

# Fujitsu Petascale Supercomputer PRIMEHPC FX10



4x2 racks (768 compute nodes) configuration

# PRIMEHPC FX10 Highlights



- Scales up to 23.2 PFLOPS
- Improves **Fujitsu's supercomputer technology** employed in the FX1 and "K computer," the world's fastest supercomputer.

## PRIMEHPC FX10

**Hybrid parallel  
(VISIMPACT)  
Collective SW  
FX1**



**SPARC64™ VII 4C/40GF  
121TFLOPS, CY2008~**

**Tofu interconnect  
ISA extension (HPC-ACE)  
K computer\***



**SPARC64™ VIIIfx 8C/128GF  
11PFLOPS, CY2010~**

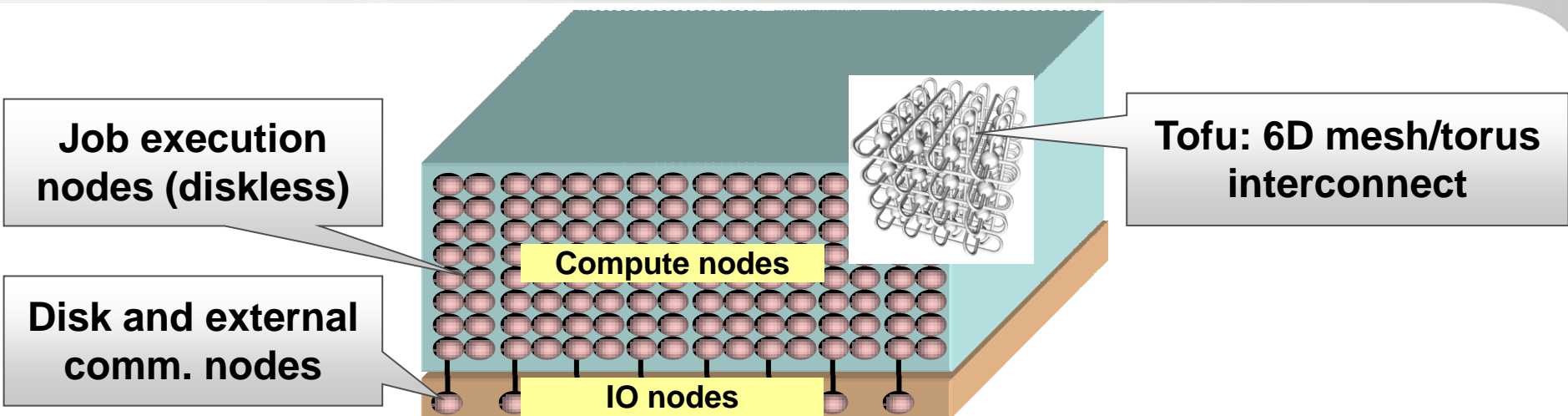


**SPARC64™ IXfx 16C/236.5GF  
~ 23PFLOPS, CY2012~**

\* "K computer" is the name of a next-generation supercomputer developed by RIKEN in July 2010

- **High-speed and ultra-large-scale computing environment**
  - Up to 23.2 PFLOPS (98,304 nodes, 1,024 racks, 6 petabytes of memory)
- **SPARC64™ IXfx- high performance w/ low power consumption**
  - 236.5 GFLOPS, and over 2GFLOPS/W
- **High execution performance with massively parallel apps**
  - Tofu interconnect, Technical Computing Suite, and VISIMPACT
- **High reliability and high operability for a large-scale system**

