

A SYNERGY OF WIRELESS SENSOR NETWORKS AND DATA CENTER SYSTEMS

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ABSTRACT

In recent years, data centers have emerged to be an increasingly important computing infrastructure. It is shown that wireless sensor networks (sensornets) can provide fine-grained measurements in data centers, and achieve better control and energy efficiency. However, the usage has so far been limited to an auxiliary network for intelligent sensory data collection in the data center. We argue that the combined computational and networking capability of a sensor network enables it to interact with the clusters in a much more sophisticated way and to perform more active control functions. We have designed a Cluster-Area Sensor Network (CASN) to improve the cluster management and network performance of a data center system. Implemented on Telos B motes and 10Gbps Ethernet (10GbE), CASN can be easily deployed in a cluster, with sensor nodes attached in an ad hoc manner to servers, and provides key system functions including cluster-wide wireless command distribution, supplementary security verification, and wireless network signaling. Experiments on 4–27 mote-server pairs show that the inexpensive and low-bandwidth sensornet can enhance the functionality and performance of the compute cluster: CASN quickly distributes control commands to servers, strengthens the system with additional verification of servers' physical presence, and improves the bandwidth utilization of 10GbE links by 13-90% in various benchmarks and the average throughput of TCP flows by 31-69% in Hadoop trace experiments on a 10GbE testbed.