Public Abstract

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New paradigms such as Mobile Edge Computing (MEC) are becoming feasible for use in e.g., real-time decision-making during disaster incident response to handle the data deluge occurring in the network edge. However, MEC deployments today lack flexible IoT device data handling such as e.g., handling user preferences for real-time versus energy-efficient processing. Moreover, MEC can also benefit from a policy-based edge routing to handle sustained performance levels with efficient energy consumption.

In this paper, we study the potential of MEC to address application issues related to energy management on constrained IoT devices with limited power sources, while also providing low-latency processing of visual data being generated at high resolutions. Using a facial recognition application that is important in disaster incident response scenarios, we propose a novel `offload decision-making' algorithm that analyzes the tradeoffs in computing policies to offload visual data processing (i.e., to an edge cloud or a core cloud) at low-to-high workloads. This algorithm also analyzes the impact on energy consumption in the decision-making under different visual data consumption requirements (i.e., users with thick clients or thin clients). To address the processing-throughput versus energy-efficiency tradeoffs, we propose a `Sustainable Policy-based Intelligence-Driven Edge Routing' (SPIDER) algorithm that uses machine learning within Mobile Ad hoc Networks (MANETs). This algorithm improves the geographic routing baseline performance (i.e., minimizes impact of local minima) for performance sustainability, and enables easy/flexible policy specification. We evaluate our proposed algorithms by conducting experiments on a realistic edge and core cloud testbed, and recreate disaster scenes of tornado damages (occurred in Joplin, MO in 2011) within simulations. From our empirical results obtained
from experiments with a facial recognition application in the GENI Cloud testbed, we show how MEC can provide flexibility to users who desire energy conservation over low-latency or vice versa in the visual data processing. Our NS-3 based simulation results show that our routing approach is more sustainable in terms of throughput, more energy-efficient and flexible than existing solutions to handle diverse user preferences under high node mobility and severe node failure conditions.