Mobile Edge Computing

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Editors

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Preface

Mobile edge computing (MEC) provides cloud computing services at the edge of mobile network, which facilitates developers, service providers as well as users. For low latency and high bandwidth services, edge computing–assisted IoT has become the pillar for the development of smart homes, smart health, smart traffic management, smart cities, etc. This book will discuss the overview of mobile edge computing along with its real time applications. The book is organized into three parts: Part I, Part II and Part III.

Part I contains seven chapters focusing on the architecture and working model of MEC. In chapter "Introduction to Mobile Edge Computing", an overview of MEC has been given, where the authors have discussed the architecture, applications and challenges of MEC. In chapter "Performance Analysis of Mobile, Edge and Cloud Computing Platforms for Distributed Applications", a comparative analysis of mobile, edge and cloud computing platforms has been provided for distributed applications. Chapter "Performance Analysis of Mobile, Edge and Cloud Computing Platforms for Distributed Applications" provides an experimental work on how to select the best mobile-aware computing environment based on parameters including application type, data size and network bandwidth quality. A comprehensive analysis has been provided that highlights the experiment results and provides recommendations for scheduling the execution of data-intensive applications on mobile-aware computation systems. In chapter "Geospatial Edge-Fog Computing: A Systematic Review, Taxonomy, and Future Directions", geospatial edge-fog computing has been discussed along with future research directions. Chapter "Study of Power Efficient 5G Mobile Edge Computing" has focused on the use of edge computing in the field of fifth generation mobile network. This chapter gives an all-encompassing outline of MEC, its energy-efficient innovation, potentials, needs and applications. Further, the authors have focused on energy-efficient resource allocation and task offloading. The future directions of 5G MEC have been also explored in chapter "Study of Power Efficient 5G Mobile Edge Computing". Sensor mobile edge computing, its architecture and its applications along with future research directions have been demonstrated in chapter "SMEC: Sensor Mobile Edge Computing". The integration of MEC with the Internet of Things (IoT) has

been discussed in chapter "IoT Integration with MEC". Chapter "Green-aware Mobile Edge Computing for IoT: Challenges, Solutions and Future Directions" has illustrated a green-aware framework for MEC to address the energy-related challenges and provides a generic model formulation for the green MEC. Few state-of-the-art workloads offloading approaches to achieve green IoT have also been discussed and compared in comprehensive perspectives. Few future research directions related to energy efficiency in MEC have been also explored in this chapter.

Part II contains eight chapters focusing on the systems, platforms, services and issues of MEC. In chapter "Prescriptive Maintenance Using Markov Decision Process and GPU-accelerated Edge Computing", the authors have discussed the GPU-accelerated edge computing for predictive maintenance. A prescriptive maintenance method has been presented in this chapter for a distributed factory environment using the partially observable Markov decision process (POMDP) framework. In chapter "Software-Defined Multi-domain Tactical Networks: Foundations and Future Directions", the authors have discussed the software-defined multi-domain tactical networks. In this chapter, the authors have explicitly analysed the challenges and reviewed the current research initiatives in SDN-enabled tactical networks. Mobility is a vital factor in MEC, which has been the focus of chapters "Mobility Driven Cloud-Fog-Edge Framework for Location-aware Services: A Comprehensive Review" and "Mobility-Based Resource Allocation and Provisioning in Fog and Edge Computing Paradigms: Review, Challenges, and Future Directions". Chapter "Mobility Driven Cloud-Fog-Edge Framework for Location-aware Services: A Comprehensive Review" has discussed the concerns and challenges associated with mobility-driven cloud-fog-edge-based framework to provide several location-aware services to the endusers efficiently. Chapter "Mobility-Based Resource Allocation and Provisioning in Fog and Edge Computing Paradigms: Review, Challenges, and Future Directions" has discussed the current state –of the art of the methods and technologies used to manage the resources to support mobility in fog and edge environments. Chapter "Mobility-Based Resource Allocation and Provisioning in Fog and Edge Computing Paradigms: Review, Challenges, and Future Directions" has also explored future research directions to efficiently deliver smart services in real-time environments. Service migration and security are also important issues in MEC. Optimal migration decisions are challenging because they depend on the cloud environment, or edge nodes belong to different orchestrators, and security issues in the migration process must also be resolved in order to prevent unreliable requests. In chapter "Cross Border Service Continuity with 5G Mobile Edge", different approaches have been discussed to address these challenges by identifying the security implications of migration methods based on the blockchain integration. Chapter "Security in Critical Communication for Mobile Edge Computing based IoE Applications" has discussed the different security protocols in communications for the architectures which can be designed for MEC based Internet of Everything (IoE) applications. In chapter "Blockchain for Mobile Edge Computing: Consensus Mechanisms and Scalability", existing consensus protocols and scalability techniques in both well-

established and next-generation blockchain architectures have been discussed, and from that the authors have evaluated the most suitable solutions for managing MEC services and discussed the benefits and drawbacks of the available alternatives. In chapter "Evaluation of Collaborative Intrusion Detection System Architectures in Mobile Edge Computing", the authors have outlined some of the characteristics relevant for evaluating collaborative intrusion detection systems (CIDS) deployment models and surveyed existing CIDS architectures in the context of MEC.

Part III contains seven chapters illustrating various applications of MEC. In chapter "Edge Computing based Conceptual Framework for Smart Health Care Applications Using Z-Wave and Homebased Wireless Sensor Network", the authors have studied the concepts of wireless biomedical image monitoring systems along with their features. The use of MEC in the field of agriculture has been discussed in chapter "Mobile Edge Computing Based Internet of Agricultural Things: A Systematic Review and Future Directions". In chapter "Deep learning in Computer Vision Through Mobile Edge Computing for IoT", the authors have described how deep convolutional neural network (CNN) through MEC can be a potential technique for IoT-based solutions. In chapter "Mobile Edge Computing for Content Distribution and Mobility Support in Smart Cities", the authors have discussed the aspects of distributed multi-tiered mobile edge computing (MEC) architectures, which offer data storage and processing capabilities closer to data sources and data consumers, taking into account how mobility impacts the management of such infrastructure. Chapter "Complex Event Processing in Sensor-Based Environments: Edge Computing Frameworks and Techniques" has focused on an edge computing framework that partitions the processing of sensor data at a mobile node placed at the edge and backend computations at a powerful server. The primary application of the framework is in the area of processing of complex events, each of which may correspond to the simultaneous occurrence of multiple raw events generated by sensors that are monitoring the phenomena of interest. Application of such complex event processing techniques spans smart buildings, smart machinery as well as smart healthcare systems. Chapter "Complex Event Processing in Sensor-Based Environments: Edge Computing Frameworks and Techniques" has focused on using the framework and techniques to a smartphone-based remote patient monitoring system and by using prototyping and measurement presents a rigorous performance analysis of the system. The application design and service provisioning for multi-access edge cloud has been discussed in chapter "Application Design and Service Provisioning for Multi-Access Edge Cloud (MEC)". Finally, in chapter "Simulating Fog Computing Applications Using iFogSim Toolkit" the simulation of fog computing applications has been demonstrated.

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