




Current Status on the Development of the K Computer



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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.
 - It comes from a target performance of the system, that is 10petaFLOPS.
 - “京” is a Japanese prefix number which stands for 10^{16} , or 10 peta.
 - “K computer” is assigned for English documents.
 - A logo  written in Japanese calligraphy is also determined.
- Another meaning of the “京” is “a big gate.”
 - A new era of computational science is coming through the gate “京” by hoping promised future success.



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- System configuration of the K computer
- Facilities



Outline of the project

Outline of the next-generation supercomputer project



- Objectives are
 - to develop the world's most advanced and high-performance supercomputer,
 - to develop and deploy its usage technologies including application softwareas one of Japan's Key Technologies of National Importance.
- Period of the project: FY2006-FY2012 (7-year project)
- RIKEN (The Institute of Physical and Chemical Research) plays the central role of the project in developing the.

Goals of the 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” as one of the Center of Excellences around supercomputing facilities.

Schedule of the project



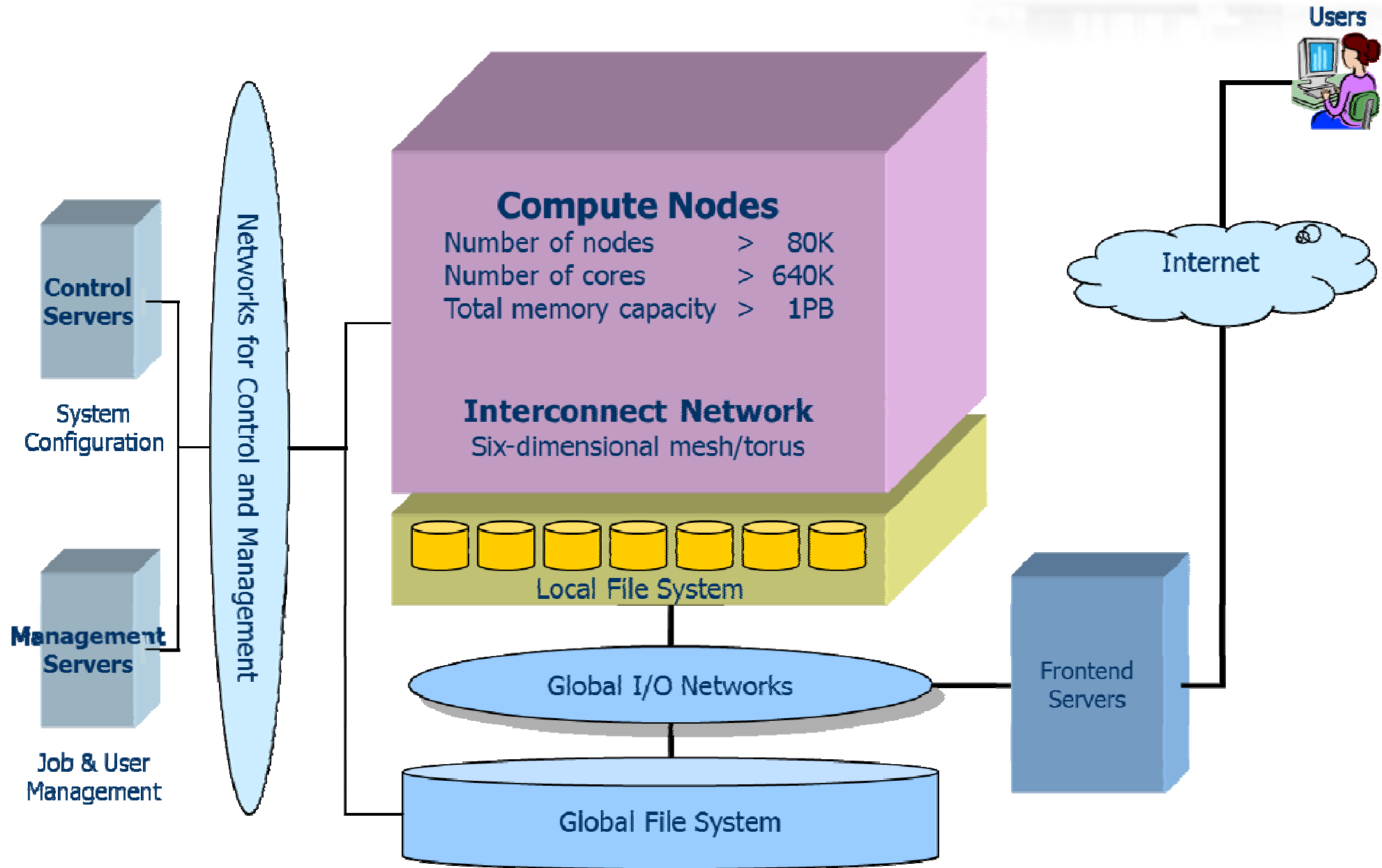
We are here.

		FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	
System		Conceptual design		Detailed design		Prototype, evaluation	Production, installation, and adjustment		Tuning and improvement
Applications	Next-Generation Integrated Nanoscience Simulation	Development, production, and evaluation						Verification	
	Next-Generation Integrated Life Simulation	Development, production, and evaluation						Verification	
Buildings	Computer building		Design	Construction					
	Research building		Design	Construction					



System configuration of K computer

System configuration

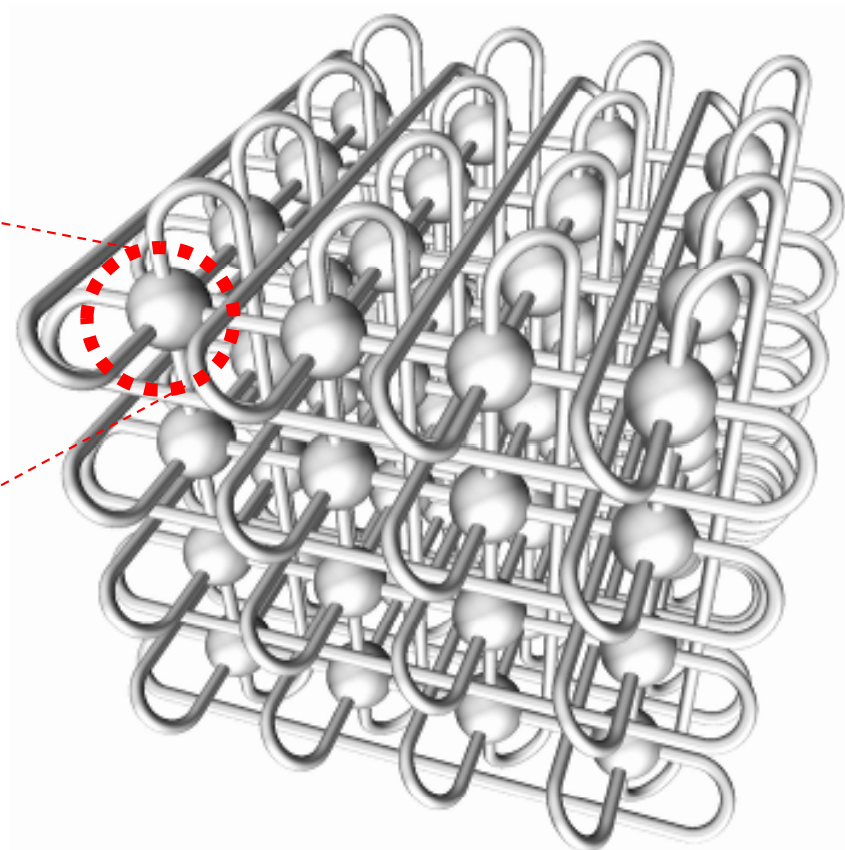
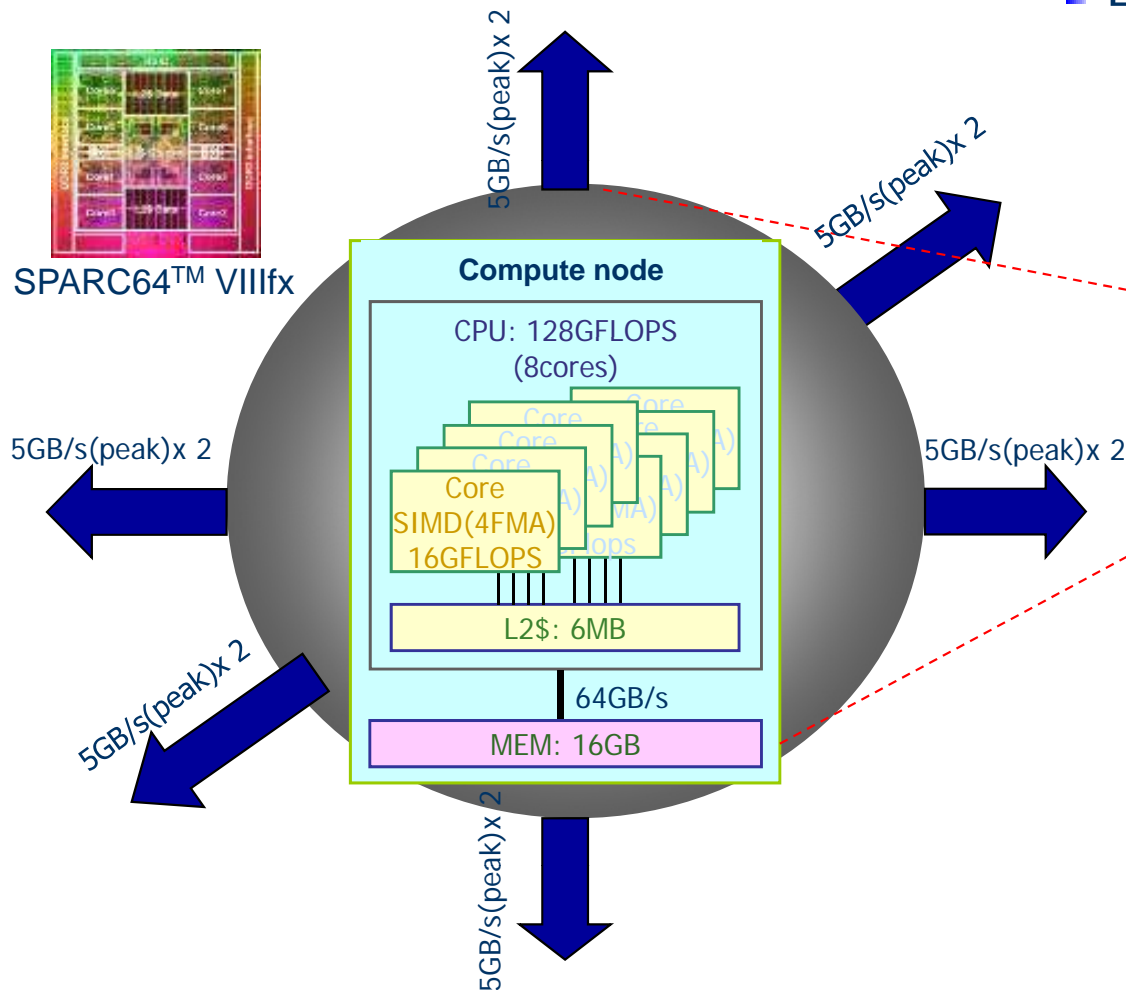