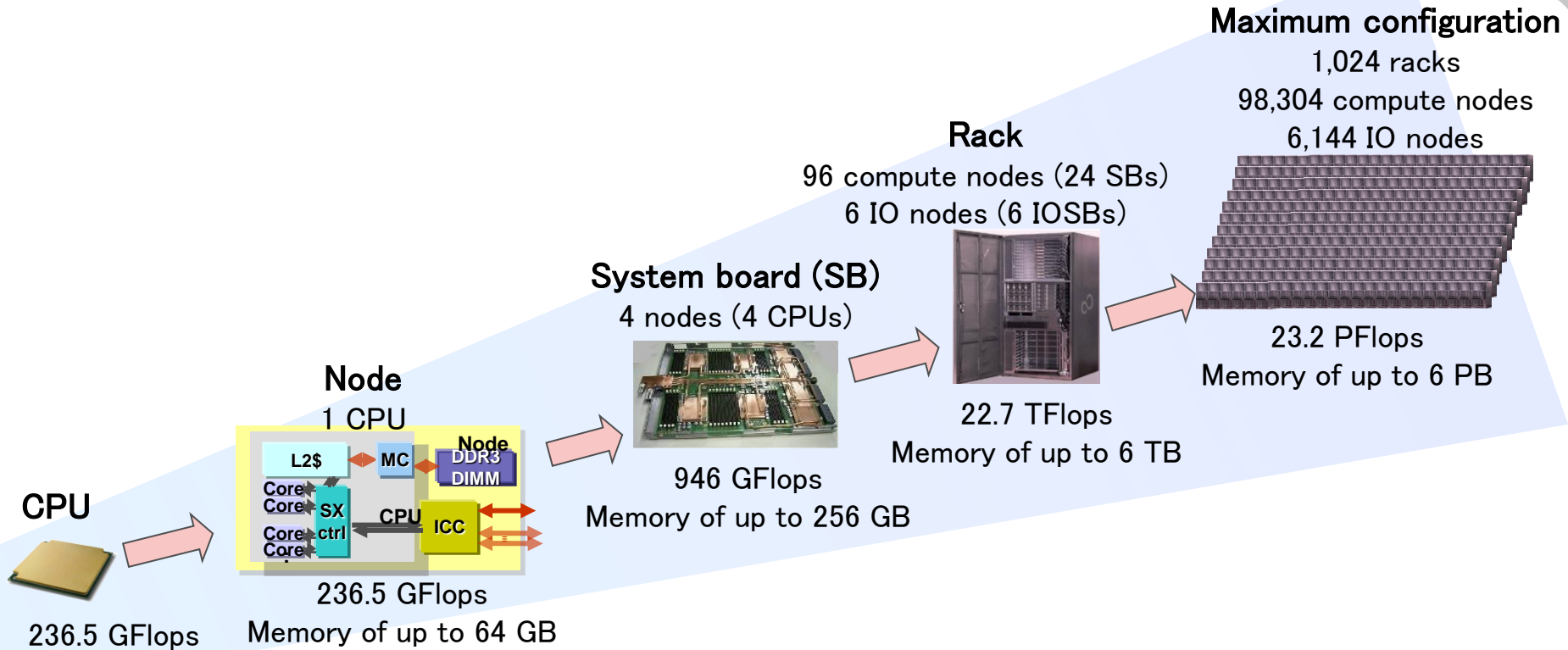
# PRIMEHPC FX10 Configuration



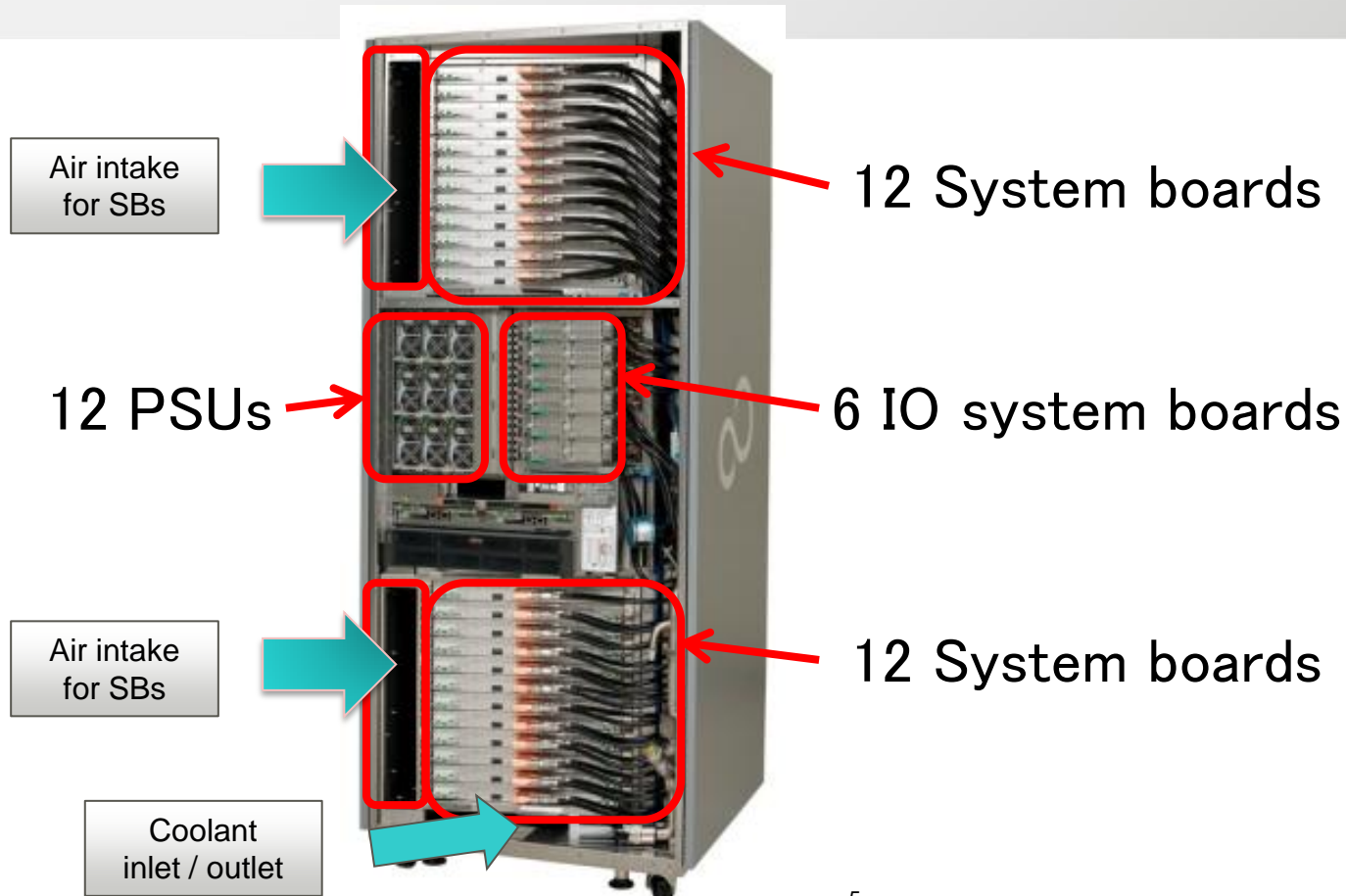
System	Maximum configuration
Number of nodes	98,304 (= 32x32x8x2x3x2) nodes
Peak performance	23.2 PFlops
Total memory bandwidth	8.3 PB/s
Total interconnect bandwidth	3.1 PB/s
Total IO bandwidth	49.1 TB/s

Node	
Number of CPUs	1 CPU
Peak performance	236.5 GFlops
Memory bandwidth	85 GB/s
Interconnect link bandwidth	5 GB/s x bidirectional
IO bandwidth	8 GB/s per IO node

