FUJITSU

shaping tomorrow with you

Post-K Supercomputer Overview

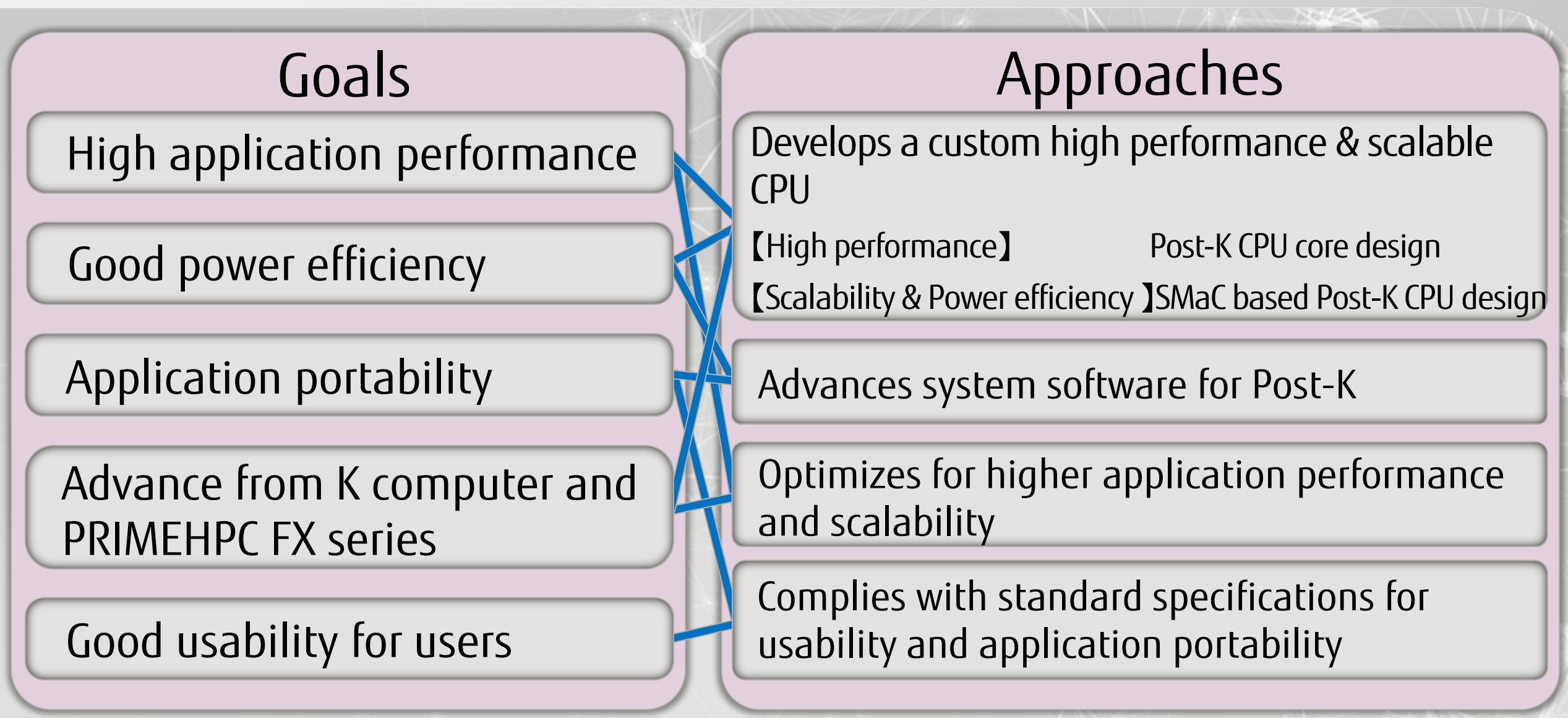
Post-K supercomputer overview

FUJITSU

- Developing “Post-K” as the successor to the K computer with RIKEN
- Developing HPC-optimized high performance CPU and system software
- Selected ARMv8 with SVE ISA for the CPU

