MS Thesis Defense Announcement
Mechanical and Aerospace Engineering Department
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COMPUTATIONAL ANALYSIS FOR THERMAL OPTIMIZATION OF A SERVER FOR SINGLE PHASE OIL IMMERSION COOLING

By

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9:00am, Monday, April 29th, 2019

Woolf Hall, 413

Abstract

Complete immersion of servers in synthetic dielectric fluids is rapidly becoming a popular technique to minimize the energy consumed by data centers for cooling purposes. In general, immersion cooling offers noteworthy advantages over conventional air-cooling methods as synthetic dielectric fluids have high heat dissipation capacities which are roughly about 1200 times greater than air. Other advantages of dielectric fluid immersion cooling include even temperature profile on chips, reduction in noise and addressing reliability and operational enhancements like whisker formation and electrochemical migration. Nevertheless, lack of data published and availability of long-term reliability data on immersion cooling is insufficient which makes most of data centers operators reluctant to implement this technique. The first part of this paper will compare thermal performance of single-phase oil immersion cooled HP ProLiant DL160 G6 server against air cooled server using computational fluid dynamics on 6SigmaET®. Focus of the study are major components of the server like Central Processing Unit (CPU), Dual in Line Memory Module (DIMM), Input/output Hub (IOH) chip, Memory controller Hub (ICH) and Network Interface Controller. The second part of this paper focuses on thermal performance optimization of oil immersion cooled servers by varying inlet oil temperature, flow rate, direction of flow and by modifying heat sin