

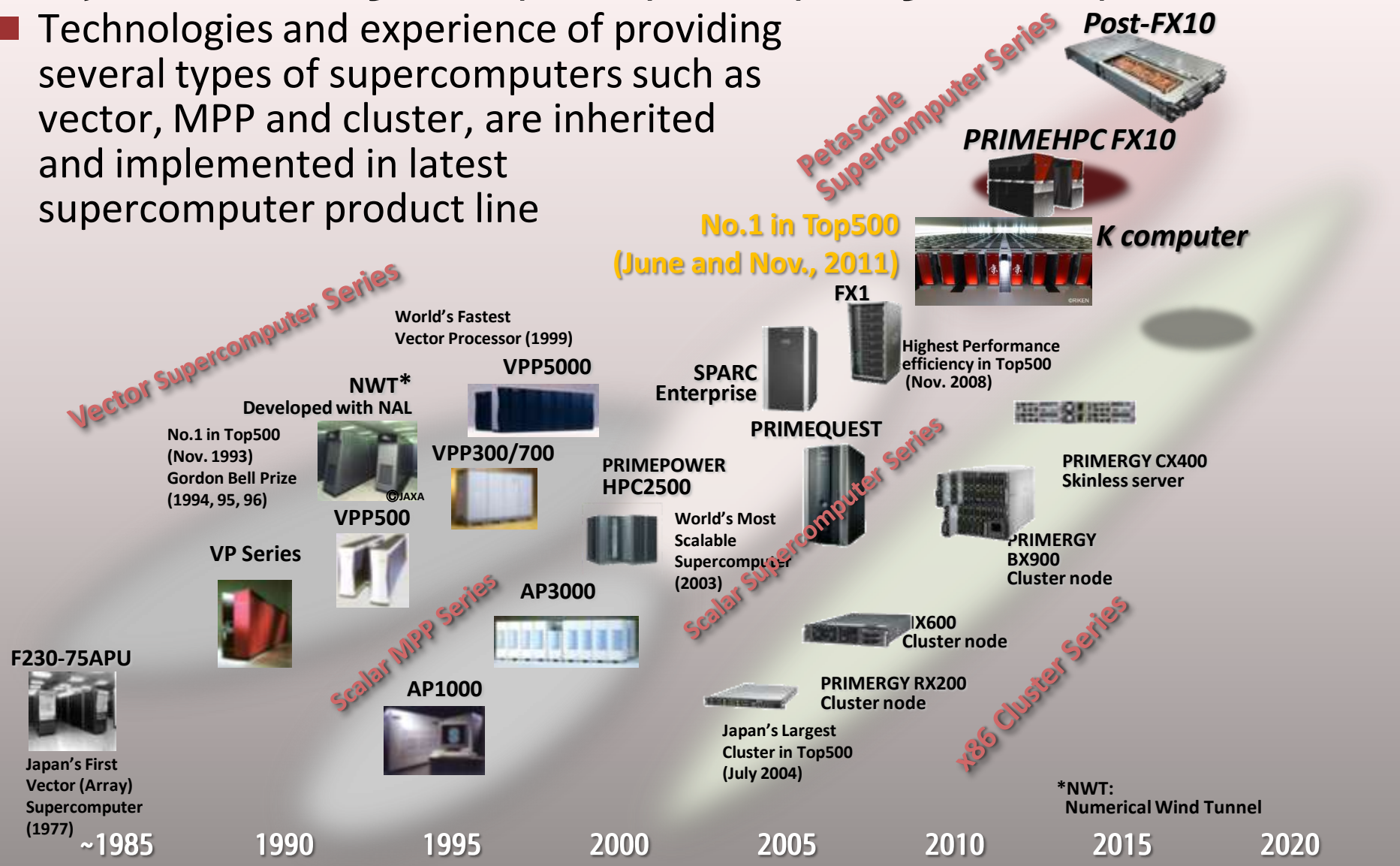
Introduction of Fujitsu's next-generation supercomputer

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HPC Platform Solutions

- Fujitsu has a long history of supercomputing over 30 years
- Technologies and experience of providing several types of supercomputers such as vector, MPP and cluster, are inherited and implemented in latest supercomputer product line



