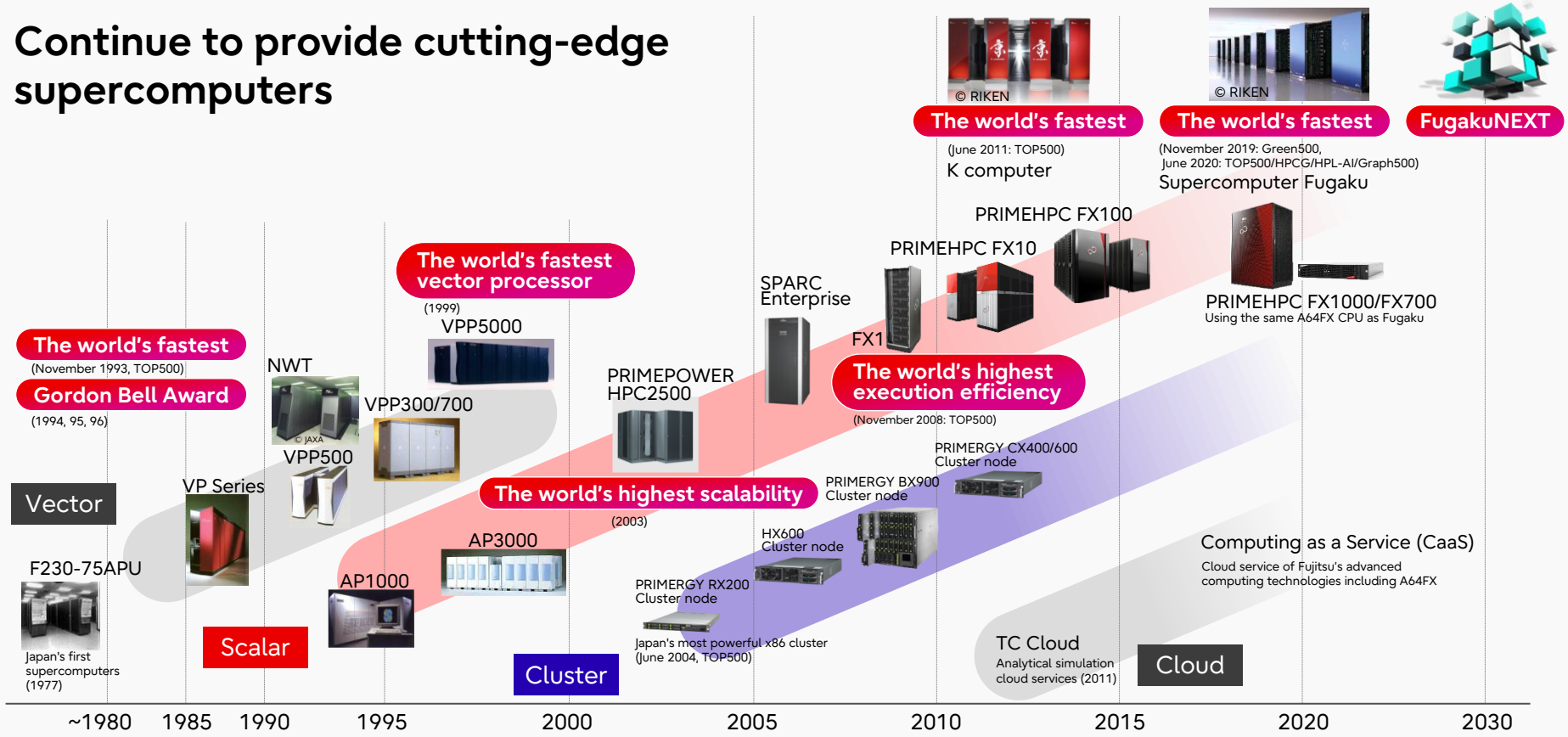
FugakuNEXT: AI-HPC platform

November 2025

Fujitsu Limited

Fujitsu Challenges on Supercomputer

Continue to provide cutting-edge supercomputers



Future Supercomputing

FUJITSU

Trends in HPC Technologies

Ever-Growing data volumes and computation power

Higher computational density and power efficiency

Rapid AI evolution and expansion of applicable areas

AI-HPC platform

- FUJITSU's Arm-based CPU proven in HPC and GPUs optimized for large-scale AI training
- Driving innovation across science, technology, and industry to shape humanity's future

The impact of AI-HPC platform

AI-enhanced Simulation

- Significantly improve accuracy and speed by optimize simulation parameters using AI

Data-Driven Science

- Uncover hidden correlations, causalities, and new scientific laws by analyzing massive datasets

Research Process Optimization

- Accelerate scientific discovery by optimizing research workflows from experiment design to insight

Knowledge Discovery

- Discover new hypotheses and knowledge by mining vast scientific papers and literatures.

