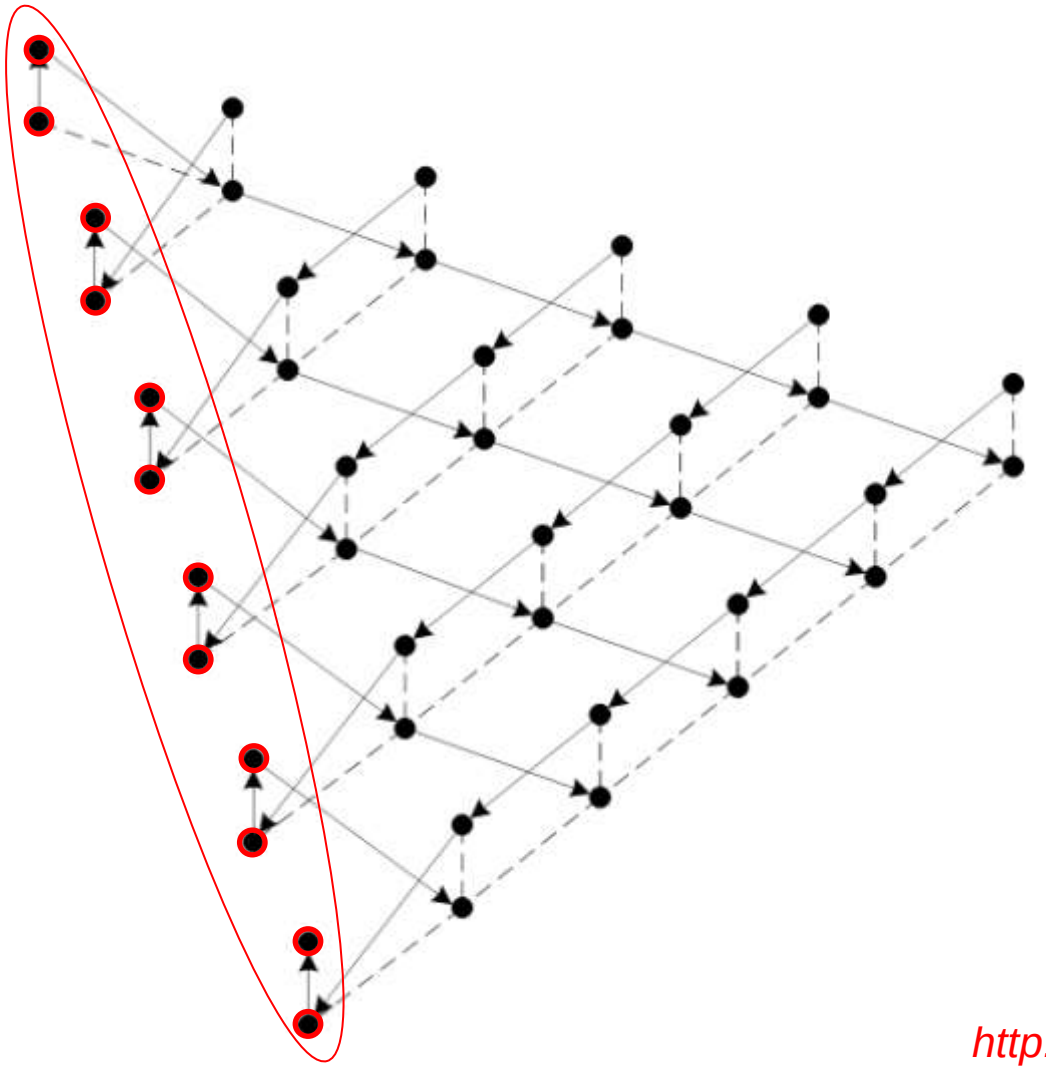
Algorithms: description of properties and structures
(information graph)