K computer and Fujitsu PRIMEHPC series

- Single CPU/node architecture for multicore
 - Good Bytes/flop and scalability
- Key technologies for massively parallel supercomputers
 - Original CPU and interconnect
 - Support for tens of millions of cores (VISIMPACT*, Collective comm. HW)

PRIMEHPC Series

FX1

VISIMPACT
Collective comm. HW



CY2008~
40GF, 4-core/CPU

K computer

SIMD extension HPC-ACE
Direct network Tofu



CY2010~
128GF, 8-core/CPU

FX10

HPC-ACE
Direct network Tofu



CY2012~
236.5GF, 16-core/CPU

Post-FX10

HPC-ACE2
Tofu interconnect 2
HMC & Optical connections



Coming soon
1TF~, 32-core/CPU

* VISIMPACT: Virtual Single Processor by Integrated Multi-core Parallel Architecture

Architecture continuity for compatibility

■ Upper compatible CPU:

- Binary-compatible with the K computer & PRIMEHPC FX10
- Good byte/flop balance

■ New features:

- New instructions (stride load/store, indirect load/store, permutation, concatenation)
- Improved micro architecture (out-of-order, branch-prediction, etc.)

■ For distributed parallel executions:

- Compatible interconnect architecture
- Improved interconnect bandwidth

K computer



FX10



Post-FX10



The K computer and the evolution of PRIMEHPC

	K computer	PRIMEHPC FX10	Post-FX10
CPU	SPARC64 VIIIfx	SPARC64 IXfx	SPARC64 XIfx
Peak perf.	128 GFLOPS	236.5 GFLOPS	1TFLOPS ~
# of cores	8	16	32 + 2
Memory	DDR3 SDRAM	←	HMC
Interconnect	Tofu Interconnect	←	Tofu Interconnect 2
System size	11PFLOPS	Max. 23PFLOPS	Max. 100PFLOPS
Link BW	5GB/s x bidirectional	←	12.5GB/s x bidirectional



Feature and Configuration of Post-FX10

Fujitsu designed SPARC64™ XIfx

- ◆ 1TF~(DP)/2TF~(SP)
- ◆ 32 + 2 core CPU
- ◆ HPC-ACE2 support
- ◆ Tofu2 integrated



Chassis

- ◆ 1 CPU/1 node
- ◆ 12 nodes/2U Chassis
- ◆ Water cooled



Cabinet

- ◆ 200~ nodes/cabinet
- ◆ High-density
- ◆ 100% water cooled with EXCU (option)



