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UT3 Paul Sabatier, IRIT, Auditorium J. Herbrand

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Energy-efficient Resource Provisioning for Cloud Databases

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Abstract: Today a lot of cloud computing and cloud database techniques are adopted both in industry and academia to face the arrival of the big data era. Meanwhile, energy efficiency and energy saving become a major concern in data centers, which are in charge of large distributed systems and cloud databases.

However, energy efficiency and service-level agreement of cloud databases are suffering from resource provisioning, resource over-provisioning and resource under-provisioning, namely that there is a gap between resource provided and resource required. Since the usage of cloud database is dynamical, resource of the system should be provided according to its workload.

In this thesis, we present our work on energy-efficient resource provisioning for cloud databases that utilizes dynamic voltage and frequency scaling (DVFS) technique to cope with resource provisioning issues. Additionally, a migration approach is introduced to improve the energy efficiency of cloud database systems further. Our contribution can be summarized as follows:

At first, the behavior of energy efficiency of the cloud database system under DVFS technique is analyzed. Based on the benchmark result, two frequency selection approaches are proposed.

Then, a frequency selection approach with bounded problem is introduced, in which the power consumption and migration cost are treated separately. A linear programming algorithm and a multi-phases algorithm are proposed. Because of the huge solution space, both algorithms are compared within a small case, while the multi-phases algorithm is evaluated with larger cases.

Further, a frequency selection approach with optimization problem is introduced, in which the energy consumption for executing the workload and migration cost are handled together. Two algorithms, a genetic based algorithm and a monte carlo tree search based algorithm are proposed. Both algorithms have their pros and cons.

At last, a migration approach is introduced to migrate data according to the given frequencies and current data layout. A migration plan can be obtained within polynomial time by the proposed Constrained MHTM algorithm.