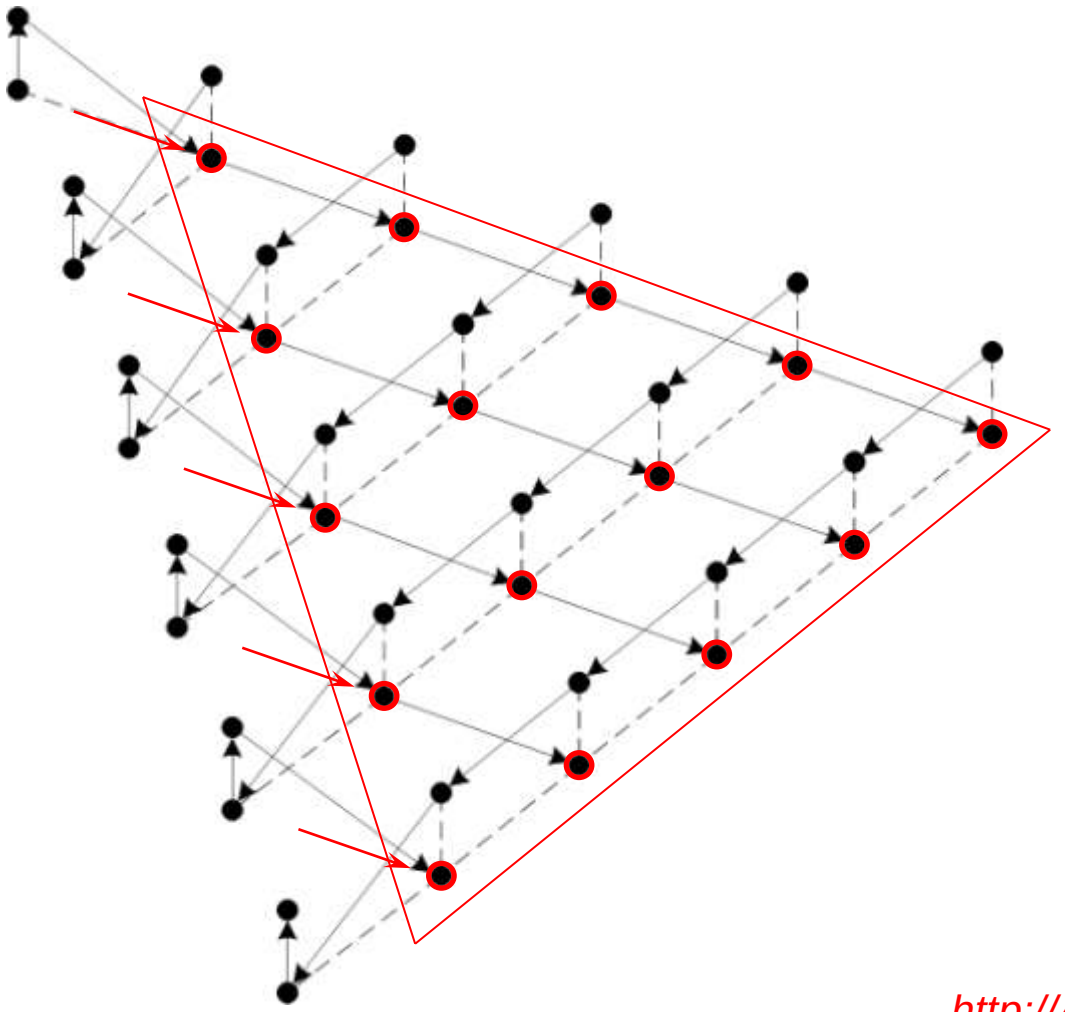
Algorithms: description of properties and structures
(information graph)



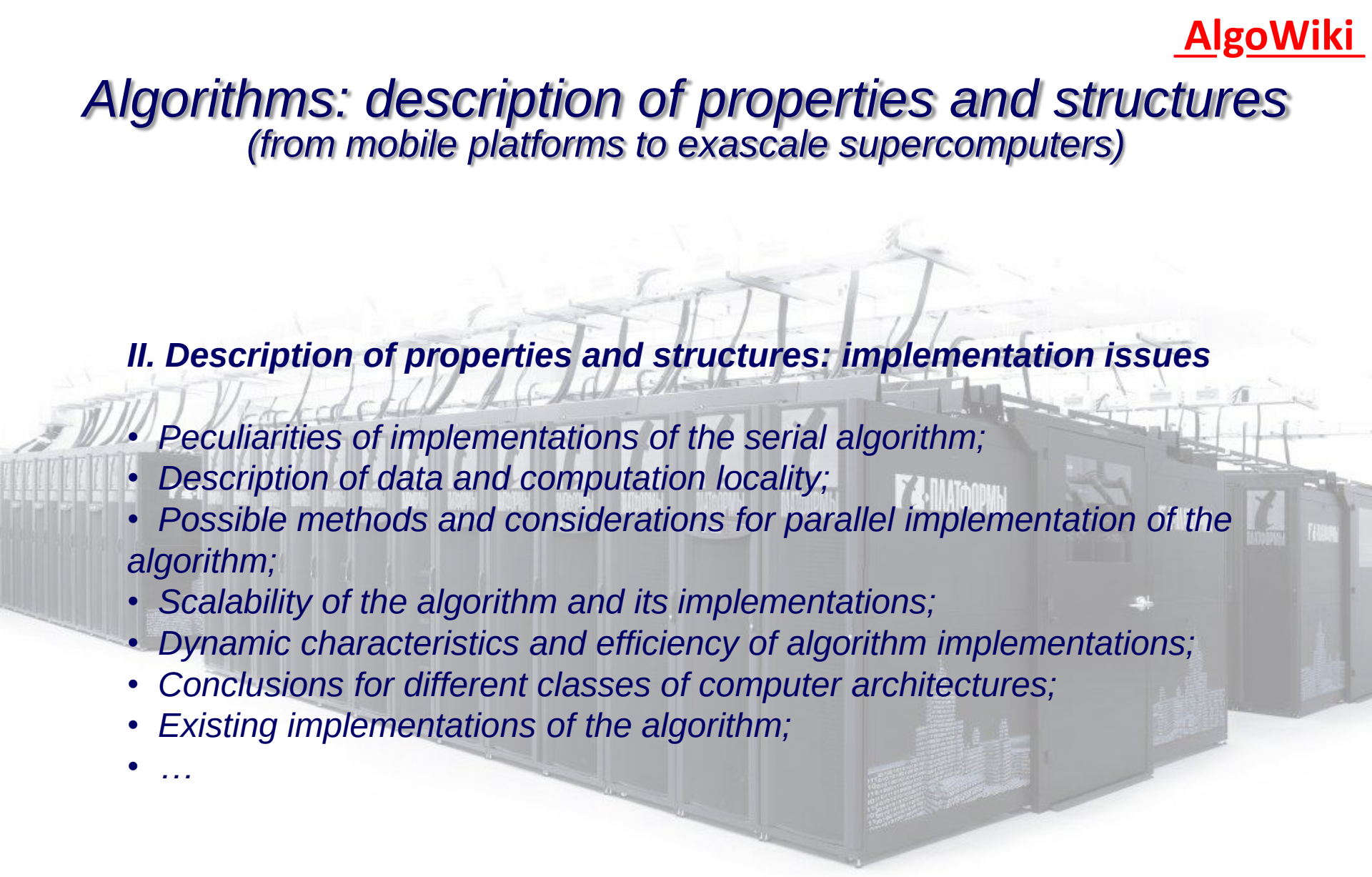
Algorithms: description of properties and structures
(information graph)



