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**Model-based Thermal Anomaly Detection in Cloud Datacenters using Thermal Imaging**

**Abstract:**

The growing importance, large scale, and high server density of high-performance computing datacenters make them prone to attacks, misconfigurations, and failures (of the cooling as well as of the computing infrastructure). Such unexpected events often lead to *thermal anomalies* – hotspots, fugues, and coldspots – which impact the cost of operation of datacenters. A modelbased thermal anomaly detection mechanism, which compares *expected* (obtained using heat-generation and -extraction models) and *observed* thermal maps (obtained using thermal cameras) of datacenters, is proposed. In addition, a novel Thermal Anomaly-aware Resource Allocation (TARA) is designed to induce a time-varying thermal fingerprint (thermal map) of the datacenter so to maximize the detection accuracy of the anomalies. As shown via experiments on a small-scale testbed as well as via trace-driven simulations, such model-based thermal anomaly detection solution in conjunction with TARA significantly improves the detection probability compared to anomaly detection when scheduling algorithms such as random, round robin, and best-fit-decreasing are employed.