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Editorial

Mobile Edge Computing

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1. Introduction

The advent of mobile cloud computing has increased expectations for optimal and reliable services and support for mobile users. The large pool of cloud resources and services has enabled the emergence of many novel applications for smart environments. However, the state of the art of mobile cloud computing turns into a problem for communication-intensive applications, which need to meet the delay requirements. The problem becomes even more intense in smart cities or Internet of Things. Current cloud computing paradigm is unable to meet the requirements of low latency, location awareness, and mobility support.

Mobile edge computing (MEC) is emerging as a very promising computation architecture by pushing computation and storage closer to end users with both strategically deployed and opportunistic processing and storage resources. Such mechanism is essentially different from the traditional cloud computing. MEC aims to enable millions of connected mobile devices to execute the real-time applications directly at the network edge. The distinguishing features of MEC are its closeness to end users, mobility support, and dense geographical deployment of the MEC servers.

This special issue aims at presenting the current state-of-the-art research and future trends on various aspects of mobile edge computing techniques for cloud-based IoT applications and attempts to build highly adaptive smart environments that can automatically adapt behaviors to the amount of available resources. The main areas covered by this special issue or main topics cover methodologies, modeling, analysis, and newly introduced applications. Besides the latest research achievements, this special issue also deals with innovative commercial management systems, innovative commercial applications of MEC technology, and experience in applying recent research advances to real-world prob lems.

Papers selected for this special issue represent recent progress in the field, including works on communication technologies, cloud and fog computing, information security, mobile social networks, and machine learning. All of these papers not only provide novel ideas and state-of-the-art techniques in the field, but also stimulate future research in the sustainable environment.

2. Architecture and Resource Management

Recently, the edge computing paradigm has attracted interest from both industry and researchers, carrying the promise of a new communication era in which industry can meet the rising performance needs of future applications. The paper by K. Toczé and S. Nadjm-Tehrani, entitled "A Taxonomy for Management and Optimization of Multiple Resources in Edge Computing", presented terminology and architectures to characterize current works within the field of edge computing. This work reviews a wide range of recent articles and categorizes relevant aspects in terms of resource type, objective of resource management, resource location, and resource use. The authors tried to provide an overview, not from a cloud perspective or an IoT device perspective but with a focus on edge resource management. Taxonomy and analysis of this paper can be used to identify some gaps in the existing research.

The paper by J. Wei et al., entitled "AIMING: Resource Allocation with Latency Awareness for Federated-Cloud Applications", proposed a novel resource allocation approach from the perspective of application providers with different types of resources taken into consideration, aiming to minimize the latency constrained by monetary overhead in the context of federated-cloud. The network resources are deployed and selected according to k-means clustering. The total latency among data-centers is optimized under the constraint of budget based on binary quadratic programming. Experimental results show that the classification is more accurate and effective than graph theory.

Aiming at QoS and user satisfaction, the paper by G. Li et al., entitled "Method of Resource Estimation Based on QoS in Edge Computing", uses weighted Euclidean distance similarity to classify multiple QoS attribute resources and regression-Markov chain prediction method to analyse the change of the load state of the candidate resources. Penalty factor and Grey incidence matrix for improving accuracy of similarity matching were introduced. Effectiveness of the matching method was validated through simulation. The authors proved that regression-Markov chain prediction method can improve the prediction accuracy.

3. Performance Monitoring and Security

In mobile edge computing, edge nodes access resources and services via application servers such as LTE base station and wireless access point. The paper by Z. Wang et al., entitled "Detection Performance of Packet Arrival under Downclocking for Mobile Edge Computing", investigated a novel downclocking technique for low-power WiFi networks. This work theoretically studied the crucial impact of tolerance threshold, correlation threshold, and energy ratio threshold on the packet detection performance. Extensive Monte Carlo experiments show that the proposed theoretical model is with high accuracy. This study can help system developers set reasonable system parameters for WiFi downclocking.

With the development of Internet of Things (IoT), the amount of data transmission shows a trend of exponential increment. The paper by G. Li et al., entitled "Data Processing Delay Optimization in Mobile Edge Computing", proposed a three-layer network model, which combines cloud computing and edge computing. In edge computing layer, a computational scheme of mutual cooperation between the edge devices was presented to reduce the communication delay. In cloud computing layer, a balanced transmission method to solve the data transmission delay from edge devices to cloud servers was introduced. Experimental results show that the proposed architecture can effectively reduce data processing delay and perform better than both the single edge node and traditional cloud computing.

Because there are many attacks against the fog computing network, to effectively handle security threats in fog computing system, the paper by X. An et al., entitled "Sample Selected Extreme Learning Machine Based Intrusion Detection in Fog Computing and MEC", proposed a new lightweight intrusion detection system, called Sample Selected Extreme Learning Machine. In the proposed architecture, classifiers are deployed on fog nodes for intrusion detection. Training data sets are stored in the cloud server, so that fog nodes do not need to handle large amounts of data sets. In addition, sample selection process is performed in the training phase in order to improve the classifier algorithm so that it can become more lightweight. Experimental results verified that the proposed architecture performs well in intrusion detection in terms of accuracy and training time.

4. Tools and Applications

Water conservancy engineering presents the national fundamental industry and is vital in national economic development. The construction of water conservancy projects is generally large in scale, with high investment, wide geographical distribution, and decentralized management and in a long construction period and contains a large amount of information. The paper by Y. Fan et al., entitled "Cloud/Fog Computing System Architecture and Key Technologies for South-North Water Transfer Project Safety", proposed a new safety system architecture for water conservancy engineering based on cloud/fog computing. The proposed architecture considered project safety, water quality safety, and human safety. Using IoT devices, fog computing layer was constructed between cloud server and safety detection devices in water conservancy projects. Technologies such as real-time sensing, intelligent processing, and information interconnection were developed. The IoT big data in water conservancy engineering with dense geographical distribution were applied based on multilevel requirements and integrated into a resource integration platform for deployment.

The smart parking system is considered as an important part of the smart city, where many advanced technologies such as the Internet of Things have been ubiquitously deployed in various sectors. The paper by A. Shahzad et al., entitled "Centralized Connectivity for Multiwireless Edge Computing and Cellular Platform: A Smart Vehicle Parking System", aims to manage massive crowd of vehicles and provide better performance for parking searching, reservation, and management. This study comprised several parking points systematically spread over several locations and traceable over the available graphical map, and the overall information is easily accessible using smart devices. The proposed architecture is a novel solution for deploying automated smart vehicle parking system.

5. Conclusions

All of the above papers address either technical issues in communication technologies or information security or propose novel application models in the various cloud/fog and mobile computing fields. They also trigger further related research and technology improvements in application of mobile edge computing. Honorably, this special issue serves as a landmark source for education, information, and reference to professors, researchers, and graduate students interested in updating their knowledge of cloud, mobile edge computing, Internet of Things, and novel application models for future information services and systems.

This special issue of this journal covers different aspects of the problem, from both the theoretical and the practical side. After a large open call, an international editorial committee selected eight research papers. Each paper was reviewed by at least 3 reviewers.

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