Compute nodes and network



- 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

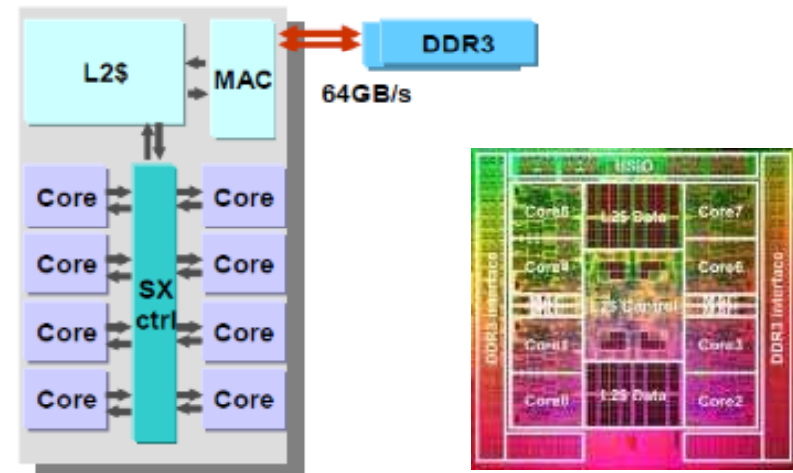


Courtesy of FUJITSU Ltd.

