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Cooling technology: how computing keeps its cool

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Immersion cooling, in which electronics are bathed in liquid coolant, is coming into its own

A US Chinook helicopter transporting a cooling unit in Afghanistan, 2013

As computing pushes into the world's most rugged geographies, immersion cooling — technology in which electronics are bathed in liquid coolant — is coming into its own.

Companies are now starting to see the business opportunities for immersion cooling in extreme environments, from desert battlefields to oil rigs.

The technology goes hand in hand with modular data centres: compact units that can be transported to provide computing and communications wherever they are needed. When equipped with liquid-immersion cooling, data centres can save up to 20 per cent on overall costs, up to 40 per cent on power and up to 60 per cent on space, according to some estimates.

Two types of liquid-immersion cooling exist. The simpler is "single-phase". A liquid absorbs heat as

it flows over the computer electronics placed in a metal casement; the liquid is then pumped to a cooling unit outside, which reduces the temperature, like a car radiator, before it is recirculated.

“Two-phase” is more like a conventional refrigerator. Heat from electronic components vaporises liquid coolant, which condenses again in an outside unit as the heat is transferred to water. A fluid called Novec made by 3M is popular because it changes easily between gas and liquid and doesn’t adhere to electronics.

Alternative cooling practices are not as effective as liquid immersion. Air cooling requires fans inside the server to cool electronics as well as outside air conditioners to purify the air running through the computer. Cold plates usually cool only the processing chips and require fans for the rest of the system.

Market forecasts show promise for liquid cooling. According to TechNavio, a UK-based technology research company, it will grow at about 16 per cent per year through 2019. The military is expected to drive modular designs because it operates in remote locations and requires security and mobility.

Among suppliers of the technology, Iceotope and LiquidCool Solutions (LCS) offer the most rugged designs because they use a single-phase approach with sealed electronics. LCS can run its servers under water or under desert sands. Allied Control and Silicon Graphics Inc (SGI) use two-phase cooling to service computer racks with higher power densities; they can handle heat generation at rates above 100kW.

The US military has been looking into liquid-immersion cooling recently, in an effort to save energy in tropical camps. The technology is also set to become popular in the oil and gas sectors.

Photograph: Capt. Peter Smedberg, US Army