

Coverage Initiation: Accelsius introduces NeuCool Kickstart program, providing trial access to its liquid cooling system

Analysts - Perkins Liu

Publication date: Monday, January 15 2024

Introduction

Accelsius, an Austin, Texas-based two-phase direct-to-chip liquid cooling systems provider, has introduced its NeuCool Kickstart program, giving datacenter and edge facility operators that are interested in attempting the transition from air cooling to liquid cooling exclusive trial access to its patented technology. Through the collaboration program, participating operators work closely with Accelsius thermal scientists and field engineers to design, deploy and commission liquid cooling solutions tailored to their needs. Accelsius will be looking for regular feedback on the NeuCool system's performance, which could help shape future updates and improvements to the system's cooling technology.

The Take

The adoption of liquid cooling is no longer a yes or no question, but a how and when question, as the ever-increasing demand for cloud computing and the wide adoption of artificial intelligence (AI), machine learning (ML) and other high-density applications are driving up the power consumption of chips, CPUs and GPUs, which increases the power density of servers and IT racks, with air cooling potentially reaching its limits. However, the transition from air cooling to liquid cooling is a process; it involves modifications or retrofits to the server, rack and even facility. Accelsius' NeuCool Kickstart program offers customers willing to try liquid cooling a chance to plan, test and gain experience in liquid cooling and forecast a hybrid IT environment for a smooth transition away from air cooling.

The company would also leverage the program to prove and validate its technology before the general availability announcement.

Context

Accelsius was established in 2022, and is funded by Innventure, a technology commercialization company specializing in identifying, funding and scaling disruptive technologies invented by large multinational partners. Specifically, Innventure builds and operates companies around environmental technologies acquired from multinational corporations. Innventure was founded in 2015, with roots going back for decades, when several current managing partners of the company developed a model to create disruptive companies based on breakthrough technologies across different industries. The core of the model is derived from a series of technical, operational and business-related questions informed by the disruptive tech companies. All of those questions have been baked into the company's DownSelect research process. A breakthrough technology passes through four stages — opportunity screen, critical factor assessment, comprehensive quantification, and strategy and formation — before it is commercialized.

Innventure has launched and built three companies since its inception. PureCycle Technologies Inc. was founded in 2017, with technology acquired from Procter & Gamble Co. (P&G) that converts recycled polypropylene into a renewable resource through its unique purification process. PureCycle was listed on the Nasdaq in 2021. AeroFlexx was launched in 2018, based on technology also from P&G that uses flexible film to create a package for liquid products that uses up to 85% less virgin plastic versus traditional rigid bottles.

Accelsius was created in 2022, the third company that Innventure launched. Accelsius is based on a two-phase direct-to-chip passive liquid cooling technology acquired from Nokia to design approaches to solve the challenge of increasing server rack power density and meet the rising demand for efficient cooling systems in datacenters and telecommunication systems.

Liquid cooling technologies

IT equipment consumes electricity to perform, and the electricity is eventually converted to heat during the process. Heat must be taken away as it is generated to keep the IT equipment from failing. Datacenters have been cooled by air for decades. However, air cooling has limitations; it is not a good conductor of heat compared with liquid, which has up to 4,000 times greater coefficient of heat rejection compared with air. The server rack power density continues to rise, and the wide use of GPU for AI applications has accelerated the increase of power consumption of servers. A key indicator of chip power density is thermal design power (TDP). When chip TDP enters the 200-300 W range, special airflow management, together with increased fan volume and velocity, is required to remove the heat quickly enough. When the TDP reaches 350-400 W, it becomes much more complex and costly to cool the server using air. Most of the time, a higher and larger heatsink is required to increase the available area for air cooling. During operation, powerful fans are usually required to run at full speed which is very noisy. Currently, the CPU is approaching 400-500 W TDP, and the GPU is going over 1,000 W TDP. Air cooling is pushed to its limit while the industry is seeking answers from liquid cooling.

