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EDOM: Improving energy efficiency of database operations on multicore servers

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*Highlights (for review)

EDOM: Improving Energy Efficiency of Database Operations on Multicore Servers

In this paper, we propose a toolkit called *EDOM* facilitating the evaluation and optimization of energy-efficient multicore-based database systems. Two core components in *EDOM* are a benchmarking toolkit and a multicore manager to improve energy efficiency of database systems running on multicore servers. We start this study by analyzing the energy efficiency of two popular database operations (i.e., cross join and outer join) processed on multicore processors. We investigate cross and outer joins, because these two operations are common components of database applications. We describe the criteria and challenges of building an energy efficiency benchmark for databases on multicore servers. We build a benchmarking toolkit, which is comprised of three parts, namely, a configuration module, a test driver, and a power monitor. The workload generator facilitates the configurations of the PostgreSQL database system. We leverage this generator to set up tables and populate data records into the database. The test driver automatically issues operations to the database system in accordance to access patterns created by the workload generator. The power monitor keeps track of energy efficiency and performance of the multicore database system processing the operations driven by the test driver. We develop a multicore manager to optimize the number of cores, thereby making the best tradeoff between performance and energy efficiency in multicore database servers. At the heart of the multicore manager is a memory usage model that estimates memory utilization from queries and database characteristics (e.g., table and record size). An appropriate number of cores is determined using the estimated memory usage to avert unnecessary memory swapping, which induces high energy consumption overhead. We make use of the proposed benchmark toolkit to quantitatively evaluate the performance