Algorithms: description of properties and structures
(information graph)



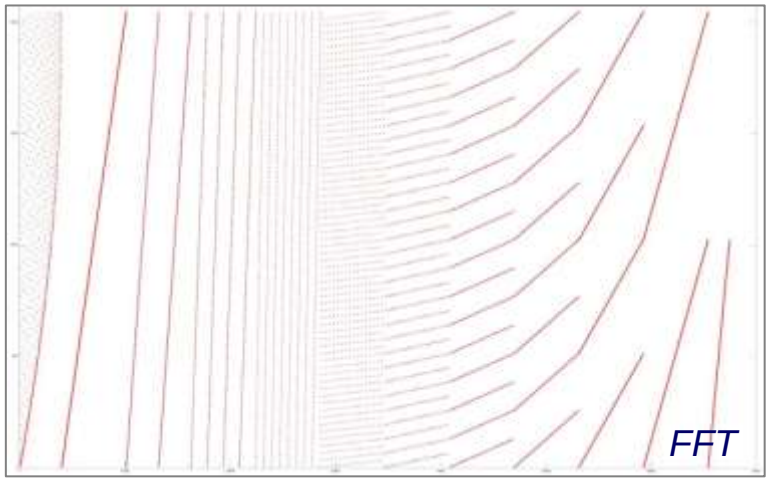
Algorithms: description of properties and structures
(from mobile platforms to exascale supercomputers)

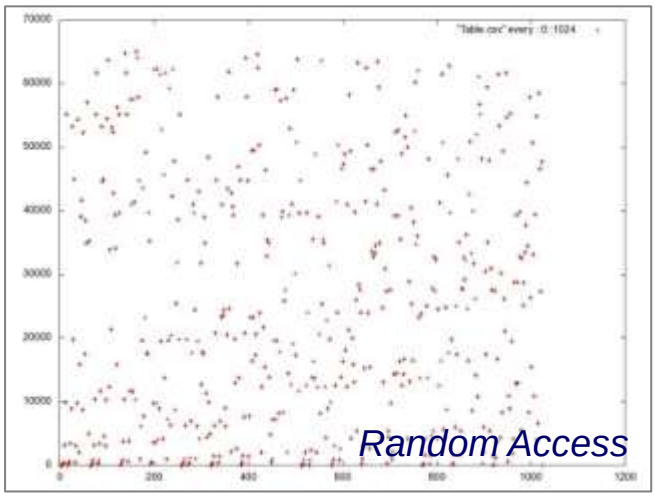


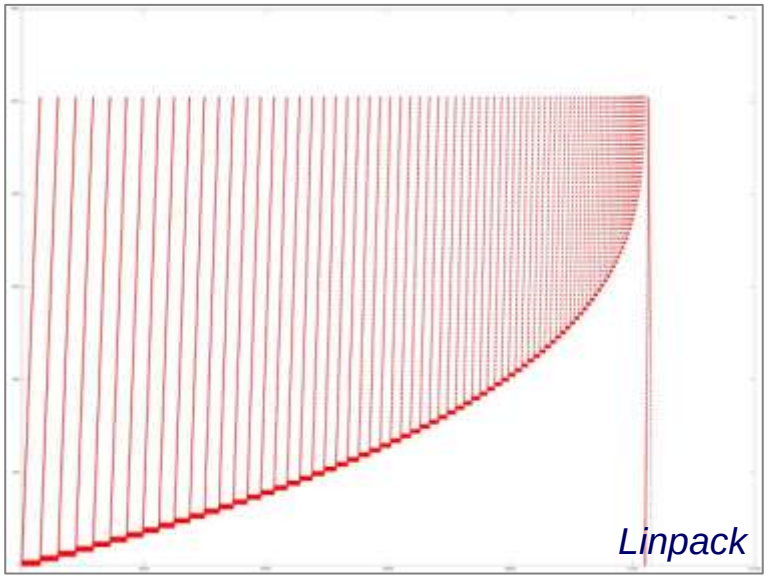
II. Description of properties and structures: implementation issues

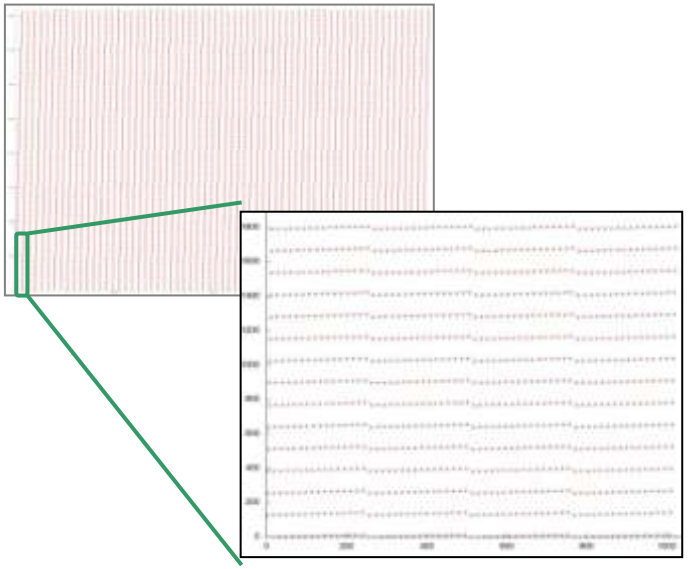
- *Peculiarities of implementations of the serial algorithm;*
- *Description of data and computation locality;*
- *Possible methods and considerations for parallel implementation of the algorithm;*
- *Scalability of the algorithm and its implementations;*
- *Dynamic characteristics and efficiency of algorithm implementations;*
- *Conclusions for different classes of computer architectures;*
- *Existing implementations of the algorithm;*
- *…*

