Welcome to AICS!

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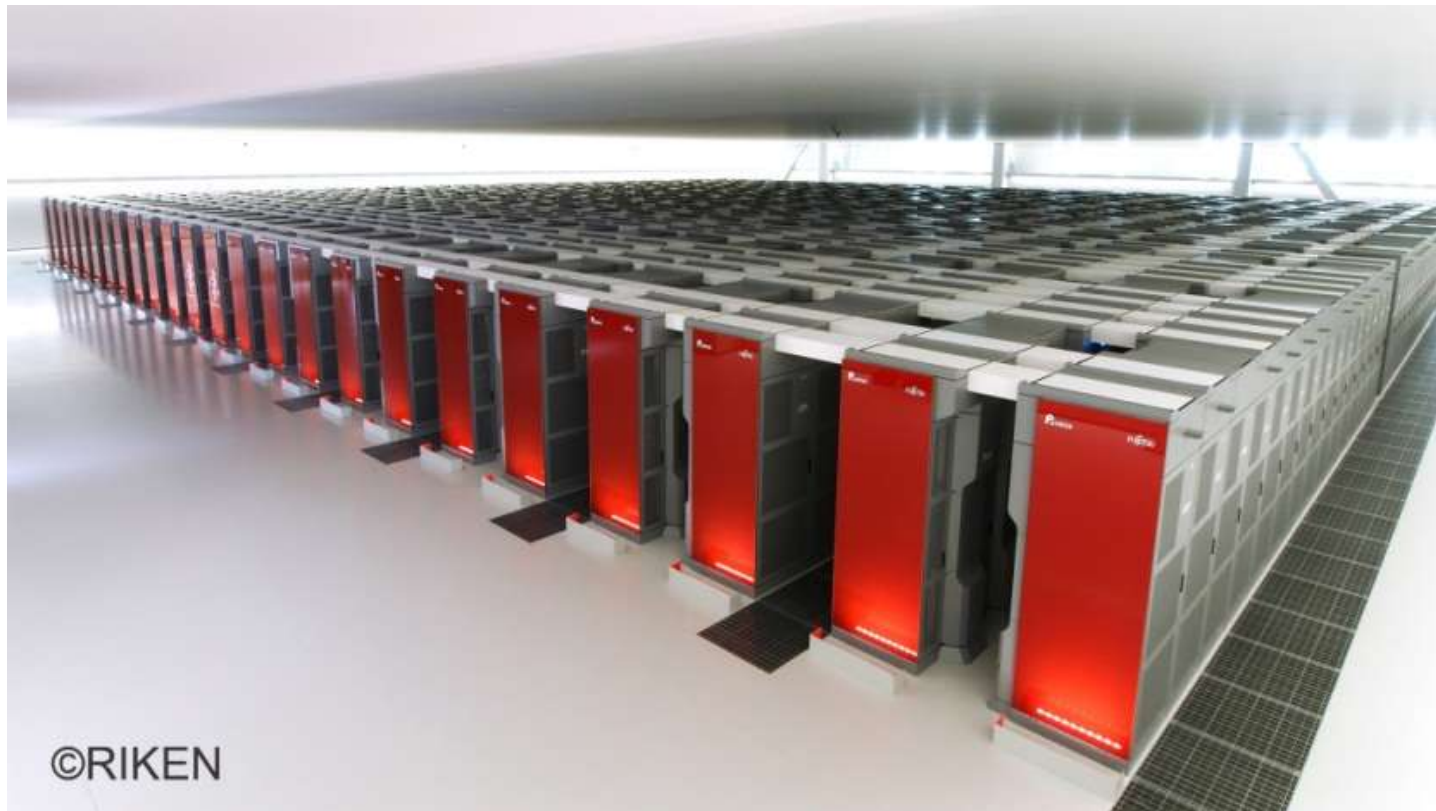**Kimihiko HIRAO**

AICS, RIKEN

K is one of the most powerful supercomputers

Although K fell behind China and US systems on latest Top500, K is still one of the most powerful and user-friendly supercomputers. K is capable of sustained performance of one petaflops on real applications in a wide range of science and engineering.