FugakuNEXT – Japan's Flagship Platform driving "AI for Science"

FugakuNEXT development Goals

Made with Japan	Technological Breakthroughs	Sustainability and Continuity
• Joint development of RIKEN, NVIDIA, and Fujitsu • Create global innovation and collaboration	• Tight integration of CPU–GPU for high-bandwidth, heterogeneous nodes • Achieve over 100× application performance by AI-HPC integration	• A sustainable software ecosystem • Modernization of applications • Advanced energy-efficient operation technology

The FugakuNEXT Ecosystem

- Accelerating scientific progress through AI for Science methodologies
- R&D leadership in advanced computing and AI technologies
- Sustained high-end processor development to secure computational resources

RIKEN
- System Design, Software and Application development

Fujitsu
- CPU and System Development

NVIDIA
- GPU development

Schedule

CY 2025	2026	2027	2028	2029	2030	2031

Basic Design
- Define overall architecture

Detailed Design
- Develop production readiness plan
- Finalize Software/Hardware Specifications

Manufacturing / Installation
- Produce individual parts and modules
- Prepare for user Acceptance Testing

Operation
- Conduct performance improvements and maintenance activities

Reference: MEXT (2025). AI for Science: Concepts and Directions. https://www.mext.go.jp/content/20251006-mxt_jyohoka01-000045188_03.pdf

The world's top-level AI-HPC platform with Fujitsu CPU and NVIDIA GPU

FUJITSU

Designed to deliver up to 100× improvement in application performance.

Specification Comparison

Specification	FugakuNEXT			Fugaku
	CPU	GPU		CPU
Number of Nodes	≧3,400			158,976
FP64 Vector perf.	≧48 PFLOPS	≧2.6 EFLOPS	×4.9	537 PFLOPS
FP16/BF16 Matrix perf.	≧1.5 EFLOPS	≧150 EFLOPS	×70.5	2.15 EFLOPS
FP8 Matrix perf.	≧3.0 EFLOPS	≧300 EFLOPS		-
FP8 Matrix sparsity perf.	-	≧ 600 EFLOPS		-
Memory Capacity	≧10 PiB	≧10 PiB	×4.1	4.85 PiB
Memory BW	≧7 PB/s	≧800 PB/s	×4.9	163 PB/s

FUJITSU-MONAKA-X Processor

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Arm-based Processor Enhanced for AI

FUJITSU-
MONAKA-X

Optimization for HPC

- Next-generation **3D many-core architecture**
- **1.4 nm process** technology
- Further acceleration through **SIMD extensions**
- Legacy support for existing HPC applications

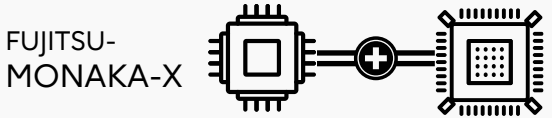
AI Processing Acceleration

- **Arm SME**: Implementation of NPU
- World's first in server-class CPUs
- Enhanced application coverage via **GPU collaboration**

Power efficiency and reliability

- **Ultra-low voltage** operation control
- Enhanced security with **Confidential Computing**
- Robust reliability through **RAS functionality**

CPU-GPU Tight Integration



NVLink™ Fusion

Accelerating AI-HPC Converged Workloads via High-Bandwidth, Low-Latency, and Coherent CPU-GPU Access

