MULTI-ACCESS MOBILE EDGE COMPUTING FOR HETEROGENEOUS IOT


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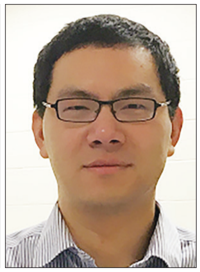
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The convergence of mobile Internet and wireless systems has witnessed an explosive growth in resource-hungry and computation-intensive services and applications, which cover a wide range of so-called heterogeneous Internet of Things (H-IoTs) systems including real-time video/audio surveillance, remote e-health systems, intelligent transportation systems, Internet of Vehicles, etc. Mobile edge computing, by placing various cloud resources (e.g., computational and storage resources) closer to smart devices/objects, has been envisioned as an enabling and highly promising technology to realize and reap the promising benefits of H-IoTs applications. However, the growing demands for ultra-low latency, massive connectivity, and high reliability of the large number of H-IoTs applications has yielded a critical issue in mobile edge computing, i.e., the limited connections (such as connection capacity, bandwidth, or the number of simultaneously affordable connections) between mobile edge cloud and smart devices/objects. Multi-access mobile edge computing (MA-MEC), which actively exploits a systematic and adaptive integration of recent radio access technologies including 5G, LTE, and WiFi to enhance the access capacity of smart devices to mobile edge platforms, has been considered as a promising technology to tackle this issue. The evolution toward the architecture of ultra-dense small-cells (micro/pico/femto cells and Wi-Fi hotspots) in future radio access networks facilitates the MA-MEC, i.e., the densely deployed small cells can significantly improve the capacity and quality of the connections between smart devices and mobile edge cloud. For instance, the emerging small-cell dual-connectivity in small-cell networks enables smart mobile devices to communicate with conventional macro-cells and offload data traffic to small cells simultaneously, which thus enhances the access capacity of mobile edge cloud at small cells. Therefore, with the strength of multi-access for capacity-enhancement, the MA-MEC is expected to bring a variety of benefits, such as:

- Ultra-low latency between smart devices and edge cloud for real-time, interactive, and mission-critical applications, e.g., real-time indoor navigation and augmented virtual-reality.
- Privacy and security in local communications to access mobile edge cloud.
- Big data analytics at the point of capture for IoT applications.

Therefore, this special feature aims at soliciting high quality and unpublished work regarding recent advances in MA-MEC, with the main focus on addressing the fundamental design issues in MA-MEC, and the emerging paradigms and testbeds that use MA-MEC.

We received 59 submissions for this feature topic, of which eight have been accepted. Each paper went through a rigorous peer review process and was followed by another round of review after revision. A summary of the accepted papers is provided as follows.

The first article studies computation offloading for multi-access mobile edge computing in ultra-dense networks. The paradigm of multi-access mobile edge computing, which provides IoT mobile devices with cloud capabilities at the edge of radio access networks, has been proposed to address the conflict between computation-intensive applications and resource-constrained IoT mobile devices.

To address the heavy computational overhead in adopting homomorphic encryption to achieve data protection and aggregation at edge servers, the second article proposes a local differential privacy obfuscation framework for IoT data analytics to aggregate and distill IoT data at the edge without disclosing the user's sensitive data. The article discusses the architecture, advantages, technical challenges, and preliminary implementation of the proposed framework.

Taking into account the increasing mobile data demands in the current radio access networks and the emerging computation-heavy Internet of things applications with heterogeneous requirements, the third article proposes a novel air-ground integrated mobile edge network, where unmanned aerial vehicles are flexibly deployed and scheduled, and assist the communication, caching, and computing of the edge networks.

Blockchain, as a promising decentralized secrecy-based data management framework, has been widely adopted in many applications, e.g., finance, healthcare, and logistics. To facilitate blockchain applications in future mobile Internet of Things systems, the fourth article exploits multi-access mobile edge computing to solve the proof-of-work puzzles for mobile users. The article first introduces a novel concept of edge computing for mobile blockchain, and then proposes an economic approach for edge computing resource management.

In the fifth article, the authors propose an air-ground integrated mobile edge computing framework by exploiting the benefits of high mobility and flexible computing resource allocation of unmanned aerial vehicles. By smartly managing the aviation trajectory of unmanned aerial vehicles and seeking the air-ground channels, the proposed framework can support numerous Internet of Things usage cases such as content caching and mobile delivery, distributed big data processing and analysis, ultra-low latency support, and so on.

Given the large number of resource-rich vehicles on the road, it is a promising opportunity to execute computation offloading and data processing on smart vehicles. The sixth article proposes a vehicular edge multi-access networks framework, which treats vehicles as edge computation resources to construct the collaborative task offloading and distributed computing architecture.

Taking into account the potential security issue in exploiting mobile edge computing, the seventh article investigates the security issues of two representative Internet of Things applications supported by mobile edge computing. The first application is an environment perception system, for which the article has reviewed its security requirements and vulnerabilities, with some attack examples illustrated and the implementation results provided. The second application is mobile Internet of Things based on networked drones and unmanned aerial vehicles.

Exploiting the computing power of edge nodes provided by multi-access edge computing has become the mainstream of dealing with big data in heterogeneous Internet of Things. In the eighth article, taking into account hacker attacks in mobile edge computing, the authors investigate big data privacy preserving in multi-access edge computing for heterogeneous Internet of Things. Based on an overview of the architecture of mobile edge computing for heterogeneous Internet of Things, the article studies the privacy issues in mobile edge computing, especially in data aggregation and data mining, and adopts machine learning privacy preserving as a case study in the application of mobile edge computing.

We would like to thank all the authors who submitted their work to this special issue. We also would like to express our thanks to many experts in the field who participated in the review process on a very tight schedule.

Biographies

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