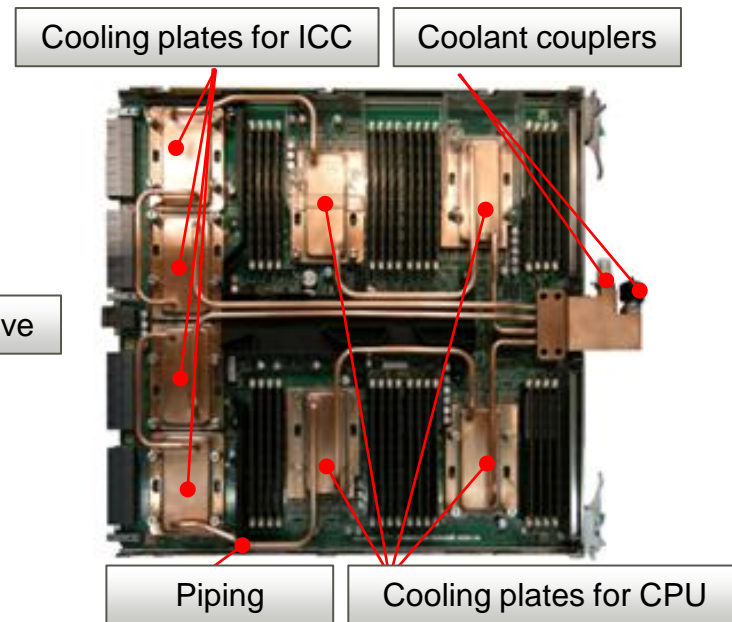
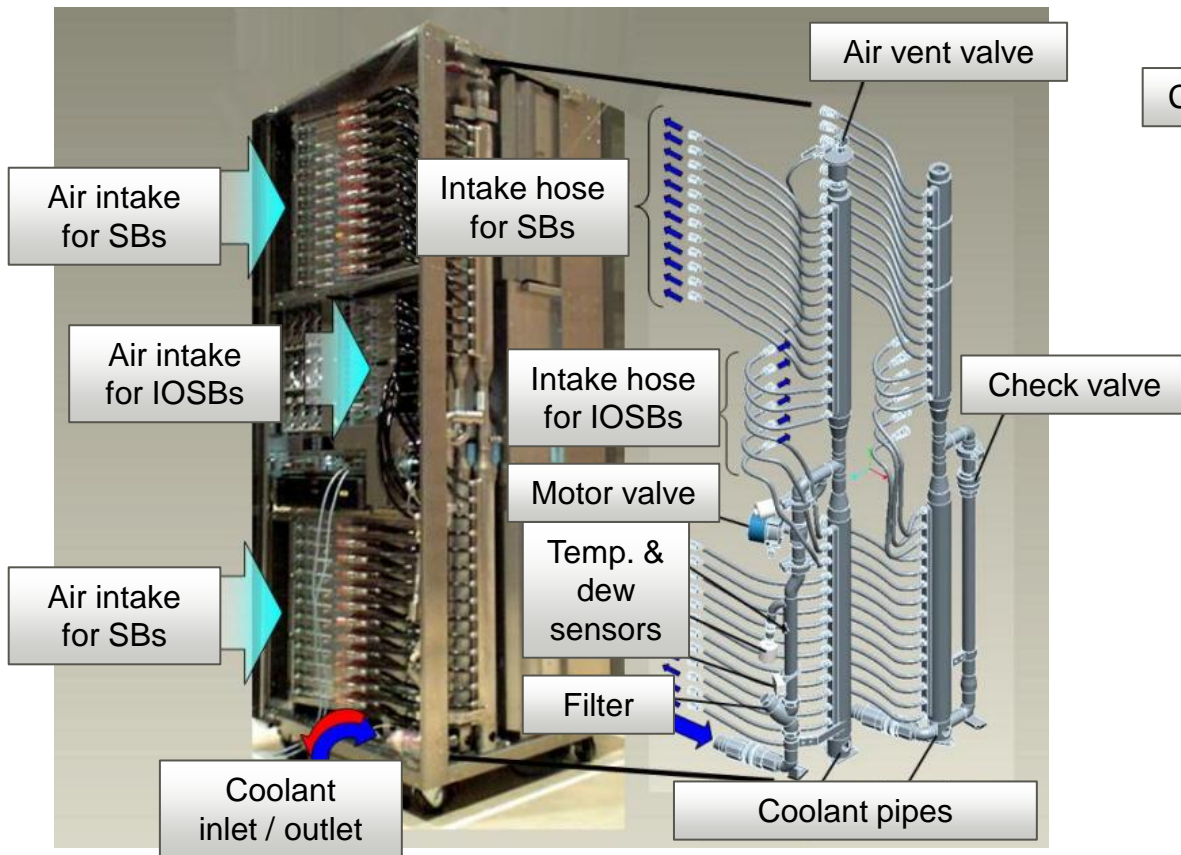
# Implementation of PRIMEHPC FX10