CPU Strengths

- complex control flow, latency-sensitive tasks, and irregular memory access

✓ Simulation, Realtime AI, Multimodal processing

+

GPU Strengths

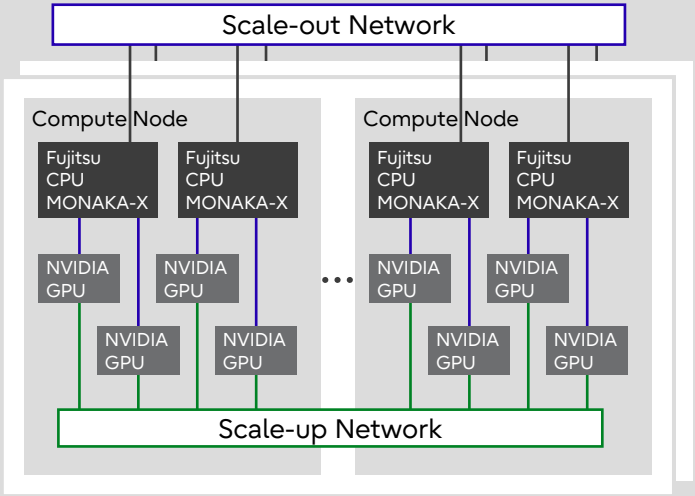
- Massively parallel data-parallel execution with regular memory access patterns

✓ Large scale DL/ML training, Image/signal recognition

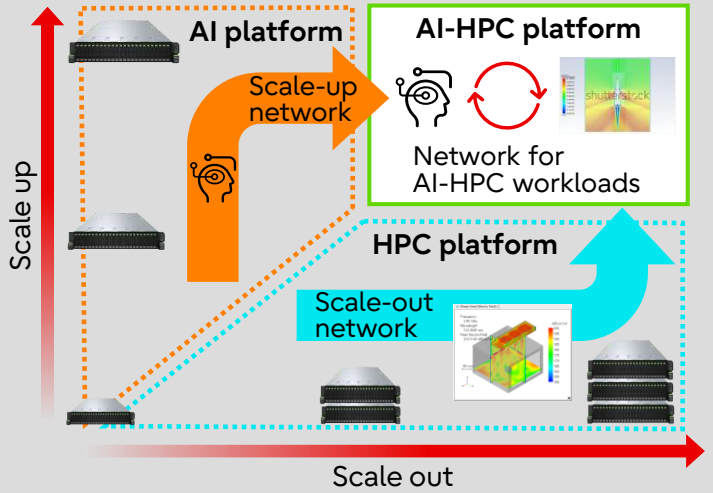
Integrating Scale-up/out network

- Heterogeneous interconnect with Scale-up and Scale-out
- Leverages both scale-up and scale-out capabilities by optimizing at the system level
  - Enhancing AI-HPC integrated workload performance through optimal allocation of network resources
  - Significant performance gains of HPC workloads with effective scale-up network utilization

Heterogeneous Interconnect



Interconnect for AI-HPC platform



Software-Driven 100x Application Performance Over Fugaku

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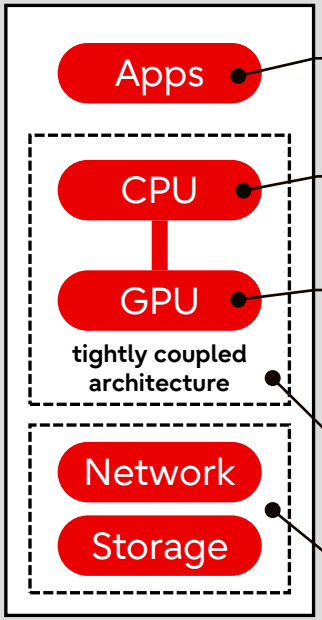
- Achieving 100x application performance necessitates software leveraging hardware far more efficiently.
- We believe total performance optimization, from application to system software, can achieve the goal.

Keys for Achieving 100x Application Performance



Leveraging AI to accelerate simulations
- Hybrid surrogate model & simulation, accuracy-preserving quantization

Fully leveraging MONAKA-X of ultra many core for boosting existing HPC applications

Accelerating high-precision operations with low-precision arithmetic, utilizing like Ozaki Scheme

Harnessing CPU-GPU tightly coupled architecture for application speedup
- Optimal workload & data placement on CPU / GPU to maximize their capabilities (e.g. Large node memory, massively parallel SIMD)

Optimizing data communication for resolving data bottleneck

Thank you

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