The K computer: Project overview

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Outline

- ✓ Project Overview
- ✓ System Configuration of the “K computer”
- ✓ Facilities for the system

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What is “K computer” ?

- ✓ “京 (Kei)” is a nickname of the Next-Generation Supercomputer system.
  - ✓ The name was chosen from public applications this July.
  - ✓ “京” is a Japanese prefix number like “mega, tera, peta, etc.”, which means 10^{16}, or 10 peta.
    “万(man)=10^4”, “億(oku)=10^8”, “兆(cho)=10^{12}”, “垓(gai)=10^{20} ”,・・・・
  - ✓ “K computer” is assigned for English documents.
  - ✓ A logo 京 was also determined.
    - ✓It was written by a famous Japanese calligrapher Souun TAKEDA.
- ✓ Another meaning of the “京” is “a big gate.”
  - ✓ A new era of computational science is coming though the gate “京.” by hoping promised future success.

京
K computer

Goals of the Next-Generation Supercomputer project

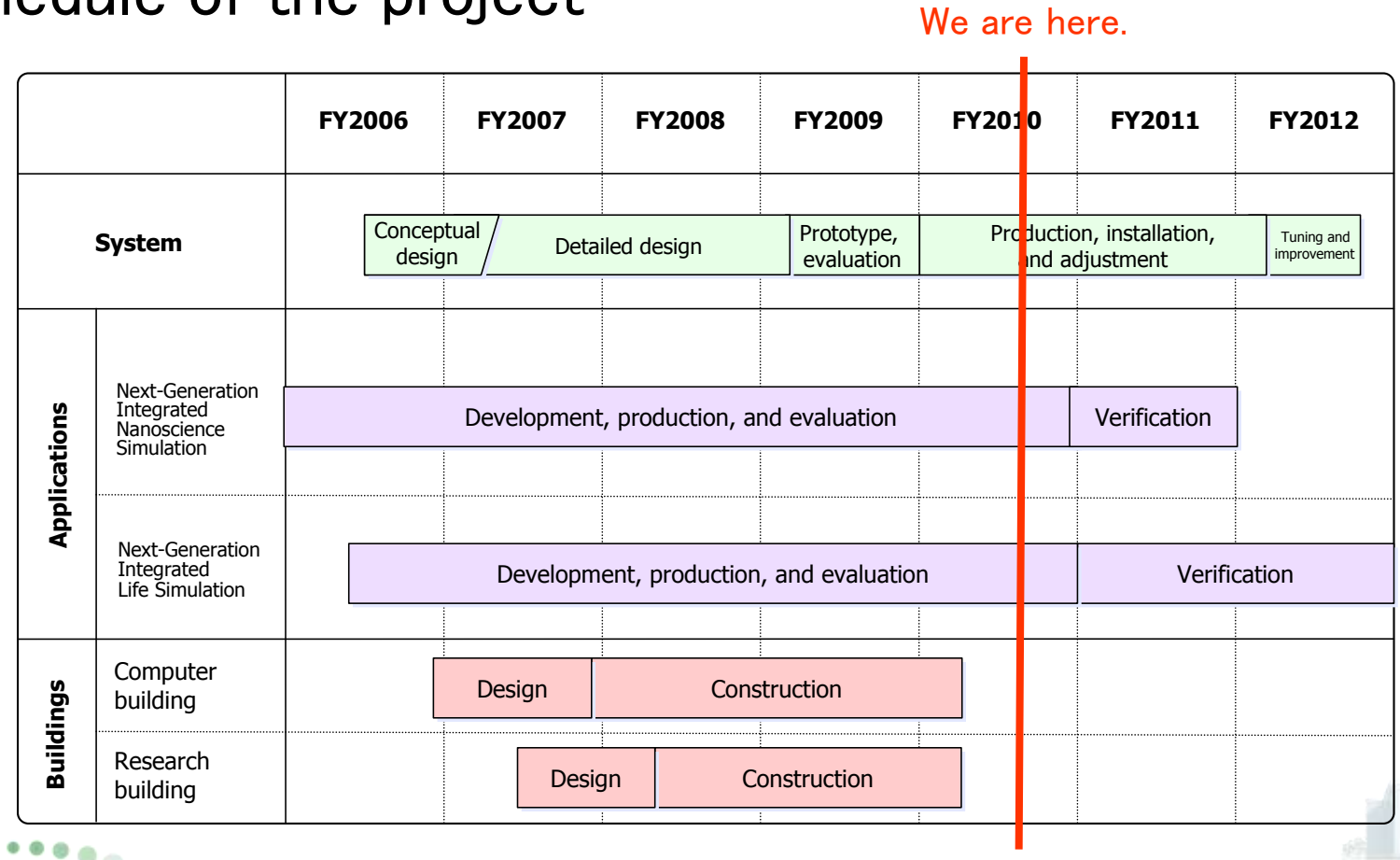
- ✓ Development and installation of the most advanced high performance supercomputer system with LINPACK performance of 10 petaflops.

