Fugaku is the Successor to the K Computer

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K computer

Ranked Top500 No.1 in 2011
Competitive in various fields

HPCG
No.1(2017)

AWARDS
Gordon Bell Prize
Finalist(2016)

GRAPH 500
No.1(2018)

PRIMEHPC FX10

PRIMEHPC FX100

Supercomputer
Fugaku

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- The K computer has been in operation for 7 years and was retired in August 2019
- Shipping and installation of "Fugaku" will start soon

Fugaku Project

■ Overview

RIKEN and Fujitsu are currently developing Japan's next-generation flagship supercomputer, the successor to the K computer, as the most advanced general-purpose supercomputer in the world.
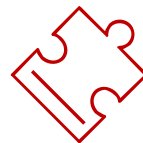
■ Goals

Application Performance

Usability

Application Compatibility

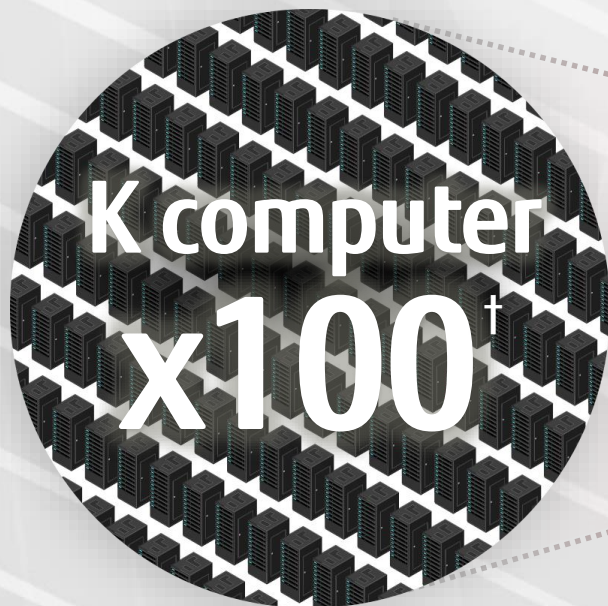**FUJITSU**

Fugaku Hardware Specifications

System	
Number of Nodes	150k+ nodes (Compute node and compute & I/O node)
Storage - 1st layer	about 1.6 TB (Total of compute & I/O node's SSD storage)
Storage - 2nd layer	about 150 PB

Node	
Architecture	Armv8.2-A SVE 512bit (SVE: Scalable Vector Extension)
Core	48 cores for compute and 2 or 4 cores for OS activities
Memory	HBM2 32 GiB, 1024 GB/s
Interconnect Interface	Tofu Interconnect D (28 Gbps x 2 lane x 10 port)
I/O	PCIe Gen3 x16
Technology	7nm FinFET

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Fugaku Ultra-dense Implementation of Hardware