# PRIMEHPC FX10 Packaging



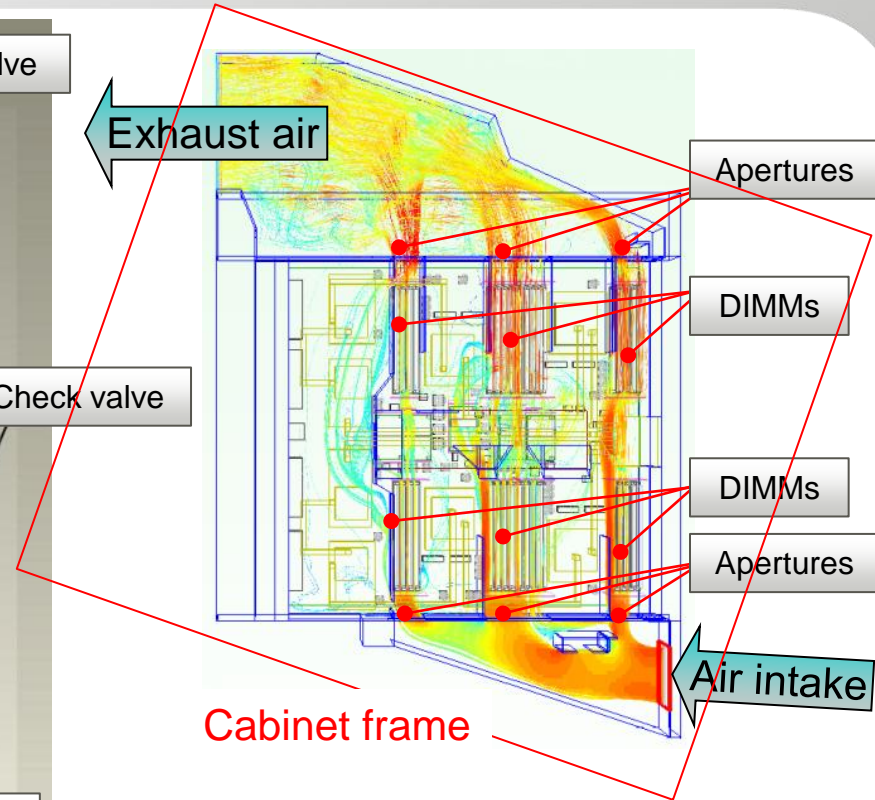
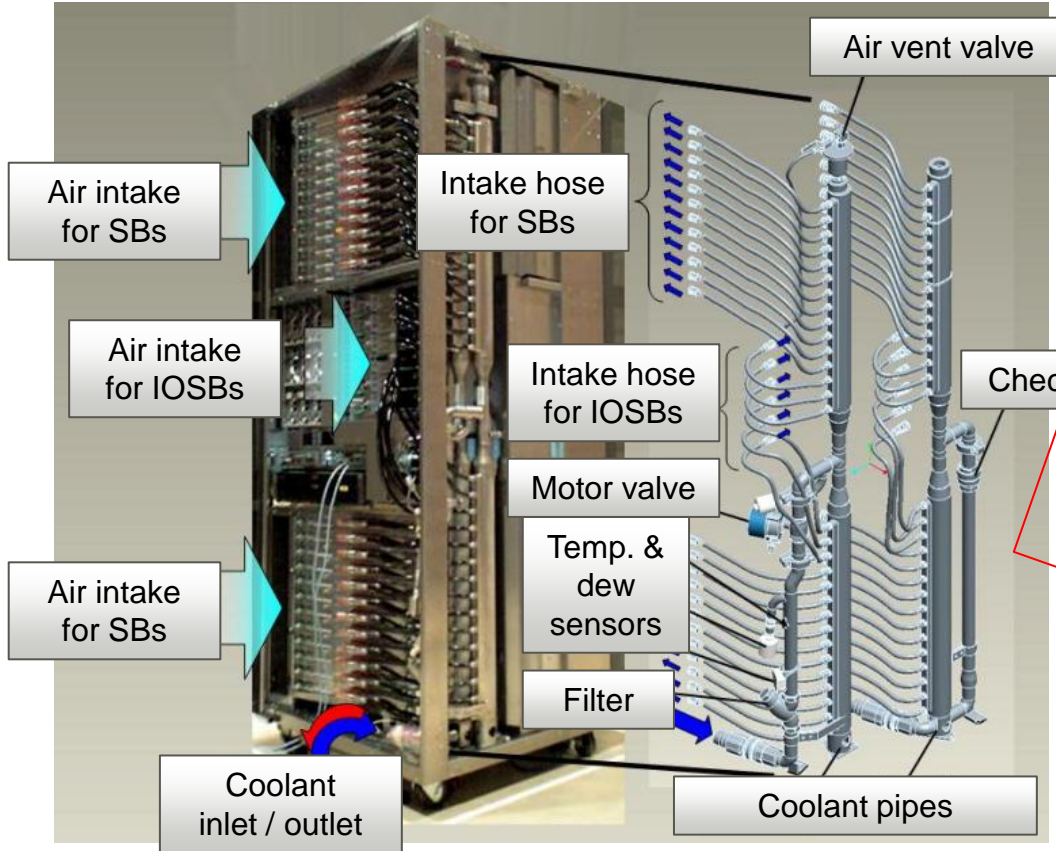
# Hybrid Cooling (Direct Water Cooling)



SB with water cold plates



# Hybrid Cooling (Slanted Mount System)



Air velocity map of SB



# K Computer and PRIMEHPC FX10

- Fujitsu supercomputer w/ enhanced technology introduced for K computer

	K computer	PRIMEHPC FX10	Note
CPU	SPARC64 VIIIfx	SPARC64 IXfx	SPARC V9 + HPC-ACE
Peak perf.	128 GFLOPS	236.5 GFLOPS	
# of cores	8	16	
Memory	16GiB	32GiB/64GiB	2GB/core~
BW	64GB/s	85GB/s	
Interconnect	6D mesh/torus	←	Tofu interconnect
System size	X x Y x 17	X x Y x 9	Z=0 is I/O node
link BW	5GB/s x bidirectional	←	