- ✓ Development and deployment of application software, which should be made to attain the system maximum capability, in various science and engineering fields.

- ✓ Establishment of an "Advanced Institute for Computational Science:AICS" as one of the Center of Excellence around supercomputing facilities.

→The AICS has been established in Kobe at October 2010.

Schedule of the project



First installation of the K computer

- ✓ The eight racks has been housed at October 1, 2010.
- ✓ First Linpack result by a part of the system
  - ✓ Rmax:48.03TFLOPS(Rpeak:52.22TFLOPS)
  - ✓ Power:57.96kW

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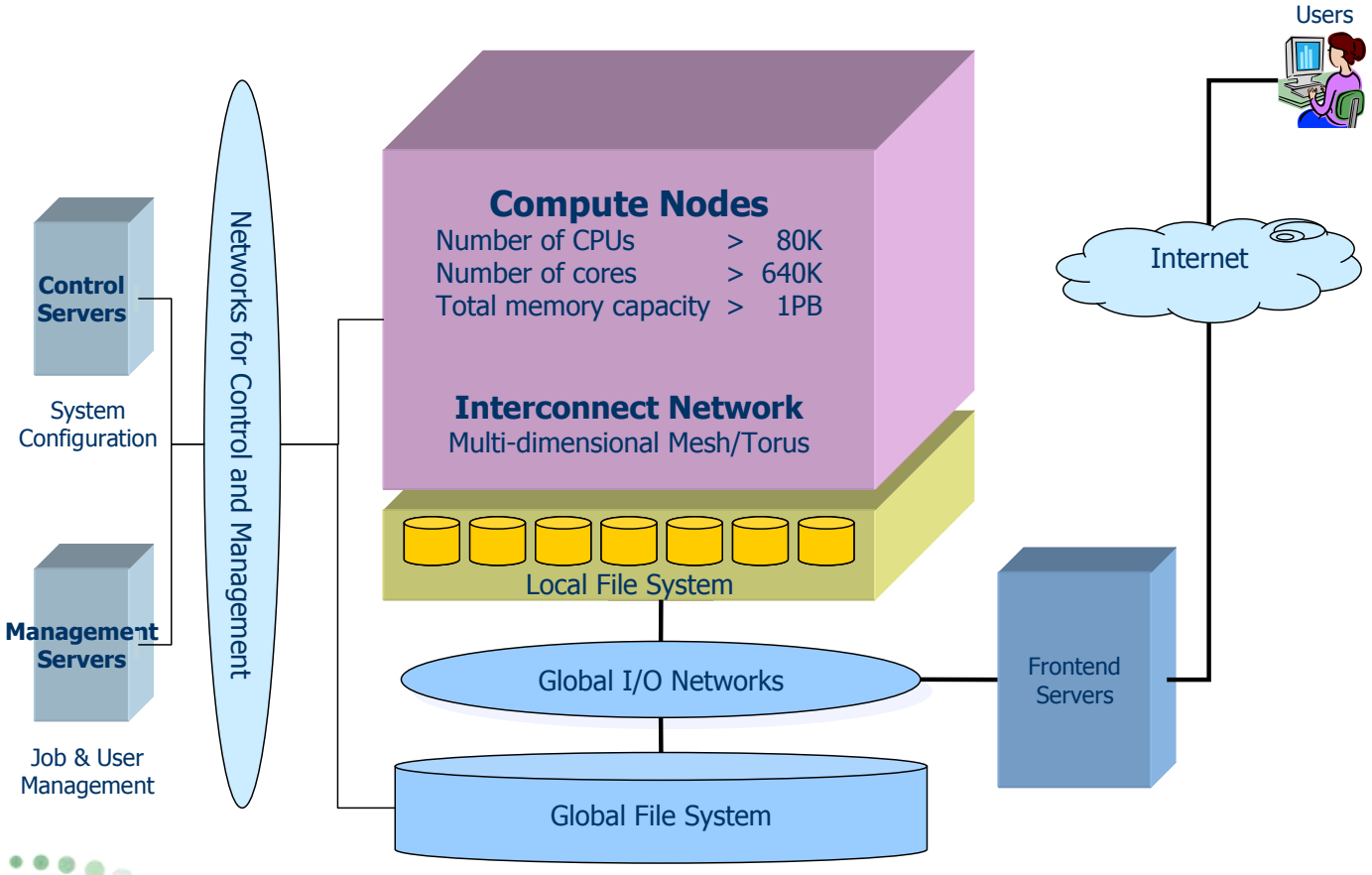
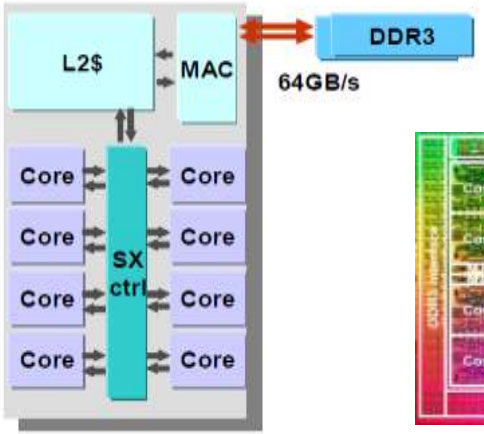
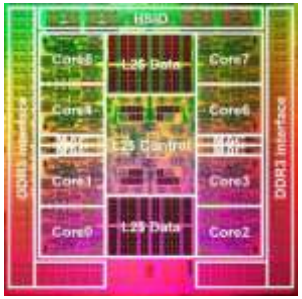
System configuration