Algorithms: description of properties and structures
(description of data locality)



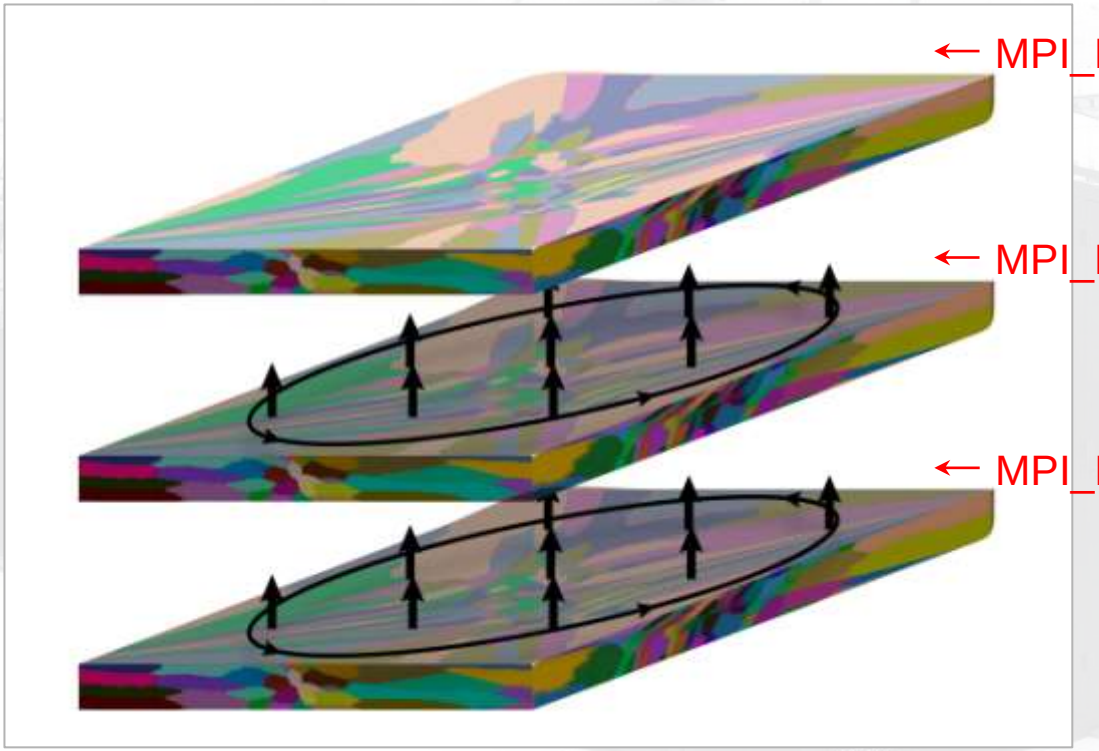






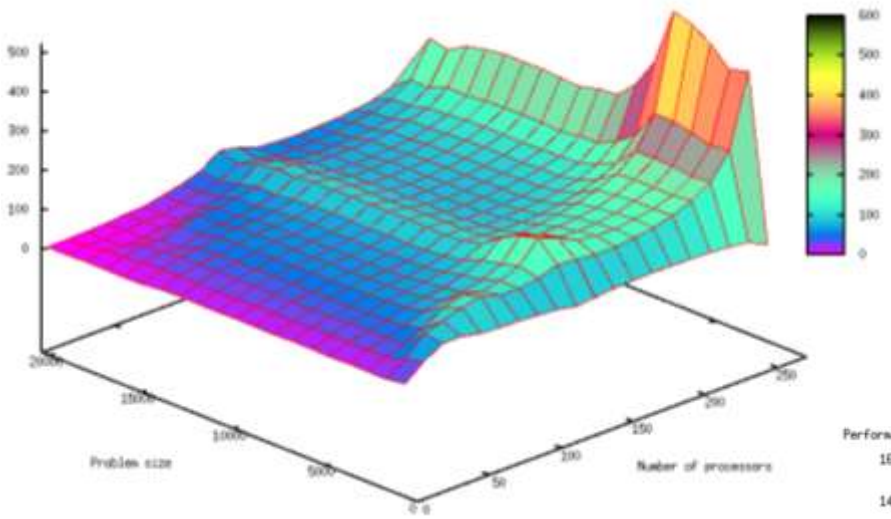
Courtesy of Vad.Voevodin, MSU

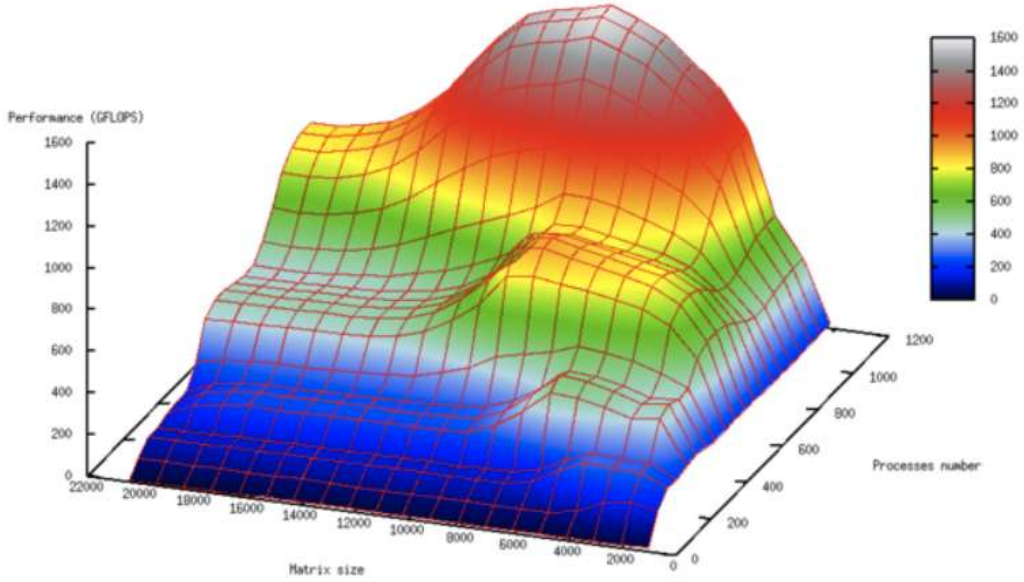
Algorithms: description of properties and structures
(communication profile: collective operations)



Algorithms: description of properties and structures

(scalability of algorithms: performance)