CPU features (Fujitsu SPARC64™ VIIIfx)



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



45nm CMOS process, 2GHz
22.7mm x 22.6mm
760 M transistors
58W (at 30°C by water cooling)

Reference: SPARC64™ VIIIfx Extensions

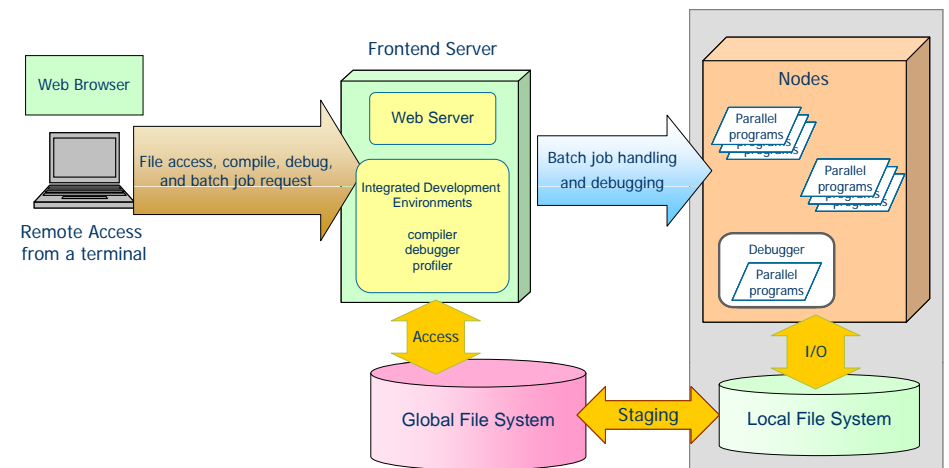
<http://img.jp.fujitsu.com/downloads/jp/jhpc/sparc64viiifx-extensions.pdf>

