

ExaScaler PEZY Computing

ZettaScaler-2.0

Configurable Liquid Immersion Cooling System

Scalable Energy Efficient HPC / Data Center Solution

Introducing ZettaScaler Core Technologies

Unique liquid immersion cooling technology

All circuits are fully immersed and cooled by
3M™ Fluorinert™ inert liquid circulation
Operating temperature is under 30°C (equal to 86°F).
Safe, no need for sealing, highly-efficient cooling solution.
Easy to maintain with much less failure rate.

Our proprietary many-core MIMD processor, PEZY-SC2

Overwhelming computing power
4.1 TeraFLOPS (Rpeak) at 1GHz
2,048 cores of original design and 6 MIPS64® cores
16nm FinFET process
56MB of cache memory
TCI 3D stacked memory with bandwidth of 2.0TB/sec
DDR4 memory with bandwidth of 153.6GB/sec
PCI-Express Gen4 with I/O bandwidth 64GB/sec
Significantly reduced transmission power loss using 48V DC input.

Sufficient interconnect bandwidth

32 processors are connected using twelve hierarchical PCI-Express fabric switches to form a Brick.
Every link between two processors in a Brick is PCI-Express Gen3 x16.
Bricks are interconnected with high-speed InfiniBand EDR, etc.

Ultra-high-density modules

Extreme densities realized by liquid immersion cooling.
Short-distance signal transmission allows for high-speed circuit operation.
Over one million processing cores in one cubic meter (1m³).
Able to select a variety of high density modules, PEZY-SC2 module, All FLASH-SSD module, Intel® Xeon® module, etc.

Value provided by these technologies

High performance

One immersion tank with 16 Bricks/512 processors delivers 2.1 PetaFLOPS (Rpeak), 1.4 PetaFLOPS (Rmax)

High energy-efficiency

World top class efficiency with over 10GFLOPS/W

Compact and silent

Compact size, silent, no air blow, no temperature nor moisture control required.

Can be installed in a laboratory office and even in a private researcher office.

Scalable

A system with multiple immersion tanks

Configuration example:

Connecting 16 immersion tanks can create 30 PetaFLOPS (Rpeak), 20 PetaFLOPS (Rmax) system

Configurable

An immersion tank can be configured with a variety of modules
Configuration example:

The system can be configured 256 Xeon® processors/Brick with 2PB of SSD storage/Brick in a tank.

Configurable Liquid Immersion Cooling System

ZettaScaler is an extensible system that adopts ExaScaler's unique liquid immersion cooling technology. In conventional systems, the equipment along with the entire room has to be cooled through air conditioning, but air conditioning is not necessary for this liquid immersion cooling system. It is a very small and silent supercomputer, it can be even installed in laboratories or offices.

The basic block of our system is called a brick, mounted with ultra-high density processor modules. These extremely dense bricks are installed in the immersion tanks and are efficiently cooled in our immersion cooling system.

The inside of the immersion tank is filled with fluorine inert liquid exhibiting excellent thermal characteristics. By circulating this liquid, it is possible to efficiently cool all immersed electronic circuits. It provides excellent electrical insulation and it is a highly safe liquid with non-combustibility, non-toxic, odorless and zero ODP (Ozone Depletion Potential) characteristics.

