

Huawei FusionServer Liquid Cooling System



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Data center IT equipment today is predominantly air cooled. However, with rack heat loads steadily climbing, the ability for many data centers to deliver either adequate airflow rates or sufficient chilled air is now being stretched to the limit. This situation is creating a need for implementing liquid cooling solutions.

— ASHRAE

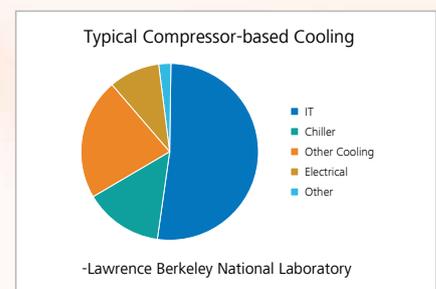
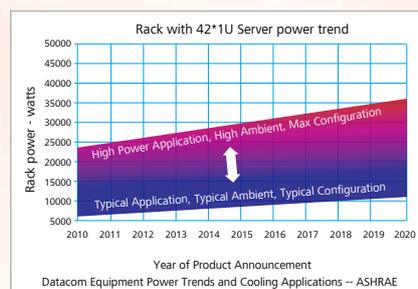
Challenges and trends of high-density computing

In recent years, data centers have been increasingly developed into the ones featuring high speed, high density, and large power consumption. The power consumption of a single cabinet can be as high as tens of kilowatts, exerting critical air ciling capacity and efficiency challenges to the data centers. Technologies such as precision air supply and thermal management system (TMS) can no longer meet heat dissipation requirements of equipment with large power capacity.

Challenges of energy conservation and emission reduction

The energy consumed by traditional air cooling equipment accounts for more than 40% of the total power consumption in a data center. High-density scenarios such as high performance computing have high requirements for energy conservation, emission reduction, and total cost of ownership (TCO) decrease. The liquid cooling technology, which outperforms in high efficiency and energy conservation, has gradually been applied to high-density IT equipment rooms.

Huawei liquid cooling solution is a board-level liquid cooling solution for high-density system. The solution is green, energy-saving, highly reliable, highly integrated, and easy to maintain.



Highlights of Liquid Cooling Solution

High energy efficiency

- Over 85% of the intra-board components use liquid cooling
- Support 45°C(113°F) warm water. The cooling PUE is less than 1.2

High reliability

- The intra-board pipes do not have solder joints nor leakage
- The cabinet is integrated with a coolant circulation monitoring device for condensation prevention, leakage detection, automatic ventilation, and automatic water supply.
- Redundancy design is adopted for key liquid cooling components.
- High-quality stainless steel fast connector and manifold, high corrosion resistance
- Isolation of the coolant circulation part and the circuit part, excellent disaster recovery performance