System environments

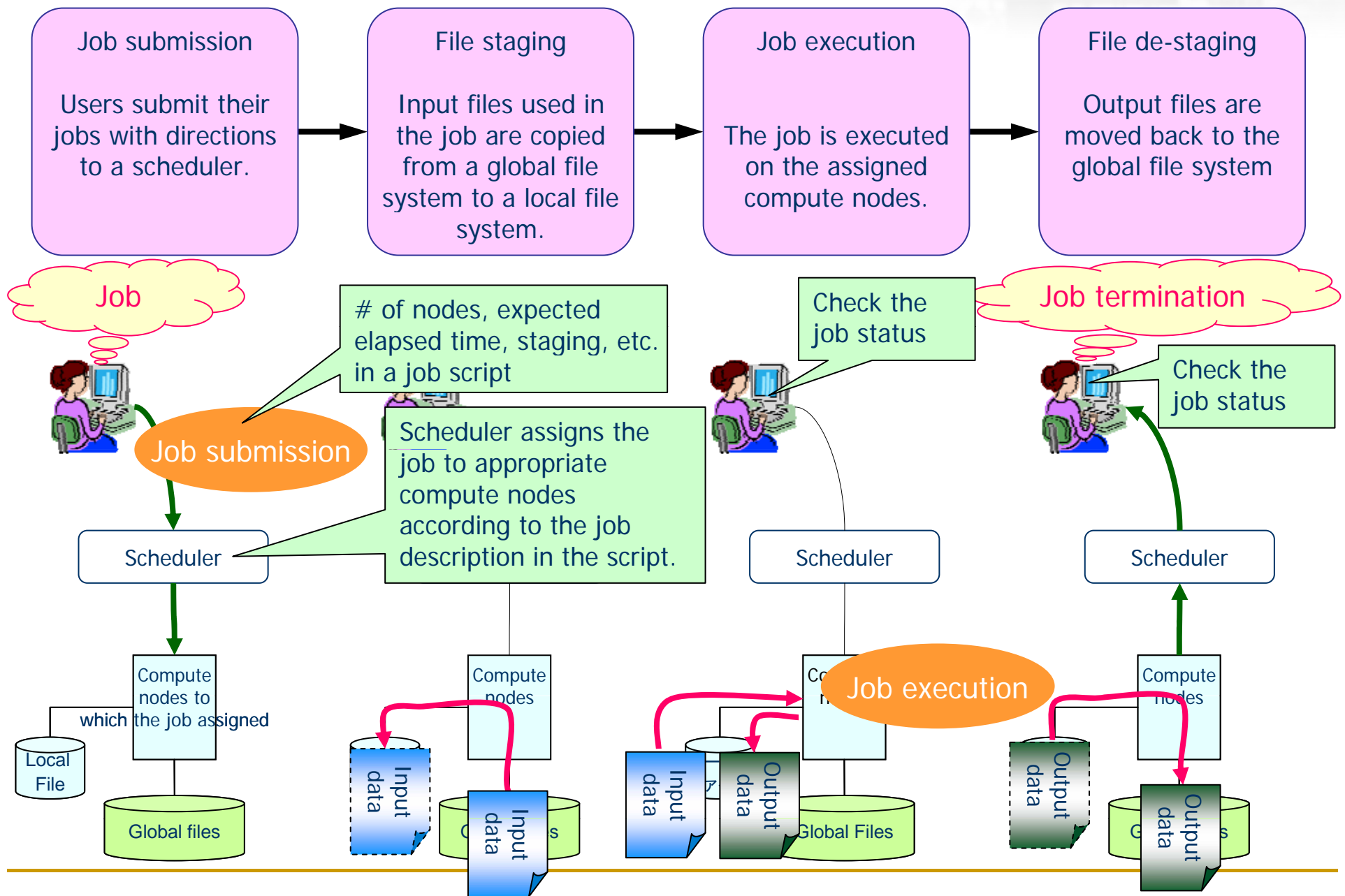


- OS: Linux based OS on compute nodes
- Two-level large-scale distributed file system with local file system and global file system
 - Users' permanent files reside in the global file system
 - Staging functions
 - Files on the global file system which are used in a job are staged into the local file system.
 - Data generated during a job execution are moved back to the global file system after the job finished.

- Batch job-oriented system
 - Interactive environments are also available in debugging.