Post-K goals and approaches

FUJITSU



Post-K CPU core design

FUJITSU

- Developing high performance CPU adopting ARMv8 with SVE ISA
  - Contributing to development of SVE (Scalable Vector Extension) with ARM
- Inheriting and enhancing the preceding CPUs' functions

HPC apps acceleration	Post-K	FX100	FX10	K computer
Base ISA + SIMD Extensions	ARMv8+SVE	SPARCv9+HPC-ACE2	SPARCv9+HPC-ACE	SPARCv9+HPC-ACE
SIMD width [bit]	512	256	128	128
Gather Load and Scatter Store	✔Enhanced	✔	-	-
FMA: Floating-point multiply and add	✔	✔	✔	✔
Packed Single Precision SIMD	✔Enhanced	✔	-	-
Math. acceleration primitives*	✔Enhanced	✔Enhanced	✔	✔
Inter-core barrier	✔	✔	✔	✔
Sector cache	✔Enhanced	✔Enhanced	✔	✔
Hardware "prefetch" assist	✔Enhanced	✔Enhanced	✔	✔

*Mathematical acceleration primitives include trigonometric functions, exponential functions, etc.

SMaC based Post-K CPU design

FUJITSU

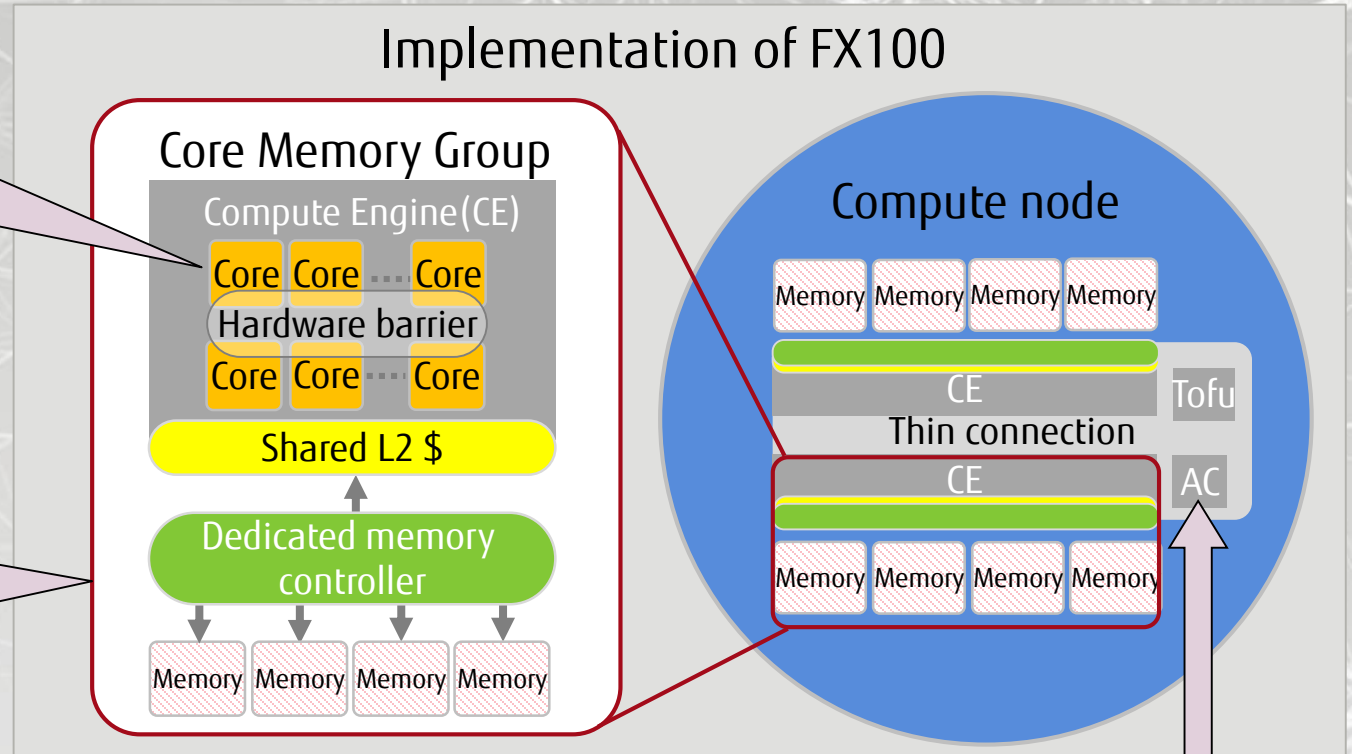
- Improves Fujitsu's proven μ-architecture, SMaC(Scalable Many Core) optimized for HPC applications