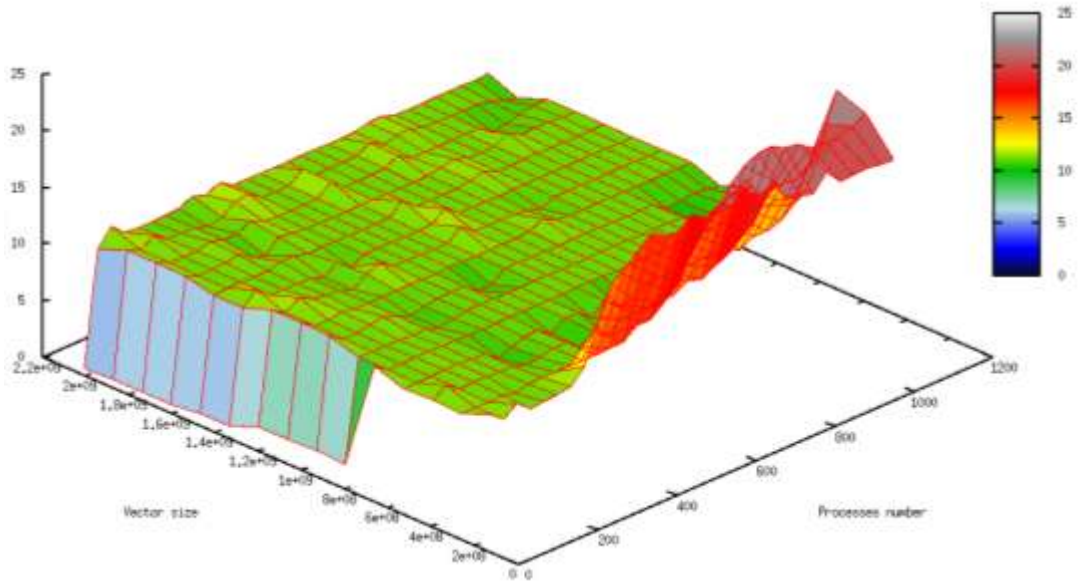


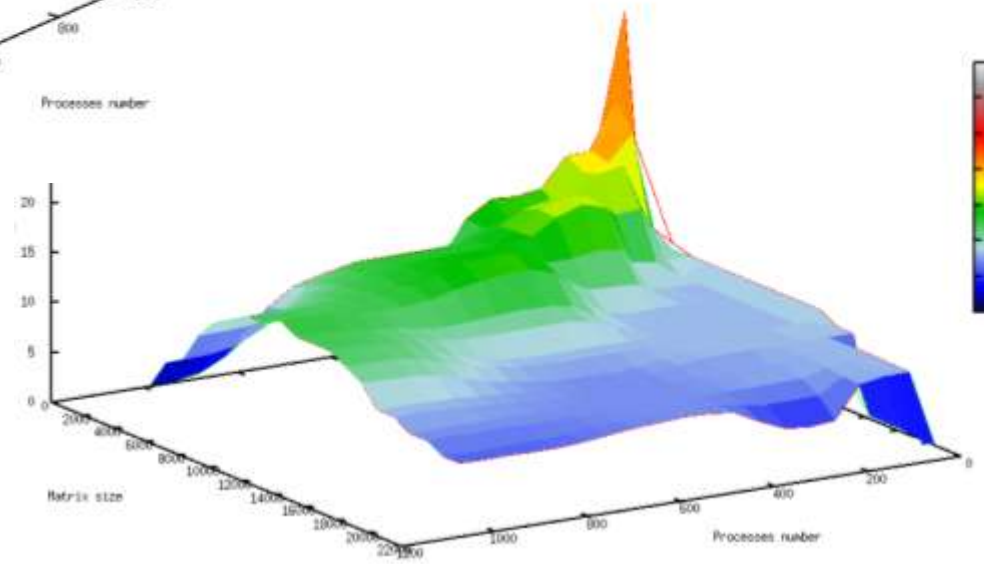


Courtesy of A.Teplov, MSU

Algorithms: description of properties and structures

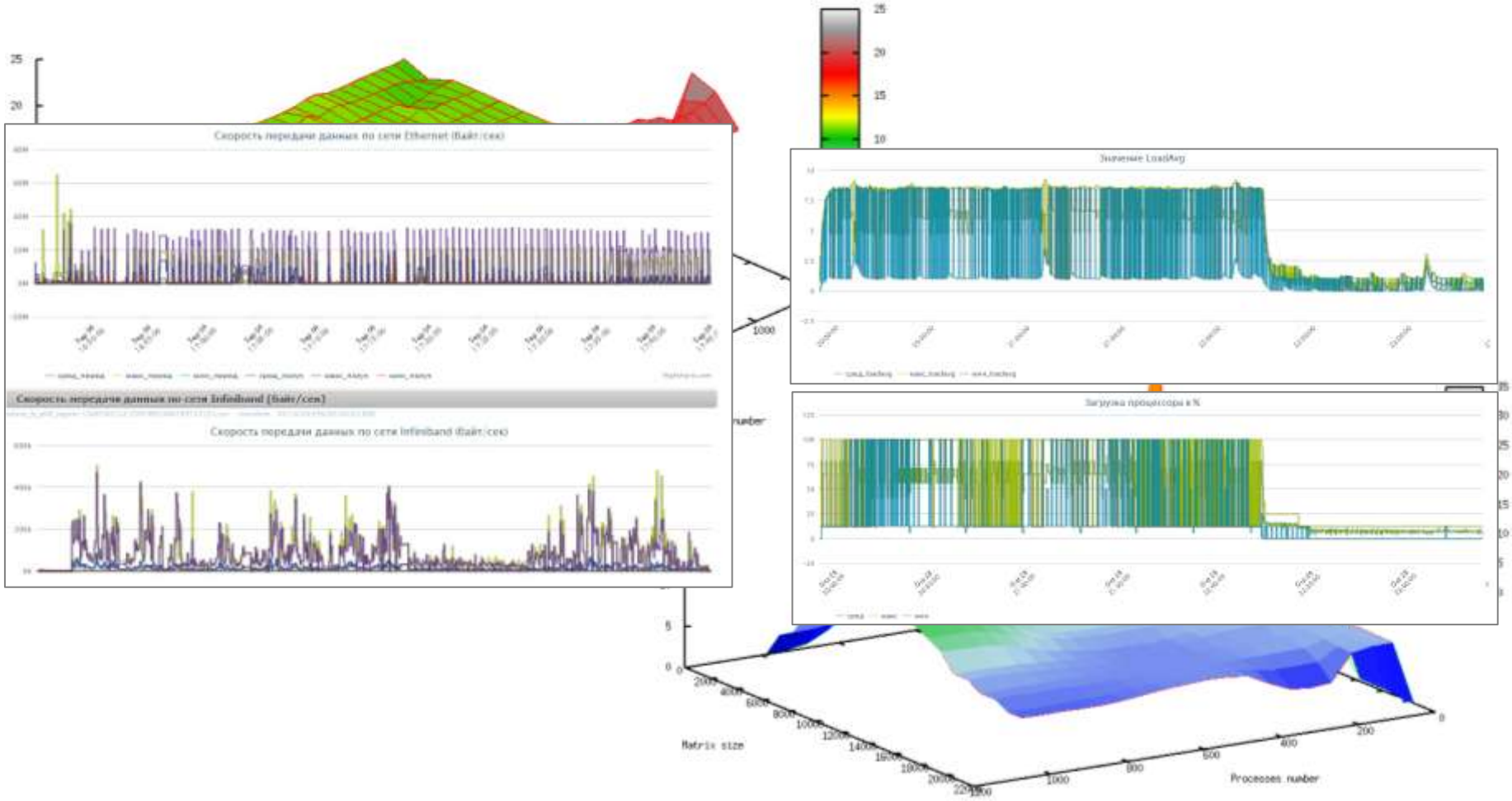
(scalability of algorithms: efficiency)





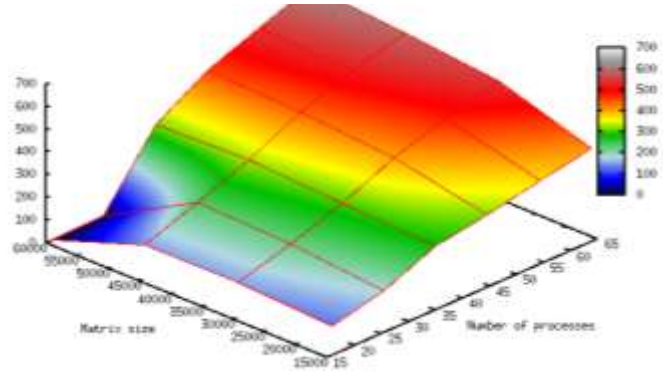
Courtesy of A.Teplov, MSU

Algorithms: description of properties and structures
(dynamic features)