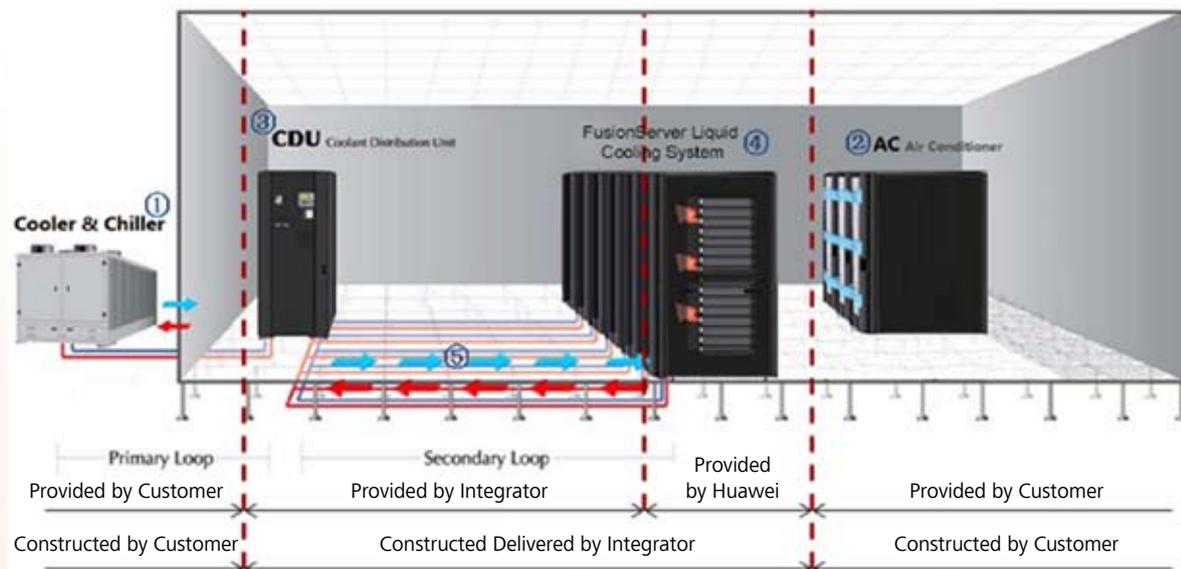
High integration

- One rack houses three E9000 chassis, supporting 96 2P nodes
- Supports 45 KW heat dissipation/power supply capability

Easy maintenance

- Supports single-node insertion and removal
- Modular cold plate; easy onsite maintenance of CUPs, DIMMs, and mezza cards
- No-leakage fast connectors, plug-and-play
- Supports onsite maintenance of key liquid cooling components such as pumps, filters, and sensors

Structure of Liquid Cooling Solution



- 1 Cooler & chiller
- 2 Air conditioning system
- 3 Coolant Distribution Unit (CDU) and liquid working medium
- 4 Computer rack
- 5 Secondary loop between the CDU and the cabinet, please see the user guide for details

Hardware structure of cabinet



- 1 Liquid-cooled compute node
- 2 E9000 chassis
- 3 Liquid-cooled cabinet
- 4 CCU
- 5 PDU

Mechanical specifications of cabinet

| Item | Specifications |
|--------------------------------|---|
| Common Configuration | Three E9000 chassis in each cabinet Up to 96 x 2P nodes |
| Cabinet Dimensions (H x W x D) | 2000 mm x 800 mm x 1200 mm (78.74 in. x 31.50 in. x 47.24 in.) |
| Weight | Product: <ul style="list-style-type: none"> • Cabinet (with the CCU and PDUs): 330 kg (727.53 lb) • Chassis: 65 kg (143.30 lb) • CH121L V3: 7.2 kg (15.87 lb) • CH140L V3: 10.4 kg (22.93 lb) |
| | Packing: <ul style="list-style-type: none"> • Cabinet packing: 130 kg (286.60 lb) • Chassis packing: 30 kg (66.14 lb) • Liquid-cooled compute node packing: 2.8 kg (6.17 lb) |
| | Maximum weight in full configuration: 1200 kg (2645.55 lb) |
| Power Consumption | <ul style="list-style-type: none"> • Cabinet fully configured with CH121L V3 compute nodes: 27 kW (N+N) • Cabinet fully configured with CH140L V3 compute nodes: 45 kW (N+1) |
| Heat Dissipation Mode | Liquid cooling and air cooling, up to 45°C water supply for blades |

Technical Specifications of Liquid-Cooled Blades

| Item | Specifications of One Cabinet |
|-----------------|---|
| Max. Nodes | 48 CH121L V3 or CH140L V3 liquid-cooled compute nodes |
| CPU | Up to 192 CPUs |
| DIMM | Up to 1152 DIMMs |
| Switch Capacity | A midplane provides a switching capacity of up to 15.6 Tbit/s of one chassis |
| Network Port | A chassis provides two pairs of slots for passthrough modules and switch modules that support Ethernet, Fibre Channel (FC), Fibre Channel over Ethernet (FCoE), and InfiniBand (IB) switching protocols |

HUAWEI CH121L V3 Compute Node

High density and large memory

- Supports the full series of Intel® Xeon® E5-2600 v3 processors to deliver up to 2*eighteen-core 2.3 GHz of computing capacity.
- Provides 24 DDR4 DIMMs. Provides a maximum capacity of 1.5TB
- Supports 2 x 2.5" SAS/SATA HDDs or SSDs. supports 2 x 2.5" PCIe SSDs.



Minimum energy for maximum efficiency

- Adopts the dynamic energy saving and power capping technologies to optimally manage and control power consumption with power remarkably reduced in low-load operating.
- Applies superb design, manufacturing processes, and components to ensure high quality.