CPU features (Fujitsu SPARC64™ VIIIfx)

- ✓ 8 cores
- ✓ 2 SIMD operation units/core
  - ✓ 2 Multiply & add floating-point operations (SP or DP) are executed in one SIMD instruction
- ✓ 256 FP registers/core (double precision)
- ✓ Performance
  - ✓ 16GFLOPS/core, 128GFLOPS/CPU
  - ✓ 2.2GFLOPS/W (58W at 30℃ by water cooling)
- ✓ Hardware barrier among cores
- ✓ Pre-fetch instruction
- ✓ Shared 6MB L2 Cache (12-way)
  - ✓ Software controllable cache (sectored cache)





45nm CMOS process, 2GHz
22.7mm x 22.6mm
760 M transistors

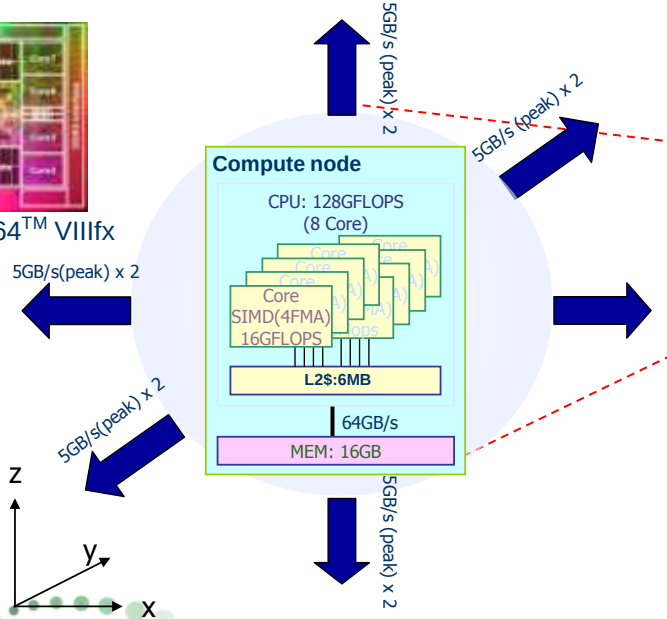
Reference: SPARC64™ VIIIfx Extensions
http://img.jp.fujitsu.com/downloads/jp/jhpc/sparc64viiifx-extensions.pdf