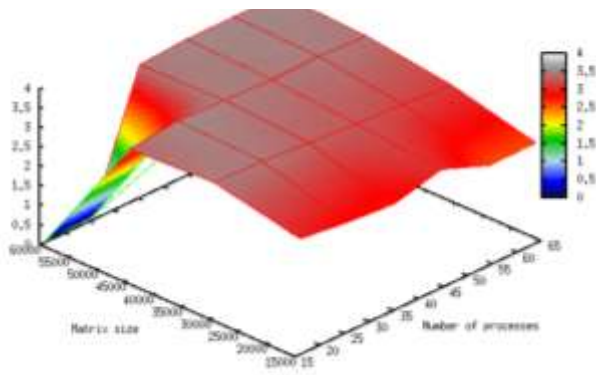


Courtesy of A.Teplov, MSU

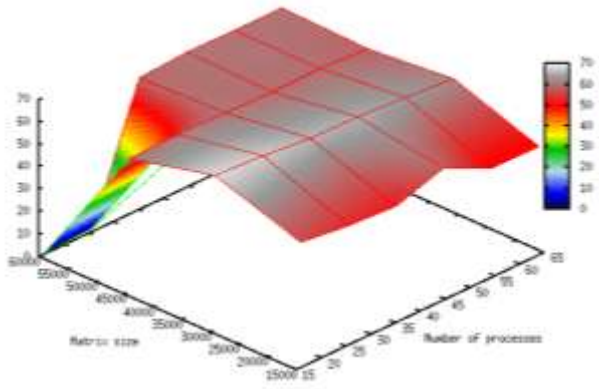
Performance (Gflops)



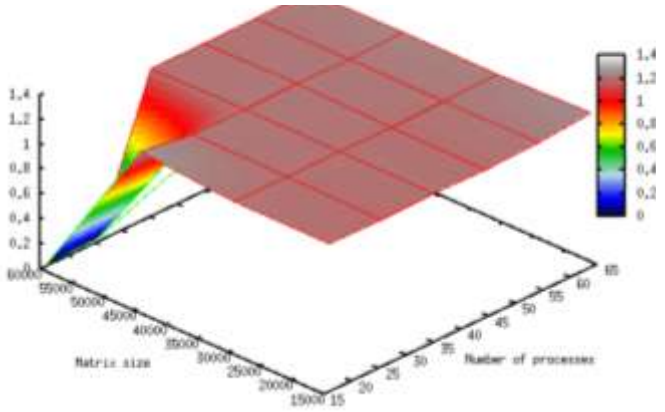
Performance of 1 core



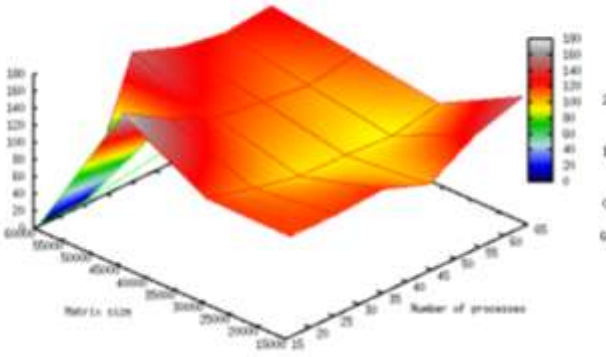
L1 cache misses (mln/s)



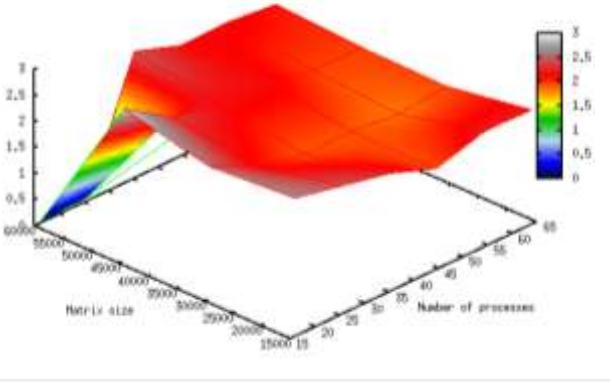
Number of Load ops (bln/s)



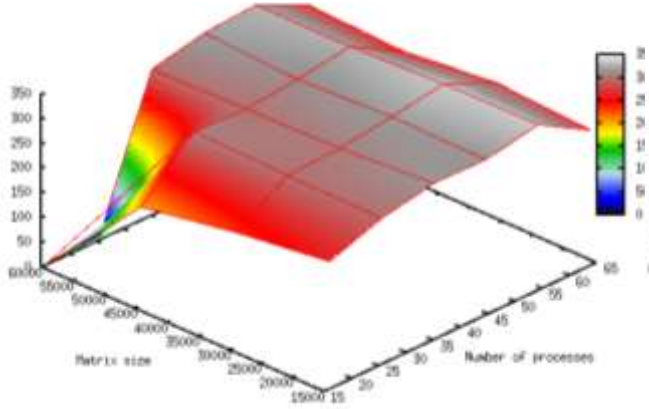
Number of Store ops (mln/s)



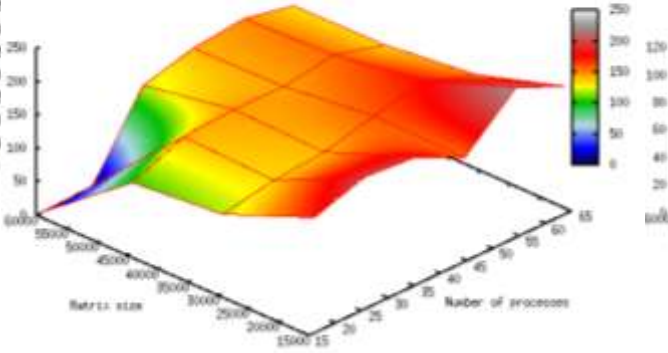
L3 cache-misses (mln/s)