Liquid cooling in datacenters can be divided into two major categories: direct-to-chip (DTC) and immersion, based on how the liquid interacts with the heat-generating electronic components. In a DTC configuration, liquid coolant in pipes is pumped to cold plates in place of the heatsinks on electronic components in an air-cooling configuration. While most of the heat (80%) is taken away by the cold plates on chips, fans are still needed to help remove heat at the board level, but at a very low volume and velocity in most cases. Some designs exchange the heat out of the server chassis through the air while others require a heat exchanger either at rack level or row level to transfer the

451 Research

heat to a primary cooling loop at facility level. DTC maintains the form of the server and can be easier to install/retrofit if dealing with traditional server and rack form factors. In an immersion cooling configuration, fluid is in direct contact with the IT equipment because the equipment is immersed in a dielectric fluid. The heat generated is then directly dissipated into the liquid and fans are completely eliminated. This typically requires an architecture different from that of traditional racks. Both DTC and immersion can also be categorized as single-phase, in which the liquid coolant always stays in a liquid state, or two-phase, in which the liquid coolant evaporates in order to transfer heat out of the liquid and then is converted back to a liquid state.

Offerings and strategy

Accelsius offers a complete rack-based two-phase DTC system of up to 100 kW per rack that includes vaporators (cold plates), dielectric tubes, a manifold and an iPCU monitoring and control system. The patent-pending vaporator is a boiling DTC system that can be configured for multiple chips for advanced CPU and GPU road maps. It comes with metal internal tubes custom-configured to an OEM sled and a five-layer nylon AC hose with very low permeability. The manifold is designed for standard 42U rack size and can be adaptable to lower or higher racks over 50U and 750 mm width. It mounts in zero-U rPDU space in the rear or side of the rack, color-coded and sized for vapor and liquid transport. NeuCool Monitoring and Control System iPCU is an 8U system stack including core logic, industrial condenser and 2N+1 pumps, interface to facility water system, and dielectric reservoir. It has multiple redundancies with hot swap servicing on pumps, power supplies, core logic and sensors. The system uses <1 GWP (Global Warming Potential, referring to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, CO₂, which is assigned a value of 1) dielectric instead of water, eliminating the threats of corrosion and damaging leaks inherent in single-phase water-based systems.

Accelsius offers the complete DTC system to customers instead of individual components, focusing on the North American market with local supply chain and manufacturing. Customers interested in converting an air-cooling rack to a two-phase DTC NeuCool system to create a hybrid IT environment would need to work with Accelsius and partners to configure and deploy the system. The NeuCool Kickstart program is an early-access program offered to customers committed to a transition from air cooling to liquid cooling to have a trial of the two-phase DTC system. Customers would work with Accelsius' engineering and field service team to design, deploy and commission the system. Channel partners, including systems integrators and server OEMs, would help convert an air-cooled server to be NeuCool DTC compatible, depending on the volume. Customer feedback will be collected to help validate the design and figure out corner cases through this selective limited availability before an announcement of general availability for the product.

Competition

There are a handful of liquid cooling technology companies in the market. Due to its compatibility with existing server rack architecture with less disruption, DTC is the mainstream liquid cooling solution. CoolIT, which offers single-phase DLC, is a company with a long history in this market and has a partnership with most server manufacturers. Motivair also offers a single-phase DTC. JetCool offers a microconvective-based DTC solution. ZutaCore is another company that provides two-phase DTC. Immersion cooling companies include Asperitas, Green Revolution Cooling, Iceotope, Midas Green Technologies, Submer and LiquidStack.

SWOT Analysis

Strengths	Weaknesses
-----------	------------

Coverage Initiation: Accelsius introduces NeuCool Kickstart program, providing trial access to its liquid cooling system

Accelsius has emphasized system robustness and serviceability in its design in addition to thermal cooling capability.	The system-only approach might limit access to potential customers and partners that want to buy individual component parts.
Opportunities	Threats
The accelerated increase of chip power density (+1,000 W) is pushing traditional air cooling to its limit, which is driving the industry to seek answers from liquid cooling.	There is no one-size-fits-all solution when it comes to liquid cooling, and there are different approaches in the market, each with several competitors.

Source: 451 Research.