- Allowing 1 rack to have 384 CPUs, providing 1 Peta flops

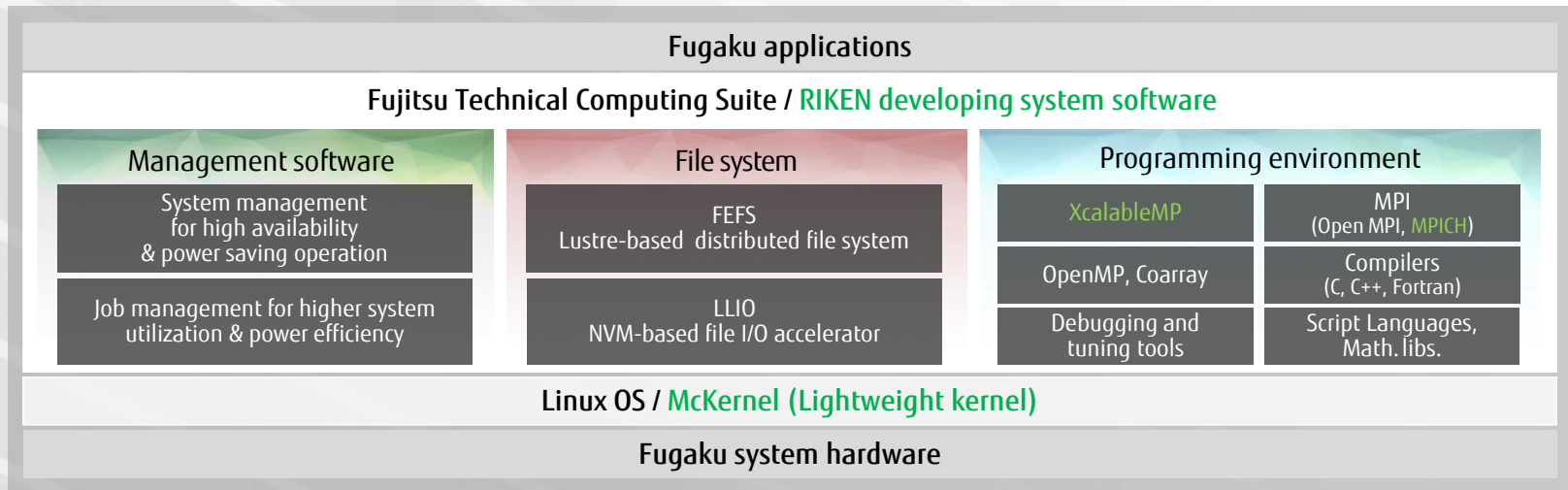**K computer x100†**

Fugaku x1

† Approximate ratio of footprint

Fugaku System Software Stack

■ RIKEN and Fujitsu are developing a software stack for Fugaku

- Compiler optimizations exploit hardware performance, such as SVE vectorization
- The programming environment and the system software maintains continuity with the K computer

Fugaku applications		
Fujitsu Technical Computing Suite / RIKEN developing system software		
Management software	File system	Programming environment
System management for high availability & power saving operation	FEFS Lustre-based distributed file system	XcalableMP / MPI (Open MPI, MPICH)
Job management for higher system utilization & power efficiency	LLIO NVM-based file I/O accelerator	OpenMP, Coarray / Compilers (C, C++, Fortran)
		Debugging and tuning tools / Script Languages, Math. libs.
Linux OS / McKernel (Lightweight kernel)		
Fugaku system hardware		

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Fugaku Target Applications

■ RIKEN announced the predicted performance

■ More than 100x faster than the K computer for GENESIS and NICAM+LETKF

■ Geometric mean of speedup over the K computer in 9 priority issues is greater than 37x

□ Predicted Performance of 9 Target Applications   *As of 2019/05/14*

Area	Priority Issue	Performance Speedup over K	Application	Brief description
Health and longevity	1. Innovative computing infrastructure for drug discovery	125x +	GENESIS	MD for proteins
	2. Personalized and preventive medicine using big data	8x +	Genomon	Genome processing (Genome alignment)
Disaster prevention and Environment	3. Integrated simulation systems induced by earthquake and tsunami	45x +	GAMERA	Earthquake simulator (FEM in unstructured & structured grid)
	4. Meteorological and global environmental prediction using big data	120x +	NICAM+ LETKF	Weather prediction system using Big data (structured grid stencil & ensemble Kalman filter)
Energy issue	5. New technologies for energy creation, conversion / storage, and use	40x +	NTChem	Molecular electronic simulation (structure calculation)
	6. Accelerated development of innovative clean energy systems	35x +	Adventure	Computational Mechanics System for Large Scale Analysis and Design (unstructured grid)
Industrial competitiveness enhancement	7. Creation of new functional devices and high-performance materials	30x +	RSDFT	Ab-initio simulation (density functional theory)
	8. Development of innovative design and production processes	25x +	FFB	Large Eddy Simulation (unstructured grid)
Basic science	9. Elucidation of the fundamental laws and evolution of the universe	25x +	LQCD	Lattice QCD simulation (structured grid Monte Carlo)

https://postk-web.r-ccs.riken.jp/perf.html

Fugaku Schedule

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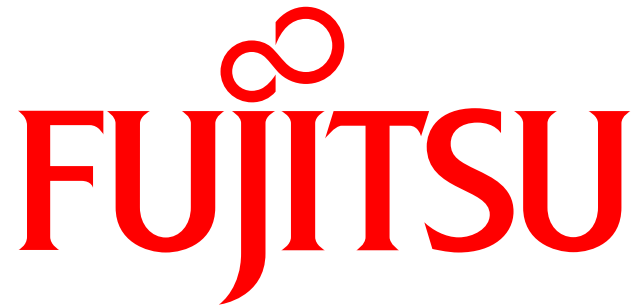
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