Flow of batch job processing





Facilities for the system



AICS: location of the K computer in Kobe

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



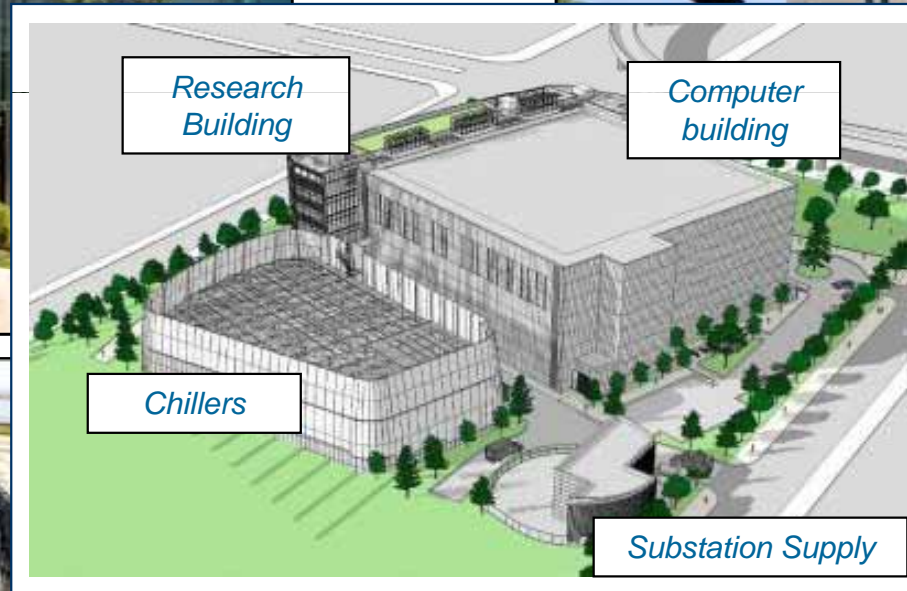
450km (280miles)
west from Tokyo



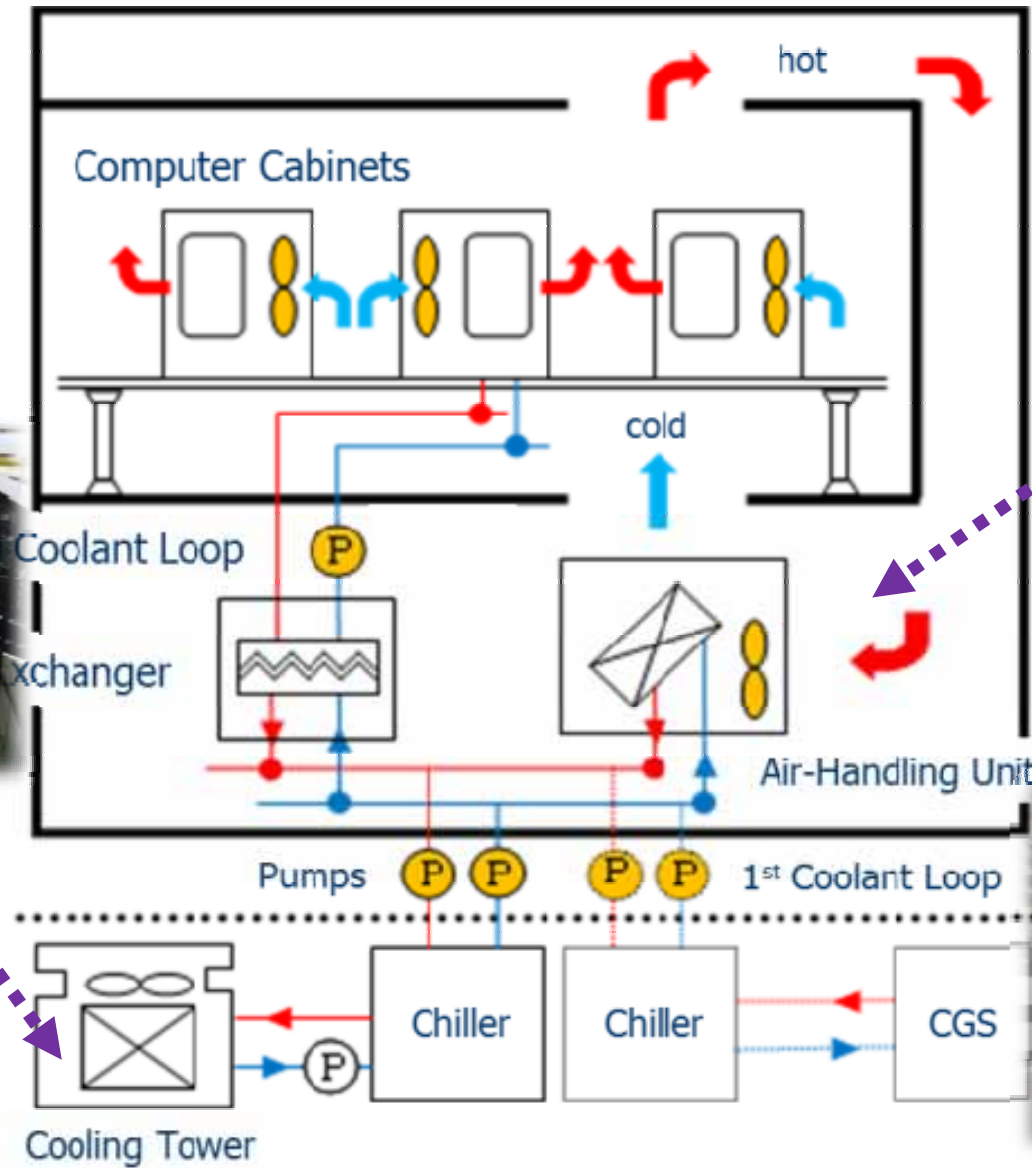
Photo (as of May 31, 2010)



Layout of the buildings



Cooling system



Features of the buildings (1/3)



■ Basement

- Soil improvement work was done at the depth of 20m below ground for prohibiting liquefaction damage.
- Basement of 2m was made so that the research and computer buildings are constructed on it.

■ Seismic isolated structure

- Three kinds of seismic isolated equipment are adapted to ensure S-grade (6 Japanese quake scale) quake-resistance.



Laminated rubber



Lead damper



Stiffness damper

Features of the buildings (2/3)



- Prevention from damage by salt in the seawater
 - Aluminum panels and glass wall are used at outer skins of buildings to prevent damages by seawater.
- Large computer room without pillars
 - Flexibility of a layout of computer cabinets and cabling of interconnect network and workability at installation are considered.
 - Average load capacity is 1,000kg/m² to support all cabinets of K computer.
 - Depth of the raised floor is 1.5m (5 ft.).



First installation of the K computer

- Eight racks are housed on the 3rd floor of the computer building on October 1, 2010.
- 98.3 TFLOPS in peak performance.
- The system will be in operational in 2012.





Thank you for your attention !

A photo in the early evening