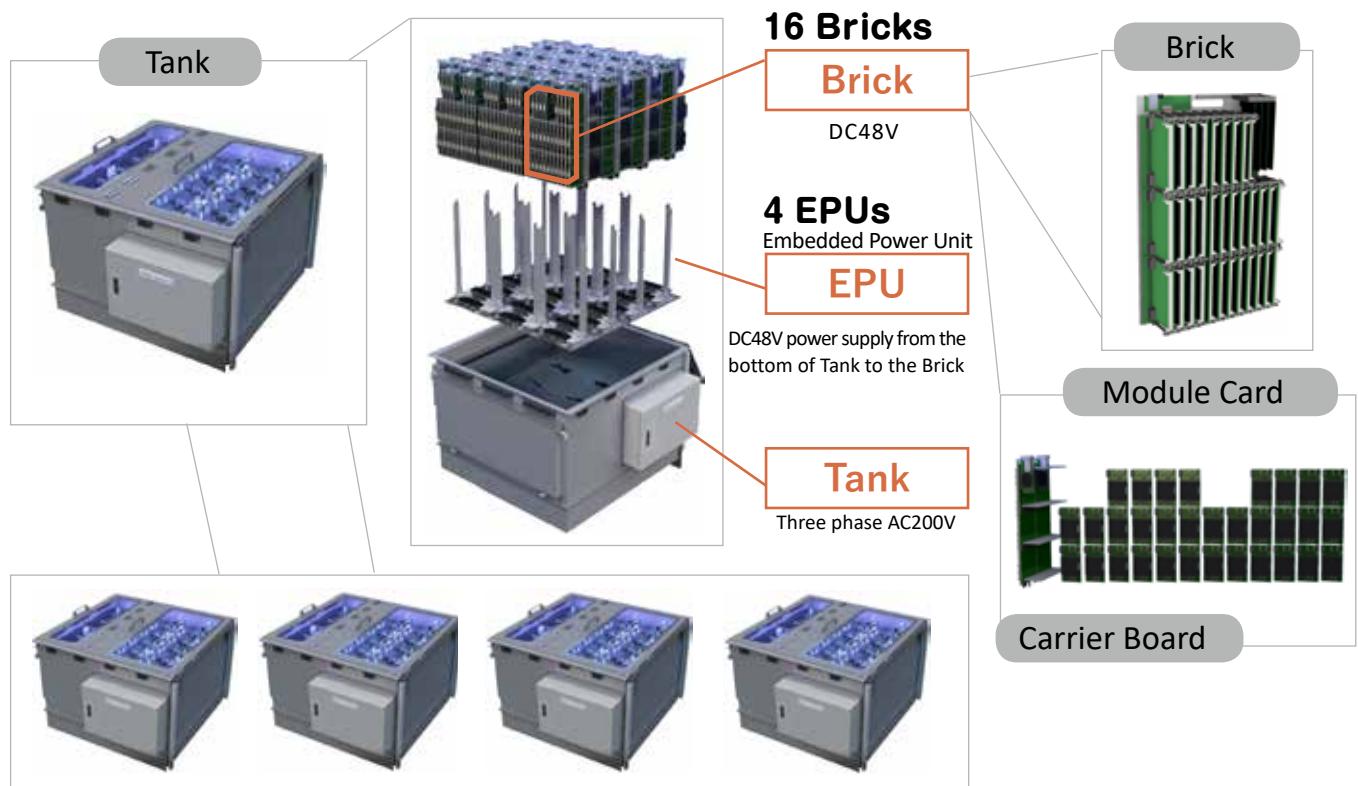
Furthermore, it has a high boiling point and hardly evaporates, so sealing is not necessary. This simplicity of our system structure along with the ease of use of our cooling system simplifies maintenance.

ZettaScaler is also extremely extensible and scalable. By connecting the immersion tanks in tandem, it is possible to scale to the desired performance level. For example, with 16 immersion tanks, the system can be configured to reach 30 PetaFLOPS (Rpeak) / 20 PetaFLOPS (Rmax).

ZettaScaler-2.0 system configuration

Tank / EPU / Brick / Module Card

(A prototype image. This prototype has 24 bricks and the final product has 16 bricks.)



Scalable (Multiple Tanks Interconnected)

32 module cards, 4 network cards and 1 control card (optional) are mounted on the carrier board (backplane) and are connected to each other using twelve hierarchical PCI-Express fabric switches interconnect.

Inter-Brick connections are facilitated using high-performance interconnects such as InfiniBand.

All features and specification are subject to change without prior notice.

ZettaScaler - 2.0

PEZY-SC2 Module

Our high-performance compute nodes are equipped with PEZY-SC2, the successor to the PEZY- SC many-core processor developed by PEZY Computing K.K.

Its predecessor PEZY-SC is the Green500 Top 1-3 awarded processor used in the systems Shoubu, Suiren, SuirenBlue and Satsuki.

PEZY-SC2 doubles the number of cores compared to PEZY-SC. Also, significantly reduces transmission power loss using 48V DC input.



