Multi-Criteria Dynamic Service Migration for Ultra-Large-Scale Edge Computing Networks

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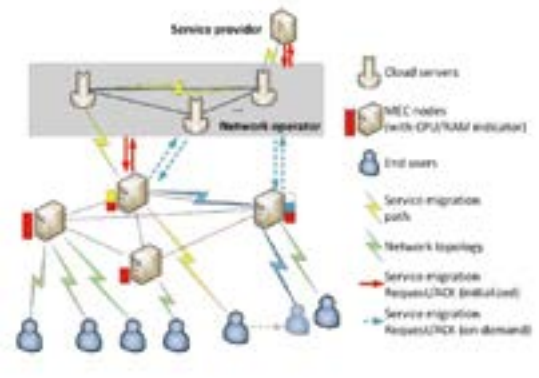
Multi-access edge computing service migration is a technology whose key objective is to support ultra-low-latency access to services. However, the complex ultra-large-scale edge service migration problem requires extensive research efforts, regarding the foreseen ultra-densified edge nodes in 5G and beyond. In this paper, we propose a novel dynamic service migration optimization architecture for ultra-large-scale multi-access edge computing networks. We develop a new multi-criteria decision-making algorithm: Technique for Order of Preference by Similarity to Ideal Solution with Attribute-based Niche count, named TOPANSIS, which showcases its strength to provide an optimal solution for service migration in large-scale deployments towards optimal data rate, latency, and load balancing. We further decentralize the operation of TOPANSIS to release the traffic burden from central datacenters by leveraging local decision making by edge nodes, while relying on central cloud coordination to account for the overall network information. Simulation results showcase that the proposed architecture outperforms the selected benchmarks with an average improvement of 39.41% for latency, 2.92% for data rate, as well as 10.53% and 6.26% for RAM and CPU load balancing, respectively. Moreover, the feasibility of the proposed solution is validated by means of a proof-of-concept implementation and experimental assessments.



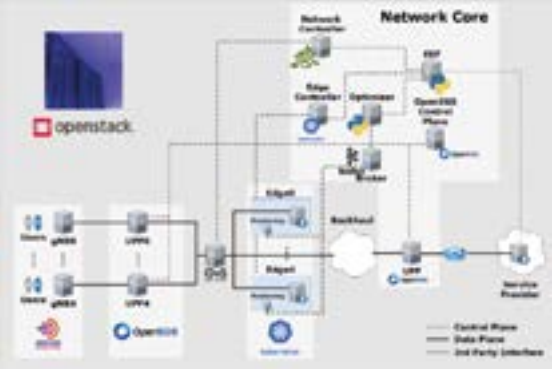


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FIGURE 1
The proposed service migration optimization architecture.

FIGURE 2
Scenario Evaluation Setup.