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Compute Project

Advanced Cooling Solutions Project Charter

Revision 1.0

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Revision

June 30, 2018	Initial draft by Bill Carter (OCP)
August 16, 2018	Rev 0.2 incorporated changes from Steve Mills (Facebook), Rolf Brink (Asperitas), and Jeremy Huylebroeck (Orange) <Bill Carter>
August 28, 2018	Rev 0.21 incorporated suggestions from Daniel Pope and added workstream detail <Steve Mills>
December 3, 2018	Rev 1.0 Released to OCP

Background

HIgh performance computing has used liquid cooling for for many years. These solutions have proven to be cost effective and efficient at heat extraction. With the growth of 5G, IoT, VR, CDN, and latency sensitive applications, data centers are being constructed in regions of the globe where cooling becomes quite a challenge. Increased power density also introduces cooling challenges. In these cases liquid cooling, and specifically warm water cooling, becomes an effective alternative for heat extraction.

During meetings between OCP foundation staff and IT equipment manufactures (e.g. ODM's), solution providers of liquid cooling/immersion solutions, and facilities providers (e.g. colo providers), these companies were asking OCP for help to enabled adoption of liquid cooling technologies .

ODMs and equipment manufacturers are interesting in providing IT equipment targeted specifically for the High Performance Computing data center. They also mention the cooling challenges they see for GPU solutions. The suppliers are willing to design and invest in compute modules optimized for cold plate technology. BUT, they don't know which cold plate solution to choose, and see many different solutions (CDU assembly, connectors, manifolds, etc.) with different implications on the compute module. Their request is that OCP choose one solution so they can align their product to work with that "rack" solution.

The liquid cooling solution providers are faced with choosing an ODM partner and working with that supplier to build plumbing and cold plates for their specific products even though the value of their solution is at the rack with different offers for resiliency, service, and capacity. They also work with the facilities teams to install or retrofit warm water cooling loops. They would like to focus their investment on the 'value' aspects and be able to support a broad range of IT

equipment from many suppliers. To this end, they would like to see the IT manufactures be able to deliver compute modules that work in their rack.

The immersion solution providers face a slightly different problem. They are providing a tank that can extract ~ 100Kw of heat, but simply taking a 1U or 2U rackable server and dunking it vertically in a bath under utilizes the bath's volume and wastes fluid. These suppliers would like to see compute board designed specifically for immersion, accommodate a narrow pitch within the tank, and maximize the power density of a given volume of space. This achieves lower costs of fluid. Their desire is that that industry creates a board form factor optimized for immersion, but none of these providers, nor any one of the customers, drives enough business to warrant a custom board form factor. Through collaboration, they see an opportunity to define an immersion-optimized board that allows their company to deliver a high power density, warm water cooled, extraction solution.

The DC facilities teams, like the other providers, have inventories the cold plate and immersion solutions and simply want a 'standard' interface to their building so they can offer white space with LC capability. Besides providing the physical connection to a DC water source, they need to know add'l parameters such as supply temperatures, delta-T, flow rates, and assure safety and resiliency is maintained/achieved.

With these 4 'user groups' in mind, the initial charter was authored.

Project Charter

The Advanced Cooling Solution project shall create specifications, standards, support documentation, or reference designs which enable global adoption of liquid cooling for the data center equipment with the goal of harmonization of liquid cooling solutions that benefit OpenRack and Olympus (EIA-310 compatible) based products as well as Project Scorpio in China. The project shall work with the other chartered OCP projects to accomplish this goal.

Project Goal

The project shall focus on standardization and definition of critical interfaces, operational parameters, and environmental conditions that enable a non-proprietary, multi-vendor supply chain of liquid cooled solutions.

Successful projects delivered by this project will include specifications that enable:

1. a supply chain offering a variety of Liquid cooling-enabled IT devices (servers ,storage, etc.)
2. a supply chain for liquid-enabled racks.
3. Data centers that can immediately support 1 and 2

Scope

The project may support more than one type of cooling architecture, such as:

- Direct liquid cooled cold plate solutions
- Immersion type solutions (single phase and 2-phase materials)
- Door heat exchangers

Any specifications developed should include be compatible with both EIA310 and Open Rack Architectures at a minimum.

Liquid Cooled Cold Plate - In-Scope Activities

- Determination of wetted materials, quality, and type - including test best practices
- Fluid physical properties and types
- Operating conditions and parameters
- Metrology of heat extraction performance
- DC to Rack Interfaces for Facility water loops such as piping, flow rates, temperatures, etc.
- Hot-plug drip-less valves between IT Gear and Rack
- Interfaces to Facilities and RDHx solutions

Liquid Cooled Cold Plate - Out of Scope Activities

The following areas will be out of scope of the Liquid Cooling Harmonization Project:

- Cold plate installation methods
- Definition of Data Center facility loops beyond the rack interfaces

Immersion Solutions - In-Scope Activities

- Determination of wetted materials, quality, and type - including test best practices
- Fluid physical properties and types for both one and two phase solutions
- Operating conditions and parameters
- Metrology of heat extraction performance
- IT Gear Architecture Optimized for Immersion
    - Impact Analysis and Best Practices
    - Considerations for non-Optimized IT Warranty Extension in Immersion
- Interfaces to Facilities

Immersion Solutions - Out of Scope Activities

The following areas will be out of scope:

Door Heat Exchanger - In-Scope Activities

- Fluid physical properties and types
- Operating conditions and parameters
- Metrology of heat extraction performance
- Solutions for refrigerated data centers that result in an energy neutral rack by removing the rack's extra heat out of the data center using a warm liquid loop (hot air to cool liquid transfer within the rack.)
- Solutions for free-air cooled data centers that allow the IT gear heat to be dissipated across the area of the rack's front or rear door (Hot IT Liquid to either DC air or Hot IT Liquid to Facility Liquid