SMaC example for FX100

Middle-sized, general purpose, out-of-order, superscalar processor core
- Good performance for variety of apps
- Low power with power management functions

Assistant core
- OS jitter reduction and assistance for IO, async MPI
- Scalable for massively parallel system

Core Memory Group (CMG), many core building block, ccNUMA thin connection
- Hierarchal structure for hybrid parallel model
- Optimized area and performance



Advanced system software for Post-K

FUJITSU

- Developing based on co-design scheme with application developers
- Keeping application portability by providing programming environment

Post-K applications

FUJITSU Technical Computing Suite / RIKEN Advanced system software

Management software

- System management for highly available & power saving system operation
- Job management for higher system utilization & power efficiency

Hierarchical file I/O software

- Application-oriented File I/O middleware
- Lustre-based cluster file system FEFS

Programming environment

- XcalableMP
- MPI(Open MPI, MPICH)
- OpenMP, COARRAY, Math Libs.
- Compilers(C,C++,Fortran)
- Debugging and tuning tools

Linux OS / McKernel(Lightweight Kernel)

Post-K system hardware

Optimizes for higher application performance and scalability

FUJITSU

- Develops HPC-optimized technologies
- Enhances the features of K computer, PRIMEHPC FX10/FX100 systems

Hardware :

- Fujitsu-designed CPU with SVE
- Tofu 6D mesh/torus interconnect

System software:

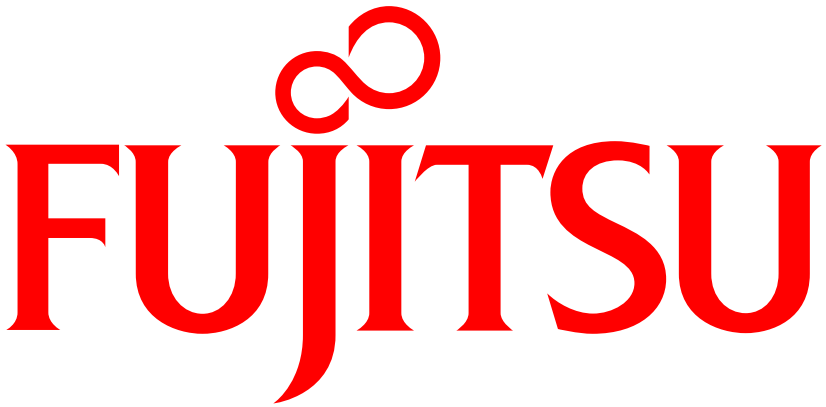
- McKernel with Zero OS jitter
- Distributed file system FEFS
- Parallelizing compilers
- Tuned MPI libs
- Management software

Complies standard specifications for usability and application portability

FUJITSU

- Compliance with ARM standard platform specifications
  - To co-operate ARM/Linux community and utilize system software and OSSs
  - To ensure binary level application portability

• ISA	ARMv8-A with SVE
• System architecture	SBSA level3, SBBR
• Firmware interface	UEFI, PSCI
• API, library	Linux APIs, Standard MPIs Standard math. libs
• Languages	
Fully supported:	Fortran 2008, C11, C++14, OpenMP 4.5
Partially supported:	Fortran 2015, C++1z, OpenMP 5.0



shaping tomorrow with you