- PRIMEHPC FX10 supports water cooling of ordinary chilling facility and resolves layout restrictions

# Information Technology Center, The University of Tokyo

## Next Generation Supercomputer System Overview



**Compute nodes, Interactive nodes**



**PRIMEHPC FX10 x 50 racks**  
**(4,800 comp. nodes, 300 I/O nodes)**  
 Peak Performance: 1.13 PFLOPS  
 Memory capacity: 150 TB  
 - aggregated memory bandwidth: 398 TB/sec  
 Interconnect: 6D mesh/torus - "Tofu"  
 - node-to-node: 5 GB/sec in both directions  
 - network bi-section bandwidth: 6 TB/sec.


**Management servers**

Job management, operation management, authentication servers:





**PRIMERGY RX200S6 x 16**

**Local file system**

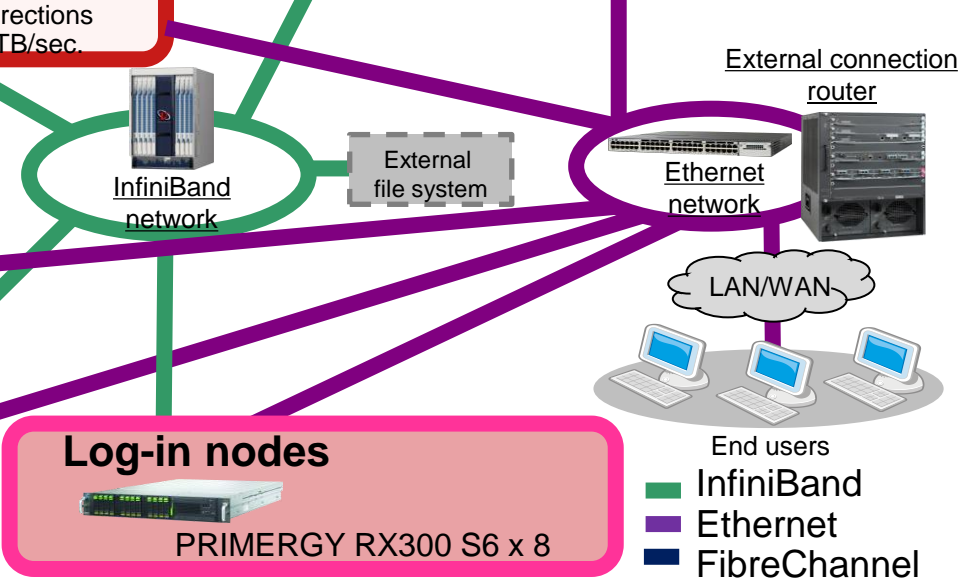


**PRIMERGY RX300 S6 x 2 (MDS)**  
**ETERNUS DX80 S2 x 150 (OST)**  
**Storage capacity: 1.1PB (RAID-5)**

**Shared file system**

**PRIMERGY RX300 S6 x 8 (MDS)**  
**PRIMERGY RX300 S6 x 40 (OSS)**  
**ETERNUS DX80 S2 x 4 (MDT)**  
**ETERNUS DX410 S2 x 80 (OST)**  
**Storage capacity: 2.1PB (RAID-6)**

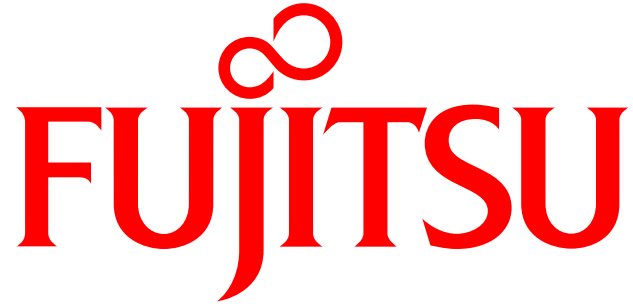


- InfiniBand
- Ethernet
- FibreChannel

# PRIMEHPC FX10 Summary



- Improves Fujitsu's supercomputer technology employed in the “K computer,” the world's fastest supercomputer
  - Newly developed SPARC64 IXfx processor (236.5GFLOPS)
  - Tofu interconnect (scales up to 98,304 nodes)
- Fujitsu provides all hardware and software
  - Processor and interconnect
  - Technical Computing Suite HPC middleware, as well as the FEFS high-performance distributed file system



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