

**Energy Efficient Scheduling of Servers with Multi-Sleep Modes for Cloud Data Center**

**Abstract:**

In a cloud data center, servers are always over-provisioned in an active state to meet the peak demand of requests, wasting a large amount of energy as a result. One of the options to reduce the power consumption of data centers is to reduce the number of idle servers, or to switch idle servers into a low-power sleep states. However, the servers cannot process the requests immediately when transiting to the active state. There are delays and extra power consumption during transition. In this paper, we consider using state-of-the-art servers with multi-sleep modes. The sleep modes with smaller transition delays usually consume more power when sleeping. Given the arrival of incoming requests, our goal is to minimize the energy consumption of cloud data center by scheduling of servers with multi-sleep modes. We formulate this problem as an integer linear programming (ILP) problem during the whole period of time with millions of decision variables. To solve this problem, we divide it into sub-problems with smaller period while ensuring the feasibility and transition continuity for each sub-problems through Backtrack-and-Update technique. Experiments show that our method can significantly reduce the power consumption for cloud data center.