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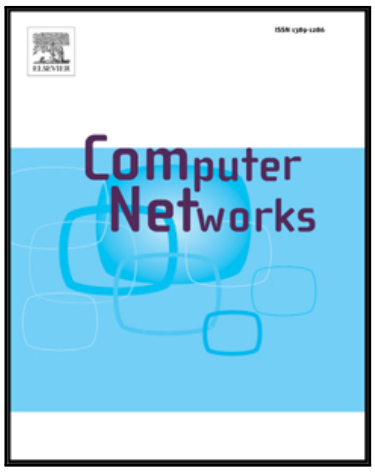

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ACCEPTED MANUSCRIPT

Dynamic Allocation of Power Delivery Paths in Consolidated Data Centers based on Adaptive UPS Switching

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Abstract

Although technique known as server consolidation approach in a data center can reduce the overall power consumption, the Power Usage Effectiveness (PUE) of the data center will still be negatively affected with presence of distributed Uninterruptible Power Supplies (UPSs). The impact on the PUE arises from the fact that all UPS modules are kept running to maintain power availability for only a few active servers during off-peak periods. To address this problem, in this paper technique for reducing power consumption in a data center by consolidating the UPSs used during off peak periods is proposed. The proposed technique achieves power savings by leveraging a micro Automatic Transfer Switch (micro-ATS) at the server end. The novelty of this work lies in developed adaptive algorithm that continuously looks for opportunities to reduce the number of UPSs by offloading under-loaded UPSs to a neighboring UPS whenever that neighboring UPS can handle the extra load. In various simulated scenarios involving corporate data centers, our approach demonstrates the ability to save more power and achieve lower PUE degradation compared with state-of-the-art approaches such as server consolidation. Specifically, the proposed approach achieves a savings of approximately 20% to 40% in a data center's power consumption, depending on the data center's off-peak periods, which can be accomplished using only 80% of the UPS modules in the data center.

Keywords: Data center, Energy efficiency, Power management, UPS

1. Introduction

Approximately 10% of world's power consumption is due to Information and Communication Technology (ICT), and according to Koomey's report [1], approximately 14% of that power is

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