W160mm, D100mm, H28mm

PEZY-SC2 Processor

- 2,048 MIMD cores / 16,384 Thread / 1GHz
- L1 12MB / L2 12MB / L3 40MB
- Theoretical performance : 4.1TFLOPS (DP) / 8.2TFLOPS (SP) / 16.4TFLOPS (HP) (Rpeak)
- MIPS64R6 (P6600) 6Cores / L1 I:64KB+D:64KB (each core) / L2 2MB
- Coming soon : Near Field Wireless Communication between Processor-Memory link with TCI* Technology

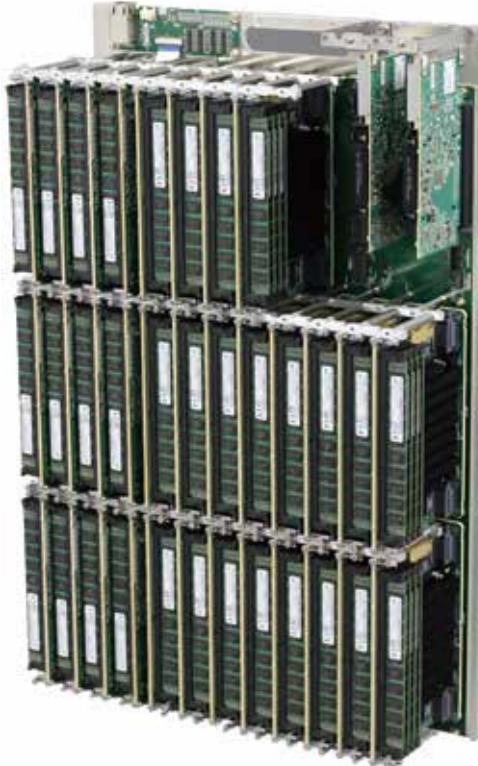
*ThruChip Interface

PCIe Gen3/4 x16 * 2CH (x8 * 4CH)

DDR4 64bit (ECC) * 4CH / 3,200Mbps

BW=100GB/sec Up to128GB

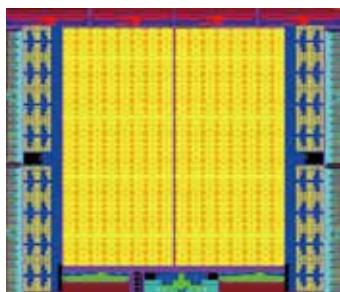
Power Consumption : 130W (Average at standard load)



A Brick with 32 PEZY-SC2 modules

4 slots (top right) for 100Gbps high speed interconnecting cards

Die Plot





ExaScaler

PEZY Computing

Photo courtesy of JAMSTEC

Intel® Xeon® E5-2600 v3/v4 Module

Dual processor node for high-performance computing and virtual machine services equipped with two QPI connected Intel® Xeon® processors



W160mm, D115mm, H60mm

A Brick with 16
Xeon® E5 modules
32 Xeon® E5 processors

4 slots (top-right)
for 100Gbps
high speed interconnecting cards



Dual Xeon® D Module

One module contains two Xeon®D nodes for high-performance computing and storage control



W160mm, D100mm, H28mm

A Brick with 32 Xeon D modules
64 Xeon® D processors

4 slots (top-right) for 100Gbps
high speed interconnecting cards



ALL FLASH - High capacity SSD module

Storage module with 16 NVMe M.2-2280 SSDs
32TB with 2TB SSDs



W160mm, D100mm, H14mm

A Brick with 64
ALL FLASH modules
Capacity up to 2PB

4 slots (top-right) for 100Gbps
high speed interconnecting cards



High capacity FPGA Module

Compute node with Xilinx's highest capacity FPGA
Virtex UltraScale XCVU440

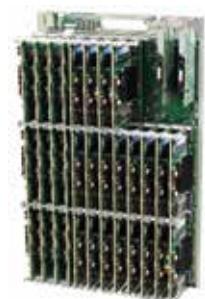


PCIe Gen3 x8* 4CH
DDR4 SO-DIMM 64bit* 1CH/2,400Mbps
BW=19.2GB/sec, 16GB memory (max)

W160mm, D100mm, H28mm

A Brick with 32 High
capacity FPGA modules

4 slots (top-right) for 100Gbps
high speed interconnecting cards



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