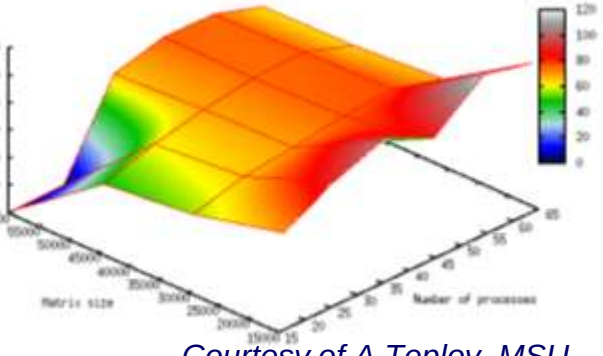
Data transfer rate (MB/s)



Average data transfer rate (MB/s)



Data transfer rate (thousands packets/s)



Courtesy of A.Teplov, MSU

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Welcome! Join us!

AlgoWiki is an open encyclopedia of **algorithms' properties** and features of **their implementations** on different hardware and software platforms and systems, from mobile to extreme scale, which allows for collaboration with the entire high performance computing community on algorithm descriptions.

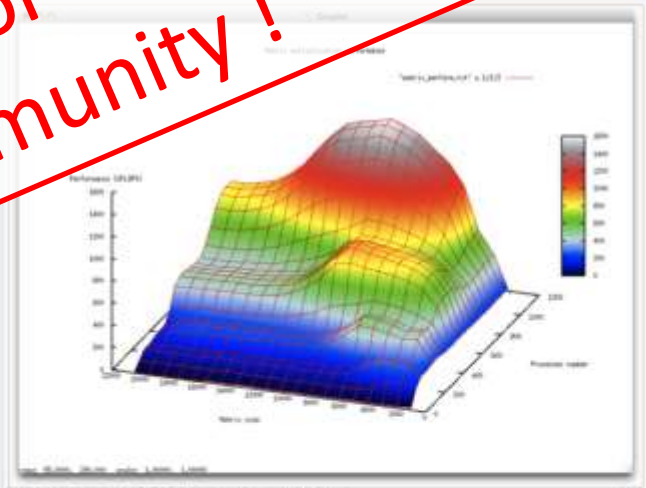
AlgoWiki provides an exhaustive description of the algorithm. In addition to the classical algorithm properties such as serial complexity, AlgoWiki describes also additional information that altogether provides a complete description of the algorithm, its properties, parallel structure, scalability, data locality, performance and scalability estimates, and implementation profiles for specific computers, and many other features. Read more: About project

Project structure

Algorithm classification — the main section of AlgoWiki which contains descriptions of all algorithms. Algorithms are added to the appropriate category of the classification, and classification is expanded with new sections if necessary.

Featured article

Today's featured picture



Performance for dense matrix multiplication

Work organization

Description of algorithm properties and structure

Guides to writing sections of the algorithm's description

AlgoWiki is a project for the entire computing community !


International Supercomputing Conference
ISC High Performance
The HPC Event
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18
BDEC
BDEC Collaboration Opportunities in Russia
Supercomputing Education
July 16, 2015, Frankfurt, Germany

Supercomputing Consortium of Russian Universities

(http://hpc-russia.ru)

2015: 61 full and associated members

СУПЕРКОМПЬЮТЕРНЫЙ
КОНСОРЦИУМ УНИВЕРСИТЕТОВ РОССИИ

СУПЕРКОМПЬЮТЕРНОЕ ОБРАЗОВАНИЕ В РОССИИ

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INTERNSHIPS AT MSU

We invite you to undertake internships at CMC MSU Department of Supercomputers and Quantum Informatics.

The head of department — corresponding member of Russian Academy of Sciences Prof. Vladimir V. Voevodin.

These internships are aimed at carrying out research, working towards PhD, preparation of publications, fulfillment of course and graduate work using unique opportunities of MSU Supercomputing Center - the largest supercomputer center in Russia. Topics of internships cover all general research areas of the department: supercomputing and quantum computing, theoretical and practical problems of system software and applications development for high performance computer systems including perspective exaflop systems, parallel algorithms, applied problems solving methods and many others. Every training is held in accordance with individual plan for the topic that can be both proposed by a trainee or by the department. Every

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Russian Supercomputing D...

russianscdays.org/en

Поиск

Russian Supercomputing Days

Moscow, september 28-29

Russian Supercomputing Days is the first united international supercomputing conference carried on the best traditions of Russian and international supercomputing events.

EXHIBITION

September 28, 13:00
Exhibition features t
and software solutic
performance compu

Main | About the Conference » | Agenda » | Attending the Conference | For Authors | Registration

Supercomputing Consortium of Russian Universities and Federal Agency for Scientific Organizations

September 28-29, 2015, Moscow

Russian Supercomputing Days

In 2015, the conference will take on a brand new format, uniting several traditional Russian and international supercomputing events, including the *Scientific Services & Internet* international supercomputing conference, the *High Performance Parallel Computing on Cluster Systems* international conference, and the *Russian Supercomputing Conference*.

The united conference will cater to the interests of a wide range of representatives from science, industry, business, education, government, and students – anyone connected to the development or the use of supercomputing technologies. The conference topics will cover all aspects of supercomputing technologies: software and hardware design, solving large tasks, application of supercomputing technologies in industry, exaflop computing issues, supercomputing education, and many others.

The new, 23rd edition of Top 50 list of the most powerful supercomputers in the CIS will be announced on the first day of the conference.

The conference will be conducted in Russian and English, with simultaneous interpretation of the reports at the plenary section.

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