Today’s Topics

1. Current HPC Status in Japan

Current HPC Status in Japan
HPCI is a nation-wide HPC infrastructure into which the supercomputers and large scale storages are mutually connected through the high speed network, SINET4.
General Use Category of the K Computer

- General Use Category: ~30% (To be called for proposals)
- Industrial Use Projects: ~5%
- Junior Researcher Promotion Projects: ~5%
- Strategic Program Category: ~50%
- General Use projects: ~20%
- Computing Resources Allocated for System Enhancement: ~15%
- Additional Allocation for acceleration of achievements: ~5%

Number of K users: 1,431
Number of projects on K Computer: 136
Strategic Application Areas

- Life science/Drug design
- New materials/New energy creation
- Global climate change prediction for disaster prevention/mitigation

- Toshio YANAGIDA
  RIKEN
- Shinji TSUNEYUKI
  University of Tokyo
- Shiro IMAWAKI
  JAMSTEC
- Chisachi KATO
  University of Tokyo
- Shinya AOKI
  University of Tsukuba

MONODUKURI
(Manufacturing technologies)
Operation of K Computer

CPU resources which are occupied to run applications

About **80%** of CPU resources are used for jobs

The rate of operation is about **93%**
The researchers who conducted simulation researches in K received Gordon Bell Prizes in two consecutive years (2011&2012).

**Real space DFT calculations of Silicon nanowires**  
*(Gordon Bell Prize 2011)*

The world’s first nano-level high precision simulation with the actual material size.

**The gravitational trillion-body problem**  
*(Gordon Bell Prize 2012)*

The world’s largest number of dark matter simulation performed on the K computer.

**Applications by Industry for Using K Computer**

**Docking simulation between protein and compound**

Estimating about 19 billion docking pairs through high speed calculations by the organized 11 Japanese pharmaceutical companies.

**Nanometer level simulation of rubber for tire**

Contribution to the development of the new rubber material for tires which realizes low fuel consumption and high grip performance.
Japanese Policy for Development of HPC Systems
Comprehensive Strategy on Science, Technology and Innovation (Cabinet Decision)

- Promotion of development, establishment, and wide utilization of world-class R&D infrastructure (e.g., utilization of supercomputers);
  establishment of an environment where skilled talents from the industry, academia, and government can attempt to conduct innovative groundbreaking research projects beyond the field or organizational boundaries.
Continuous Development of HPCI (High Performance Computing Infrastructure)

Peak Performance [FLOPS]
FLOPS: FLoating point Operations Per Second

Continuous Development of Top-class Supercomputers

Raise the Level of Low-end Supercomputers

Earth Simulator
CP-PACS NWT

K-Computer

Exascale Supercomputer

Universities, National Institutes
Industry, Laboratories

Continuous Development of Top-class Supercomputers

Universities, National Institutes
Industry, Laboratories

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Exascale Supercomputer

Universities, National Institutes
Industry, Laboratories
Direction for Development of Next Gen. Supercomputers

Flagship System
System with performance at world’s top level for wide-area applications

Aim to develop Exascale supercomputer by 2020

Leading Machines

Nation-wide infrastructure Operated by HPCI

Characterized systems supporting Flagship system

Systems at Supercomputer Centers in 9 Universities
Systems at National Institutes

Other Systems in Universities, and so on.
Development of new medicine with little side effect

Computing simulation that could take the possibility of side effects into account.

Prevention and mitigation against wide-ranging complex disaster

Damage prediction and mitigation of the wide-ranging complex disaster including earthquake, tsunami, refuge, people’s movement and so on.

Next-generation device science

Predicting the unique physical properties of a composite material in one million atomic levels.

Development of higher safety car

Evaluating damages of not only car itself but human body (injury of bones, entrails, etc) of driver.

Development of an epoch-making battery

The combination of the optimal electrode material and an electrolyte is realized and it contributes to the development of the advanced battery which has high safety and tolerance.

Explorer of the origin and evolution of the universe

Clarifying the large variety of galaxies and planets by integrated simulations of the overall universe ranging from planets formation to large scale structure formation in the universe.
Japan Exascale System Development

Outline:
- Double-digits (higher) performance by 2020
- Push state of the art in power efficiency, scalability & reliability
- Enable unprecedented application capability
- AICS RIKEN in charge of exascale systems development
- Total project cost ca. JPY140 billion with about JPY 110 billion from the government’s budget (JPY 1.2 billion for 2014)

Schedule:

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<th>Year of 2013</th>
<th>System</th>
<th>Application</th>
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<td>2014</td>
<td>Basic Design</td>
<td>Development and utilization of Application for Exascale Computing</td>
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<tr>
<td>2015</td>
<td>Trial Production</td>
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<td>2016</td>
<td>Detailed Design</td>
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<td>2017</td>
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<td>2019</td>
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<tr>
<td>2020</td>
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- Architecture: general-purpose plus accelerator components
- Target performance of 1 Exaflops, 100 times as powerful as K
- Power consumption of 30-40MW (cf. K computer: 12.7 MW)
The Implementing Arrangement Concerning Cooperation in R&D in Energy and Related Fields
MEXT, Japan ↔ DOE, US
<April 30, 2013>
※Cooperative area described in this arrangement:
(Nuclear Fusion Science, High Energy Physics, Nuclear Physics, Computer Science, etc)

※At Joint High Level Committee Meeting on Science and Technology cooperation
(April 30, 2013)

TBC

As One of cooperative area

Project Arrangement to the Implementing Arrangement between US and Japan Concerning Computer Science and Software Related to HPC for Open Scientific Research

- Participating Organizations:
  National Lab. (DOE, US), RIKEN (Japan)
- Cooperative Area:
  System Software
- Major Contents
  Description for Forms of Cooperation and Management of Project etc
Summary

○ HPCI (High Performance Computing Infrastructure)
  · Started in September 2012
  · K Computer, other supercomputers, large storage, network
  · Great success

○ Development of Exascale Supercomputer
  · Starting point of long and hard way

MEXT continuously promotes both projects