MS Thesis Defense Announcement
Mechanical and Aerospace Engineering Department
University of Texas at Arlington

Experimental analysis for optimization of thermal performance of a server in single phase immersion cooling

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12:30 pm, Wednesday, May 1St, 2019

Wolf Hall, 413

Abstract

Liquid immersion cooling of servers in synthetic dielectric fluids is an emerging technology which offers significant cooling energy saving and increased power densities for data centers. A noteworthy advantage of using immersion is cooling is high heat dissipation capacity which is roughly 1200 times greater than air. Other advantages of dielectric fluid immersion cooling include high rack density, better server performance, even temperature profile, reduction in noise. The enhanced thermal properties of oil lead to the considerable saving of both upfront and operating cost over traditional methods. In this study, a server is completely submerged in a synthetic dielectric fluid. Experiments were conducted to observe the effects of varying the volumetric flow rate and oil inlet temperature on thermal performance and power consumption of the server. Various parameters like total server power consumption, temperature of all heat generating components like Central Processing Unit (CPU), Dual in line memory module (DIMM), input/output hub (IOH) chip, Platform Controller Hub (PCH), Network Interface Controller (NIC) will be measured at steady state. Since this is an air-cooled server, the results obtained from the experiments will propose better heat removal strategies like heat sink optimization, better ducting and server architecture. Assessment will also be made on the effect of thermal shadowing caused by the two CPUs on the nearby components like DIMMs and PCH.