ACHIEVING ENERGY EFFICIENCY AND SUSTAINABILITY IN EDGE/FOG DEPLOYMENT


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The Internet of Things (IoT) has emerged as one of the most advanced and complex technological trends, where more than 50 billion things will be connected (e.g., mobile devices, sensors, wearable devices, and other computing nodes) to the Internet by 2020. Edge/fog computing will play an increasingly important role in handling the information flow of such large and complex networks. An unintended consequence is the impact of their operations on carbon emissions and the resulting electricity costs. Thus, there has been focus on designing energy-efficient solutions for the edge-fog environment.

In this Feature Topic, state-of-the-art research advances in energy efficiency and sustainability for edge/fog deployment are presented. This issue received a total of 31 paper submissions, and after a rigorous review process, only 11 papers were accepted for publication; another seven papers were sent for Open Call publication. Next, we summarize these 11 accepted papers.

The first article, "Secure and Energy-Efficient Handover in Fog Networks Using Blockchain-Based DMM" by Sharma *et al.*, presents a blockchain-based distributed mobility management scheme for efficient handover of services in fog networks. The proposed scheme reportedly achieves both the energy efficiency and security required in a typical setup.

In the second article, "Knowledge-Centric Edge Computing Based on Virtualized D2D Communication Systems" by Wang *et al.*, a knowledge-centric edge-based framework is presented. This framework was designed to detect dynamic changes in the network to automatically manage the communication resources from the information discovered from device-to-device communication systems.

The third article, "Mobile Edge Computing and Networking for Green and Low-Latency Internet of Things" by Zhang *et al.*, presents a mobility-aware hierarchical computing resource framework for computation offloading of mobile devices, as well as an energy-efficient offloading scheme.

The fourth article, "Fog Computing: Architecture, Evaluation, and Future Research Directions" by Aazam *et al.*, discusses cloud-IoT integration challenges and provides a comparative summary between fog and cloud computing paradigms. The authors also provide an overview of fog computing architecture and its typical layers.

In the next article, "Mobility Support for Fog Computing: An SDN Approach" by Bi *et al.*, an SDN-based approach designed to support mobility in fog computing architecture is proposed. Specifically, the authors designed an efficient signaling operation to provide seamless and transparent mobility support to mobile users, and present their proposed route optimization algorithm.

The sixth article, "Secure and Sustainable Load Balancing of Edge Data Centers in Fog Computing" by Puthal *et al.*, presents a novel secure and sustainable load balancing solution for edge data centers. In their approach, the edges are authenticated prior to load balancing.

The seventh article, "Flight Security and Safety of Drones in Airborne Fog Computing Systems" by He *et al.*, discusses security and safety vulnerabilities of drones in airborne fog computing systems, with an emphasis on GPS spoofing attacks.

The eighth paper, "A Study of Green Development Mode and Total Factor Productivity of Food Industry based on Industrial Internet of Things" by Zhang *et al.*, examine the mode

of the food industry's green development in China based on Industrial IoT.

The ninth article, "Semantic Multimedia Fog Computing and IoT Environment: Sustainability Perspective" by Rahman *et al.*, proposes a smart city solution consisting of fog nodes in order to solve always-available sustainability through incentives, and energy-aware cloud computing challenges in a smart city.

The 10th article, "Energy-Optimal Edge Content Cache and Dissemination: Designs for Practical Network Deployment" by Lien *et al.*, proposes an efficient edge content cache and data dissemination technique to reduce energy consumption.

The 11th article, "On Enabling Sustainable Edge Computing with Renewable Energy Resources" by Li *et al.*, proposes an energy management framework that integrates edge computing and microgrid to increase the effectiveness and use of energy resources, while still satisfying the requirements of IoT applications.

The last article, "Saving Energy on the Edge: In-Memory Caching for Multi-Tier Heterogeneous Network" by Xu *et al.*, focuses on the improvement in energy efficiency for edge caching by using in-memory storage and processing. For this purpose, the authors propose two time-to-live designs for data caching at the routers.

The Guest Editors would like to thank the Editor-in-Chief (Dr. Tarek S. El-Bawab) for approving this Feature Topic, and all the authors for submitting their findings for consideration. We are also extremely grateful to the reviewers who devoted their time and effort to conduct thorough reviews and provide timely responses. We hope that the articles published in this Feature Topic will benefit the research community working in this domain.

BIOGRAPHIES

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