پژوهشگاه دانش‌های بنیادی
پژوهشکده علوم کامپیوتر

سخنرانی علمی

Cache–Aware Task and Workflow Ensemble Scheduling in Edge–Based Infrastructures

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Abstract

To address the limitations of cloud computing in supporting latency-sensitive applications, edge computing has emerged as a promising solution. This paradigm places computational resources near end-user devices, at the edge of the network. It is particularly suited for latency and security-sensitive applications, which typically involve low processing demands but high interaction between end devices and servers. However, unlocking the full potential of edge-based infrastructures requires comprehensive and effective resource management policies. This area presents several significant challenges. To overcome these, we propose a cache-aware task and workflow ensemble scheduling solution tailored for edge environments. The proposed method utilizes a workflow ensemble model to account for task dependencies and determine execution order within applications. To improve resource management efficiency, it incorporates cache-awareness into the scheduling algorithm, reducing data transfer costs, improving data availability, decreasing service latency, and enhancing overall system performance. Specifically, we aim to proactively cache frequently accessed data on edge servers before scheduling workflow ensembles. A scheduling strategy is then applied to optimally assign tasks to resources, minimizing the total workflow execution time within each ensemble. Simulation results confirm that the proposed method outperforms existing approaches in terms of execution time and efficiency.

Keywords: Resource management, Task scheduling, Workflow ensemble, Cloud computing, Edge computing

Biography

Farzaneh Rastegar recently received her Ph.D. in Software Engineering from Sharif University of Technology, Tehran, Iran.

Her research interests include distributed systems, cloud computing, edge computing, internet of things and optimization.

زمان: چهارشنبه ۱۴۰۵/۰۸/۲۰ – ساعت ۱۳:۰۰
ارائه به صورت مجازی انجام خواهد شد.

https://vmeeting2.ipm.ir/b/com-qcl-udn-x4b

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