Top5 of TOP500 List – June 2014

Country		Institute	PF (Efficiency)
1	China	Tianhe-2, National University of Defense Technology	33.86 (61.7%)
2	USA	Titan, DOE/ Oak Ridge National Laboratory	17.59 (64.9%)
3	USA	Sequoia, DOE/National Nuclear Security Administration/LLNL	17.17 (85.3%)
4	Japan	K, RIKEN AICS	10.51 (93.2%)
5	USA	Mira, DOE/ SC/Argonne National Laboratory	8.586 (85.3%)

Tianhe-2

Titan

Sequoia

K

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No. 1 in Graph 500 "Big Data" Supercomputer Ranking

The Graph 500 ranking is a benchmark, which seeks to gauge the ability of supercomputers on data-intensive loads rather than simple speed. It demonstrates the K computer's usefulness for tackling complex phenomenon taking place in the real world.

Top5 of Graph500 List – June 2014

	Country	Institute	GTEPS
1	Japan	K, RIKEN AICS	17977.1
2	USA	Sequoia, DOE/National Nuclear Security Administration/LLNL	16599
3	USA	Mira, DOE/Argonne National Laboratory	14328
4	Germany	JUQUEEN, Forschungszentrum Jülich	5848
5	Italy	Fermi, CINECA	2567

K

Sequoia

Mira

JUQUEEN

HPCG Benchmark Results

The new benchmark, a preconditioned high performance conjugate gradient (HPCG) benchmark, has been proposed, which measures the speed and efficiency of solving linear equation for large *sparse* matrix. It should better correlate to computation and data access patterns found in many applications

Tianhe-2

Top5 of HPCG results - June 2014			
Country	Institute	TFLOPS (HPCG/HPL)	Ranking of Top500
1 China	Tianhe-2, National University of Defense Technology	580 (1.7%)	1
2 Japan	K, RIKEN AICS	427 (4.1%)	4
3 USA	Titan, DOE/ Oak Ridge National Laboratory	322 (1.8%)	2
4 USA	Mira, DOE/Argonne National Laboratory	101 (1.2%)	5
5 Swiss	Piz Daint, CSCS	99 (1.6%)	6

K

Titan

Computers as Tools for Discovery

Last year's Nobel Prize in chemistry shows how computing is changing every field of research. The Prize was awarded to M Karplus, M Levitt and A Warshel **for taking the experiment to cyberspace**. They have pioneered the modelling of complex chemical reactions and molecules in computers.

Harvard University
Martin Karplus

Photo:©S.Fisch
Michael Levitt

Photo:Wikimedia Commons
Arieh Warshel

Computers are transforming every aspect of the scientific process

Computer simulation is becoming more and more important for contemporary science

Simulations performed on the supercomputer will drive progress in science and technology and also play an important role in solving difficult problems that we face as a society.

There are very **critical issues** that need to be solved
- disaster mitigation
- global warming
- alternative energy creation
- healthcare
- security
- …

K is the Strong Science Machine

Before K, a large scale calculation was not possible in Japan.

Now K is being used in many different fronts to develop a new world and it provides new opportunities and challenges.

K is extending the boundaries of computational science. We can see the scenery never seen before.

Ongoing projects on K

- Prediction of the behavior of complex biological systems,
- Dynamics-based drug design
- Neuronal network simulation
- Human heart simulation (UT Heart) starting with sarcomeric proteins
- Understanding of how the cosmos evolved after the big bang,
  Simulation of supernova explosion
- Design of new devices and materials at the atomic level,
  RS-DFT calculations of silicon nanowires of 39,696 atoms
- Development of new materials for solving our energy problems
  Design of new electrolyte for fast-charging lithium-ion batteries
- Prediction the climate changes and behavior of typhoons, torrential rains,
  Global cloud resolving model with 0.87 km-mesh
- Simulations of earthquakes and tsunamis to mitigate the disasters,
- Optimization of engineered systems, automobiles, vessels, airplanes, etc
- ….

Computing is a Tool, not the End

Computer simulation will dramatically increase our ability to understand the world around us.

We hope to produce exciting results on K. These results can be communicated to the world.

AICS, with its strong focus on science and technology, feels a particular responsibility for engaging the present, and shaping the future.

Thank you for your attention