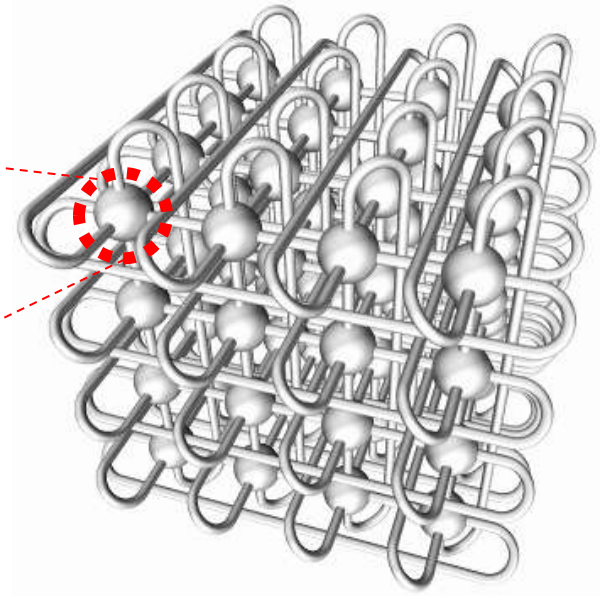
Compute nodes and Network

- Compute nodes (CPUs): > 80,000
  - Number of cores: > 640,000
- Peak performance: > 10PFLOPS
- Memory: > 1PB (16GB/node)

- 6-dimensional mesh/torus network: Tofu
  - 10 connections to each adjacent node
- Peak bandwidth: 5GB/s x 2 for each connection
- Logically 3-dimensional torus network

