Dell Technologies Direct Liquid Cooling Support for New PowerEdge Servers

Tech Note by

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Summary

Liquid cooling is a very effective method of capturing heat commonly produced by semi-conductors, such as processors and memory, and transferring it to an isolated region to dissipate.

For the release of the new Intel and AMD-based PowerEdge servers, Dell Technologies is offering a direct liquid cooling solution to ensure that customer cooling needs are met.

This DfD will educate readers on how the Dell Technologies direct liquid cooling solution works, which PowerEdge servers support them, and why this solution is advantageous for data centers.

Introduction

New 15G PowerEdge platforms will offer CPUs with higher power than ever before. Dell is introducing new Direct Liquid Cooling (DLC) solutions to effectively manage these growing thermal challenges. Dell DLC solutions cool the CPU with warm liquid which has much greater (~4x) heat capacity versus air. Thus, DLC is a higher performance cooling solution for managing the CPU temperature while also enabling higher performance and better reliability. Because DLC solutions are more efficient at extracting heat, this reduces the burden on server system fans as well as the data center's cooling infrastructure, improving sustainability and saving customers money.

New PowerEdge Server Support

Dell is expanding our portfolio of platforms with factory-installed DLC solution, from dense compute C-series to our 1U and 2U rack-mount servers. The PowerEdge servers below offer DLC cooling on the newest Intel and AMD processors:

- C6520
- C6525
- R6525
- R7525
- R650
- R750
- R750XA

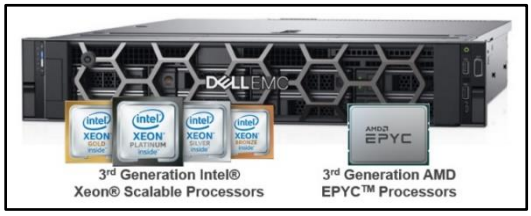

Figure 1 - Multiple PowerEdge servers with new Intel and AMD processors will support the Dell Technologies DLC

Direct Liquid Cooling Technology

DLC uses the exceptional thermal capacity of liquid to absorb and remove heat created by new high-power processors. Cold plates are attached directly to the processors (see Figure 2), and then coolant captures and removes the heat from the system to a heat exchanger located in the rack or row. This heat load is removed from the datacenter via a warm water loop, potentially bypassing the expensive chiller system. By replacing (or supplementing) conventional air-cooling with higher-efficient liquid cooling, the overall operational efficiency of the data center is improved.

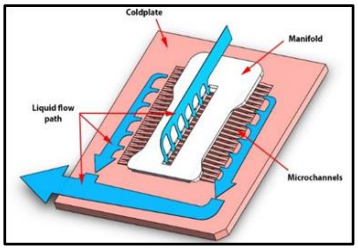

Figure 2 - DLC example of a cold plate and coolant loop

New Features and Solutions

Leaking Sensing Technology

Leak Sense technology is a new feature now included with all Dell DLC solutions, providing customers with the knowledge that potential issues will be found and reported quickly. If a coolant leak occurs, the system's leak sensor will log an alert in the iDRAC system. Three errors can be reported: small leak (warning), large leak (critical), leak sensor error (warning – indicates the issue with the leak detection board). These error detections can be configured to take meaningful actions, such as raise an alert or power-off a server.

POD Solution

Whereas a node-level DLC solution captures between 50%-60% of a server's internal heat (depending on the configuration), the Dell Technologies rack-level POD solution concept is designed for total heat capture. The POD solution contains front and back containment for racks of DLC servers, plus an InRow Cooler integrated between the IT racks to capture any remaining heat. Figure 3 illustrates a POD solution example.

Figure 3 - Pod solution containing two outer racks with node-level DLC and one middle InRow Cooler

Benefits of Liquid Cooling Implementation

1. ***Increased System Cooling Capacity*** – DLC enables system configurations that may not possible with air cooling alone, such as high TDP CPUs, dense storage and/or add-in cards.
2. ***Improved Energy Efficiency (PUE)*** – The DLC cold plate solution reduces energy costs by up to 45% relative to cooled air [1], and helps extend the life of existing air infrastructure
3. ***Higher Compute Density*** – For the Ice Lake based C6520 system, DLC cooling supports of up to 25% more cores per rack. For the Milan based C6525 system (with backplane configuration supporting storage drives), DLC cooling enables 2x the core count over air-cooling alone.
4. ***3.1x ROI Within 4 Years*** – The cost of pairing DLC with existing PowerEdge cooling tower infrastructure typically breaks even within 1.3 years and yields a 3.1x payback within 4 years [2]
5. ***Swift Serviceability*** – The CPU DLC cold plate solution attaches with four screws, making service quick and simple.

Conclusion

The Dell Technologies DLC solution enables PowerEdge server components to take on dense workloads while staying within their required thermal limits. Customers can maximize the utilization of their datacenters with confidence knowing they have the best efficiency, ROI and flexibility that a thermal design has to offer.

1. Based on Dell EMC internal analysis, March 2021, comparing hypothetical air-cooled data center with a cooling PUE of 0.62 to a hybrid data center with a cooling PUE of 0.34. A PUE of 0.21 was assigned to all overhead not attributed to cooling. Operating costs and other factors will cause results to vary. RS Means industry standards cost basis was used to measure typical cooling infrastructure costs and determine projected savings.

2. Based on Dell EMC internal analysis, March 2021 comparing a hypothetical air-cooled data center to a hybrid data center. Assuming 1244 nodes, the air cooled data center uses 1825 kW whereas the hybrid uses 1544 kW. Individual operating costs and other factors will vary the results. RS Means industry standards cost basis was used to measure typical cooling infrastructure costs and determine projected savings. Based on Dell EMC internal analysis, calculating the capital cost of DLC minus the amount of CRAH, pumps, chiller, and tower to equal the net cost of DLC, and examining the operational costs of a hypothetical air-cooled data center and a hybrid data center to determine ROI. Assumes a high wattage CPU. Schneider Electric developed an analytical model that ascribes operating costs to the various types of facility infrastructure equipment. Electricity costs and other factors will vary the results. RS Means industry standards cost basis was used to estimate cooling infrastructure costs and determine projected savings.

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