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(57) Abstract :

Abstract Data centres are essential for running many important services, such as search engines and online retailers, which are often latency-critical, meaning that they require low response times to satisfy user demands. These types of services also tend to vary over time, constructing it problematic to optimize power consumption in data centres. Also, it might be difficult to cut power usage while still fulfilling the 3 targets due to the complexity of data centre equipment and the necessity of maintaining strict tail latency standards. To address these concerns, the authors present Twig, a scalable quality-of-service (QoS) aware task manager designed to maximize energy efficiency in data centres while maintaining high QoS guarantees for latency-critical services. Twig uses deep reinforcement learning to analyze hardware performance counters and make intelligent task management decisions that minimize energy usage without sacrificing QoS. We undertook trials on a standard data centre server handling four popular latency-critical services to determine how well Twig performs in practice. Twig demonstrated that 99% QoS for all of these services could be maintained while reducing energy consumption by up to 38%. This demonstrates the potential for Twig to significantly improve the efficiency of data centres, reducing the total cost of ownership and enabling these critical services to continue meeting the high demands of users.

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