



Liquid Cooling in the Data Center is on the Rise

Technical Note by:

Dave Moss
KC Cox
Jason Sultz

Summary

Customers are constantly looking for ways to increase data center efficiency and decrease related costs. One of the key areas that influence data center efficiency is power and cooling and the impact it has from both a CAPEX and OPEX perspective.

Customers prefer not to invest in a heavily proprietary and customized solution but leverage industry standard components in a simplified solution.

Dell EMC's new mainstream liquid cooling solution will help drive greater efficiencies across the data center and improve overall system performance.

Liquid cooling in the data center was once thought of as an expensive and unnecessary technology reserved for niche markets. While OEMs have driven optimization of air cooled solutions over the last several production generations, the addition of new CPU, GPU, and persistent memory technologies is driving system power density up against the limits of air cooling. It is in this environment that we are seeing a confluence of several factors that have liquid cooling positioned for a push into a more mainstream data center, including component power density, desire for richer compute configurations and associated processor architectures, and green initiatives. This impending market shift positions Direct Contact Liquid Cooling to provide a cost efficient method to leverage standard computing hardware components with a cooling technology that can be deployed in the data centers of today and tomorrow.

How Alternative Cooling Methods Have Evolved

Mainframes began using liquid cooling in the 1960's and continued through the 80's until, in the early 90's, the industry switched from bipolar to CMOS circuit technology. This caused a drastic decrease in power dissipation and a renewed focus on air cooling that was sufficient, even as chip densities increased throughout the 90's and early 2000's. In the mid 2000's, air cooling began running against limits again, both from the perspective of cooling high flux components as well as the impact that preheat was having on the cooling of other components in server enclosures. Multicore technology enabled somewhat of a reset by holding a status-quo on X86 processor cooling requirements and allowing designers to focus on pushing the efficiency of system layouts to manage the rest of the heat load in a server. Performance gains were possible without increasing chip power, but multicore has finally run its course. The industry is back to increasing chip power dissipation to gain performance and pushed liquid cooling back into the mainstream server discussion.





Direct Contact Liquid Cooling at Dell EMC

Dell EMC has partnered with CoolIT Systems to develop a Direct Contact Liquid Cooling (DCLC) solution that is both economical for customers as well as easy to implement. DCLC uses cold plates inside the server to transfer the heat from targeted components directly into a coolant loop. This heat load can be removed from the data center bypassing air handling and chiller systems, providing both cooling efficiency at the server as well as cost efficiency at the facility. The Dell EMC – CoolIT Systems partnership provides the Dell PowerEdge C6420 with factory integrated and warranty supported liquid cooled server nodes with CoolIT's worldwide footprint providing datacenter infrastructure installation and services.

Liquid Cooling Solutions Help Drive Better ROI and TCO in the Data Center

Liquid cooled systems can pay for themselves in a surprisingly short period of time. The coolant distribution unit (CDU) itself removes about twice the heat per dollar as a CRAH unit. The use of warm cooling tower water instead of chilled water allows cost avoidance opportunities for chiller and pumping infrastructure. Pairing that with the energy savings enabled by liquid cooling yields a payback typically within a year.

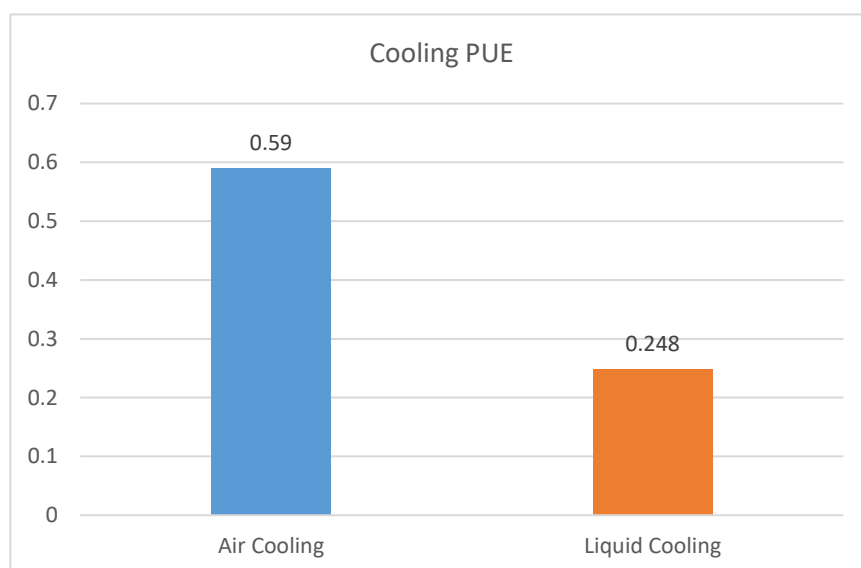


Figure 1: Analysis based on comparing 960 Air-and-Liquid cooled C6420 sleds, each with 2 x 205W CPUs, 12 DIMMs, 6 drives, 1 EDR/node. Data center infrastructure costs based on Reed Business Information data. Power cost assumed at 10c/KW-hr

Conclusion

Dell EMC continues to be at the forefront of offering emerging technologies in the mainstream server market. The PowerEdge C6420 with CoolIT DCLC technology is presented as a regular offering with Dell warranty support and not as a highly customized solution with a complex ordering process. This straightforward solution is designed specifically around what customers are asking for to meet their performance, density, and data center efficiency goals.