Tofu Interconnect 2

- ◆ 12.5 GB/s×2(in/out)/link
- ◆ 10 links/node
- ◆ Optical technology

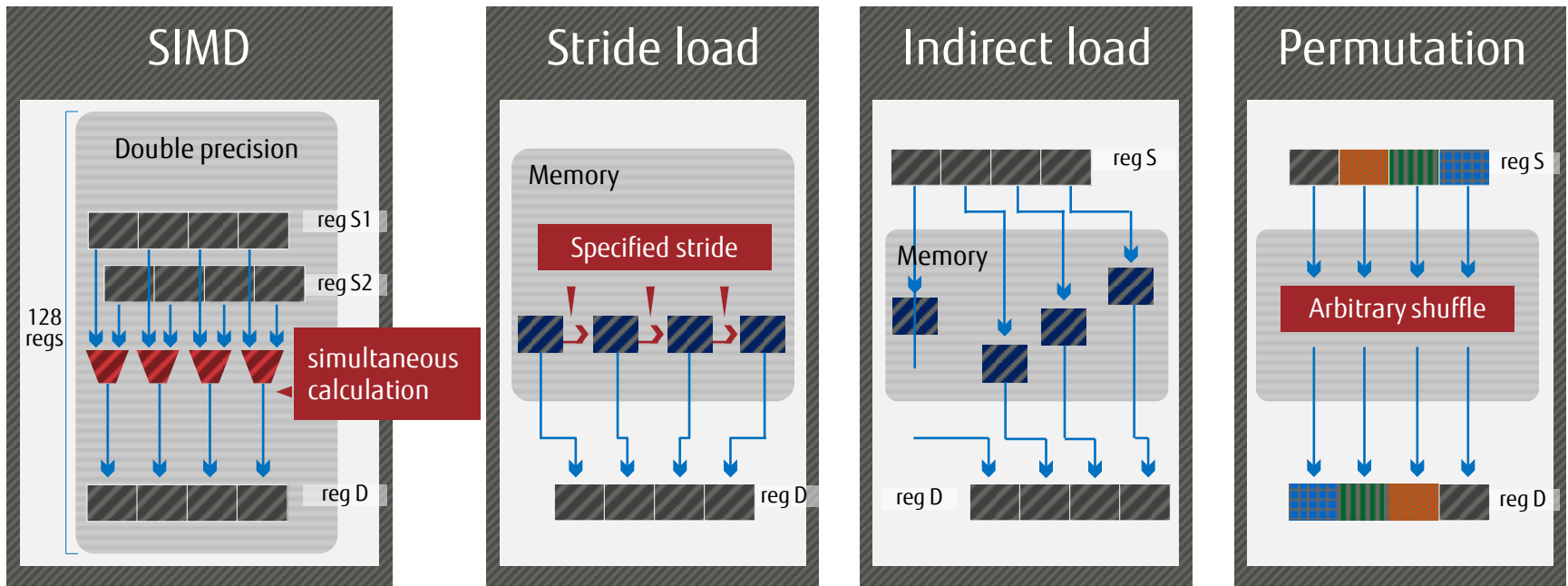


CPU Memory Board

- ◆ Three CPUs
- ◆ 3 x 8 Micron's HMCs
- ◆ 8 Finisar's opt modules, BOA, for inter-chassis connections

Flexible SIMD operations

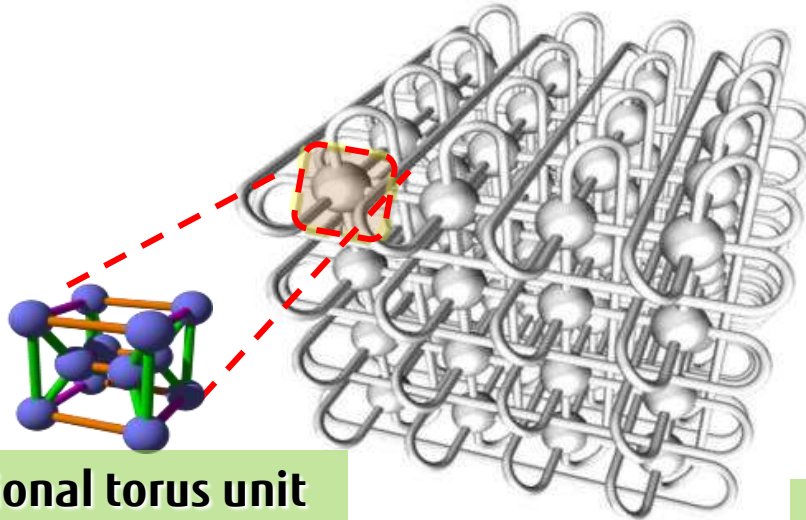
- New 256bit wide SIMD functions enable versatile operations
 - Four double-precision calculations
 - Stride load/store, Indirect (list) load/store, Permutation, Concatenation



Tofu Interconnect 2

- Successor to Tofu Interconnect
 - Highly scalable, 6-dimensional mesh/torus topology
 - Increased link bandwidth by 2.5 times to 12.5 GB/s
- Interconnect integrated into CPU
 - System-on-chip (SoC) removes off-chip I/O
 - Improved packaging density and energy efficiency
- Optical cable connection between chassis

Scalable three-dimensional torus



Three-dimensional torus unit
 $2 \times 3 \times 2$

Well-balanced shape available

Applications

HPC Portal / System Management Portal

Technical Computing Suite

System Management

- System management
- System control
- System monitoring
- System operation support

Job Management

- Job manager
- Job scheduler
- Resource management
- Parallel

High Performance File System *FEFS*

- Lustre based high performance distributed file system
- High scalability, high reliability and availability

Automatic parallelization compiler

- Fortran
- C
- C++

Tools and math libraries

- Programming support tools
- Mathematical libraries

Parallel languages and libraries

- OpenMP
- MPI
- XPFortran

Linux based OS (enhanced for FX series)