Intelligent platform for strong management

- Reduces O&M costs by supporting remote deployment and fault location technologies such as SOL, KVM over IP, virtual DVD-ROM drive, WebUI and IPMI 2.0-compliant.
- Provides efficient and secure power consumption analysis and control capabilities.
 - Complies with Intel® NM 3.0.
 - Provides a sub-3s power capping response on each compute node to optimize power consumption control.
 - Supports an intelligent and secure power-off mode for compute nodes.
- Supports the black box function to facilitate quick fault location and service recovery.

The CH121L V3 combines dense computing capabilities with an ultra-large memory capacity. Optimized for enterprise service applications such as virtualization, cloud computing, and high-performance computing, the CH121 V3 employs Intel® Xeon® E5-2600 v3 series processors (up to 145 W) and supports up to 24 DDR4 DIMM slots, 2 internal hard disks.

Technical Specifications

| | |
|-----------------------------|---|
| Form factor | Half-width 2-socket compute node |
| Number of processors | 1 or 2 |
| Processor model | Intel® Xeon® E5-2600 v3 series |
| Number of DIMMs | 24 DDR4 DIMMs, providing a maximum memory capacity of 1.5 TB |
| Internal Storage | 2 x 2.5" SSDs, SAS HDDs, or SATA HDDs, supporting 2 x PCIe SSD HDDs Built-in flash memory: 2 x SATA DOM 2 x Micro SD cards (Raid1) |
| RAID support | RAID 0 and 1 |
| PCIe expansion | 2 PCIe x16 mezz modules |
| Operating systems supported | Microsoft Windows Server 2008/2012 Red Hat Enterprise Linux SUSE Linux Enterprise Server Oracle Linux CentOS Huawei Fusionsphere Citrix XenServer VMware |
| Operating temperature | 5°C to 40°C |
| Dimensions | Height: 60.46 mm Width: 210 mm Depth: 537.2 mm |

HUAWEI CH140L V3 Compute Node

Outstanding computing performance based on ultra high density

- Supports the full series of Intel® Xeon® E5-2600 v3 processors to deliver up to 2*eighteen-core 2.3 GHz of computing capacity; a half-width slot supports two small slots in two layers for installing two independent 2-socket compute nodes.
- provides eight DIMM slots on a 2-socket compute node, supporting a DDR4 memory capacity of up to 512 GB on a 2-socket compute node.
- Supports 2 Micro SD cards on a 2-socket compute node, supporting raid 1.
- Supports one internal 2.5" SATA HDD or SSD on a 2-socket compute node.



High efficiency and energy-saving

- Uses the dynamic energy saving and power capping technologies to optimally manage and control power consumption with power reduced in low-load operating.
- Adopts the carrier-class design, manufacturing process, and component selection to ensure high quality.

Easy management with the intelligent platform

- Reduces O&M costs by using remote deployment and fault locating methods including SOL, KVM over IP, virtual CD-ROM drive, and WebUIs in compliance with IPMI 2.0.
- Supports efficient and secure power consumption analysis and control capabilities.
 - Complies with Intel® NM 3.0.
 - Implements efficient power consumption control by supporting power capping operations within 3s on a compute node.
 - Supports an intelligent and secure power-on mode for compute nodes.
- Supports the black box function to facilitate fault location, quickly recovering services.

Optimized for HPC and computing-dense enterprise services, the CH140L V3 provides ultra high computing capabilities. A half-width slot supports two 2-socket compute nodes. Each compute node can be maintained independently. The CH140 V3 uses Intel® Xeon® E5-2600 v3 series processors and supports eight DIMM slots and one hard disk, as well as built-in 2 x Micro SD slots supporting RAID 1.

Technical Specifications

| | |
|-----------------------------|---|
| Form factor | Two 2-socket twin compute nodes in a half-width slot |
| Number of processors | 1 or 2 in each 2-socket compute node |
| Processor model | Intel® Xeon® E5-2600 v3 series |
| Number of DIMMs | 8 DDR4 DIMMs for each 2-socket compute node |
| Internal Storage | One 2.5" SSD/SATA for each 2-socket compute node 2 x Micro SD cards (Raid1) |
| PCIe expansion | 2 twin nodes share 2 MEZZ modules |
| Operating systems supported | Microsoft Windows Server 2008/2012 Red Hat Enterprise Linux SUSE Linux Enterprise Server Oracle Linux Oracle Solaris CentOS Huawei Fusionsphere Citrix XenServer VMware |
| Operating temperature | 5°C to 35°C |
| Dimensions | 210mm(width) x 537.2mm(depth) x 60.46mm(height) |

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