SPARC64™ VIIIfx

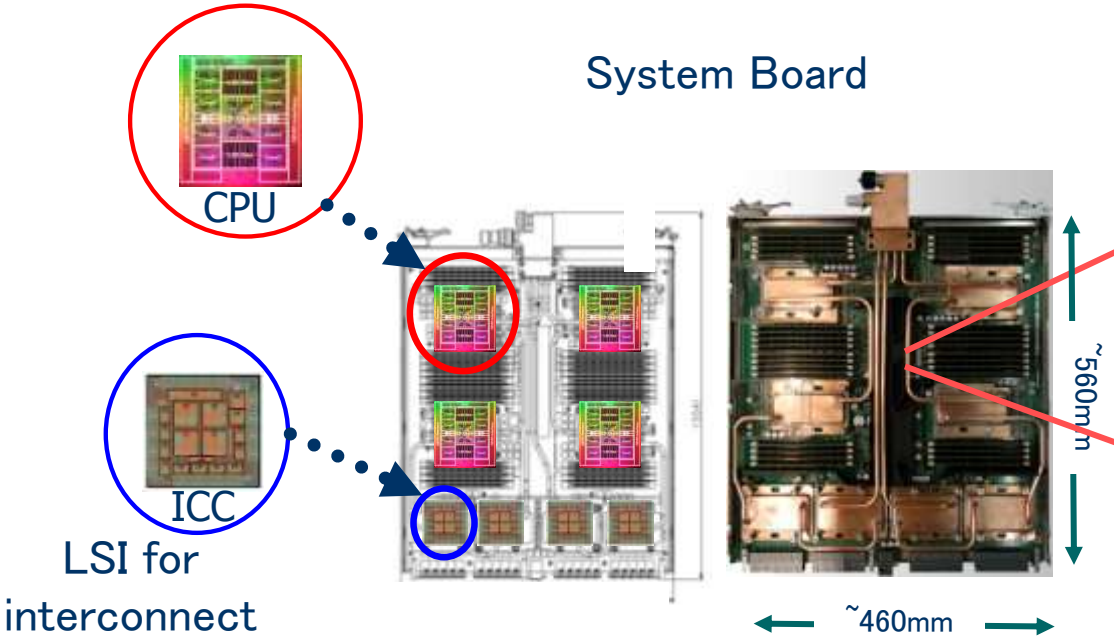


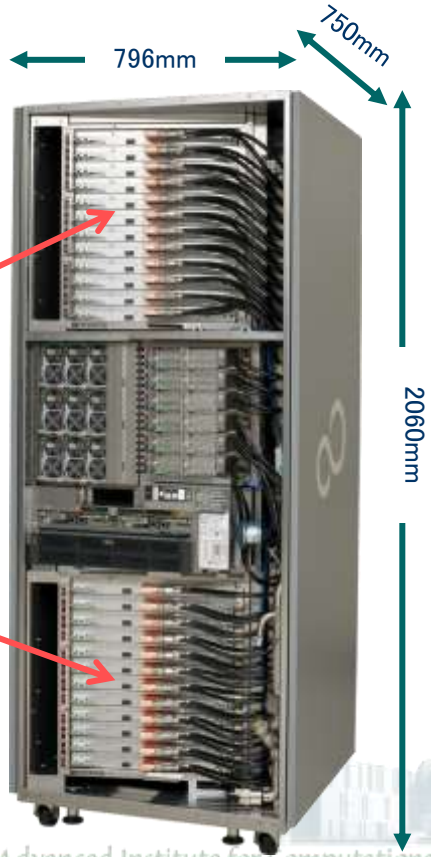


Courtesy of FUJITSU Ltd.

Packaging of the system

- ✓ A rack consists of 24 system boards, 6 IO boards, power supply units, system storages, and diagnostic processors.
  - ✓ A hose pipe is connected to the water loop under the floor.





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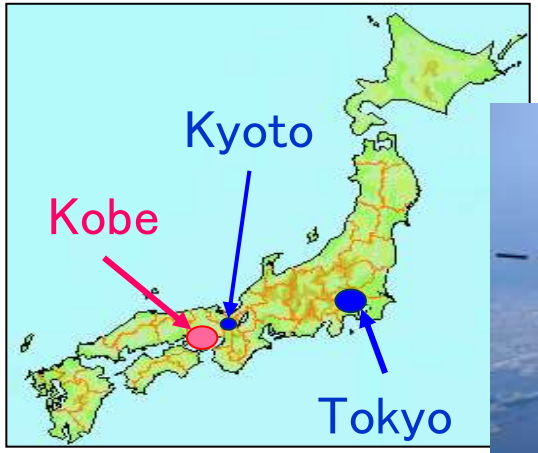
AICS: location of the K computer in Kobe



450km (280miles)
west from Tokyo

AICS (Advanced Institute for Computational Science) was established at RIKEN last July.

Layout of the buildings

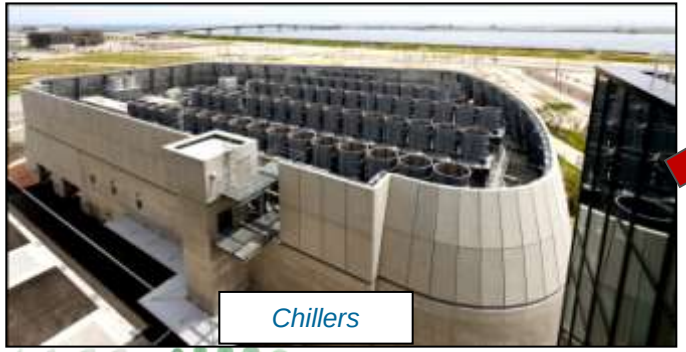
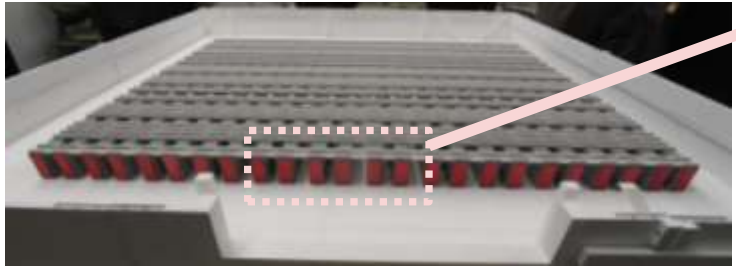


Image of the K computer

More than 800 racks will be housed.



The full system will be in operational in 2012.

Summary

- ✓ “The Next-Generation Supercomputer”
  → “京(kei)”,”K computer”
- ✓ The facilities for the K computer is complete.
- ✓ The installation of the K computer has started.
- ✓ The first measurement of LINPACK on a part of the system has been done.

- ✓ The full system of the K computer will be in operational at 2012.

Thank you for your attention !