NED UNIVERSITY JOURNAL OF RESEARCH

TOWARDS AN ADAPTIVE EDGE COMPUTING FRAMEWORK FOR COMPUTATION OFFLOADING: ABC-MDP APPROACH

Author(s): Agus Mulyana[1], Taufik Djatna[2], Sri Wahjuni[3], Heru Sucoko[4]

Volume: **XXII**
No: **Special Issue on INCITEST'25**
Pages: **403-411**
Date: **December 2025**

DOI: https://doi.org/10.35453/NEDJR-INCITEST007-2025

Abstract:
This paper introduces a novel adaptive computation offloading framework based on swarm intelligence by combining Artificial Bee Colony (ABC) integrated with Markov Decision Process (MDP), designed to optimize offloading in dynamic computing environments. The proposed framework calculates the availability of computing resources, power source, distance between nodes, RSSI-based signal quality, network bandwidth, and computation offloading risk level. Based on the reward value obtained from each iteration, the decision will be made on whether to process the task locally or offload it to the edge server. By combining the exploration capability of the ABC algorithm and the adaptive decision-making power of MDP, this framework effectively minimizes latency and energy consumption while maintaining high-quality service levels. The integration of MDP allows the system to adapt to changing network conditions and resource constraints to ensure optimal task allocation. Simulation results show significant improvements in performance metrics compared to traditional offloading strategies. The framework's ability to handle IoT devices and multi-objective optimization makes it a promising solution for edge computing systems in limited and dynamic environments.

Keywords: Computation Offloading Framework, Edge Computing, Internet of Things, and Quality of Service.

For full paper, contact:
Prof Muhammad Imran Aslam
Editor-in-Chief, NED University Journal of Research
Ph: +92 (21) 99261261-8 Ext:2670; Fax: +92 (21) 99261255
Email: NED-Journal@neduet.edu.pk
Website: http://www.neduet.edu.pk/NED-Journal

[1] Lecturer and Techonpreneur, Computer Engineering Department, Universitas Komputer Indonesia, Bandung, Indonesia, Ph. +6282116871007, Email: agus.mulyana@email.unikom.ac.id, mulyanaagus@apps.ipb.ac.id
[2] Professor and Lecturer, Agro-Industrial Tehnology Department, IPB University, Bogor, Indonesia, Ph. +6281319726435, Email: taufikdjatna@apps.ipb.ac.id
[3] Lecturer, School of Data Science, Mathematics and Informatics, IPB University, Bogor, Indonesia, Ph. +6285721495907, Email: my_juni04@apps.ipb.ac.id
[4] Lecturer, School of Data Science, Mathematics and Informatics, IPB University, Bogor, Indonesia, Ph. +6281219797981, Email: hsrkom@apps.ipb.ac.id