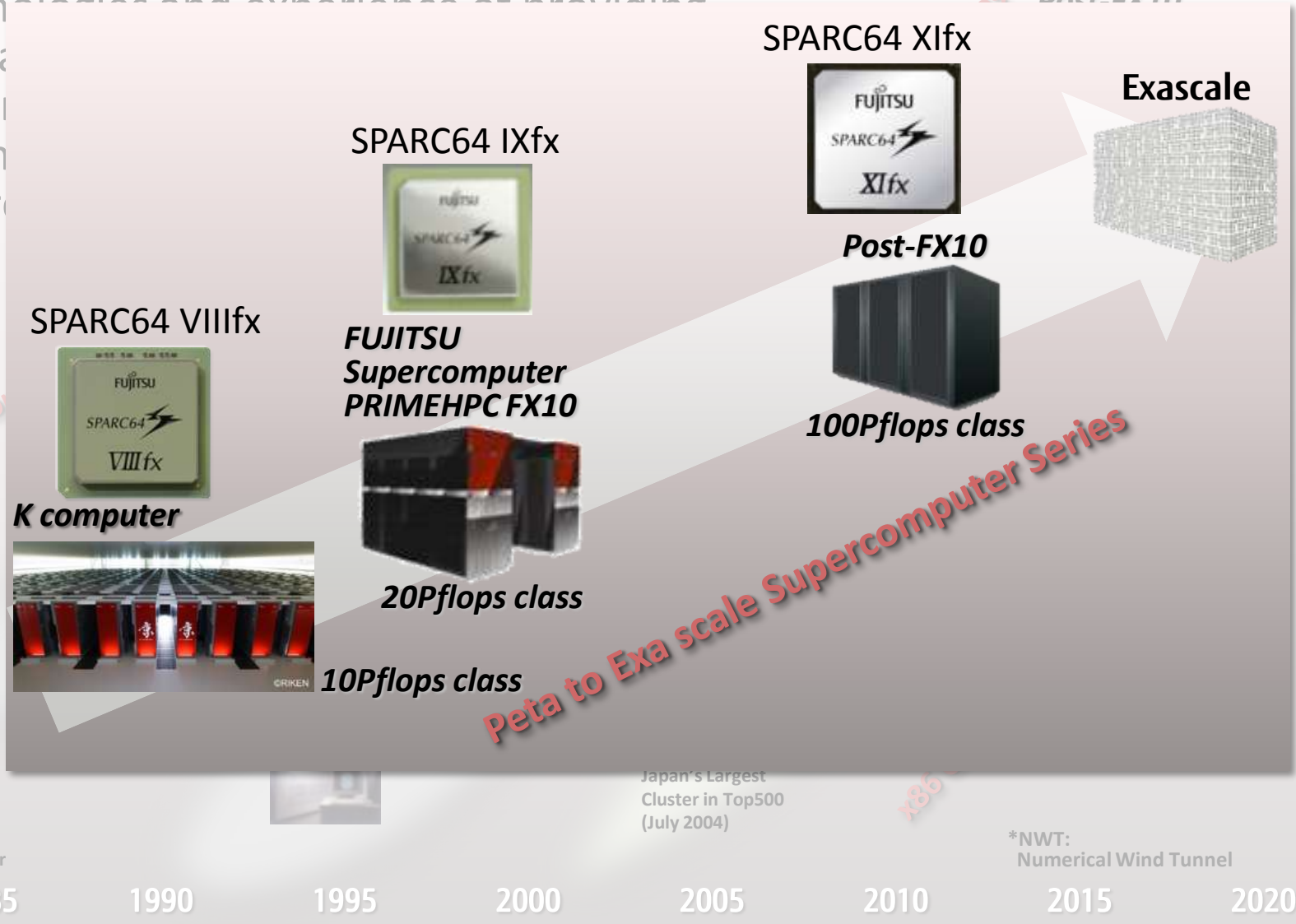
PRIMEHPC FX series

HPC Platform Solutions

Fujitsu has a long history of supercomputing since early 1980

Technologies and experiences of providing

several
vector
and in
super




F230-75APU



Japan's First Vector (Array) Supercomputer (1977)

A photograph of a young child with blonde hair lying on their back in a field of green grass and yellow flowers. The child is wearing a light blue long-sleeved shirt and is holding a daisy seed head in their right hand. The scene is bathed in warm, golden light, suggesting a sunset or sunrise. A large white circle is overlaid on the right side of the image, containing the text.

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with Technical Computing



FUJITSU

shaping tomorrow with you