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Editorial

Distributed Systems for Emerging Computing: Platform and Application

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Abstract: In recent years, the new computing paradigms such as serverless computing, edge computing and blockchain-based computing have attracted much attention in both academia and industrial communities. Distributed systems and applications play fundamental roles in connecting the underlying computers, network and devices for collaboration, as well as providing new services for users. However, due to the increasing complexity of the large-scale and dynamic heterogeneous resource, and the new requirements and features, these distributed systems and applications will face many challenges in terms of their efficiency, flexibility and algorithms. This editorial discusses the state-of-the-art advancements in distributed systems and applications for the emerging computing.

Keywords: distributed system; serverless computing; edge computing; blockchain

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1. Introduction

The emerging computing paradigms, including cloud/serverless computing [1], edge computing [2], and blockchain-based computing [3], have made great advances in the economy and society. Among them, distributed systems such as computing platforms play a fundamental role, connecting thousands of computers and the large-scale internet of things, and supporting collaboration among computers, devices, and human beings. Based on these platform services, a large amount of software applications have been developed and deployed to leverage the features and APIs of underlying computing, network, data, physical, and human resources.

These platforms and applications should be designed and implemented carefully to provide highly efficient, reliable, and secure services. The main challenges include optimizing the resource scheduling and placement to improve resource consumption, guaranteeing their interoperability and flexibility, improving the software efficiency and designing the key algorithms for the emerging computing paradigms.

This Special Issue focuses on the distributed systems and applications for emerging computing paradigms, such as edge computing, serverless computing and blockchain systems, with the aim of soliciting the latest technologies, solutions, and reviews on this topic.

2. Contributions

The first paper [4] presents the integer linear programming optimization model and the corresponding network function virtualization (VNF) placement algorithm to improve the resource scheduling in edge computing. The authors formulate the VNF placement problem with multi-objectives from multiple users to simultaneously minimize the energy consumption in the edge nodes, the overall latency and the total cost of the infrastructure. The VNF algorithm also leverages VNF sharing and reuses already placed VNF instances

to potentially reduce computational resource usage. The authors preform simulation-based experiments to validate the effectiveness of the proposed algorithm.

The second paper [5] introduces QuickFaaS, a multi-cloud interoperability tool for cloud-agnostic functions and FaaS deployment in Serverless computing. Due to the vendor lock-in problem, the authors define three cloud-agnostic models to describe different FaaS platforms and then develop a multi-cloud interoperability desktop tool for FaaS' portability. The proposed approach enables developers to reuse the serverless functions in different cloud providers without modifying any code. The authors evaluate their method by comparing the impact of the cloud-agnostic approach on the function's performance and the cloud-non-agnostic one, and shows the effectiveness of the presented cloud-agnostic approach.

The third paper [6] provides a latency analysis of the self-sovereign identity (SSI) applications on blockchain-based systems. For the popular latency-sensitive SSI applications, the authors present an evaluation architeture and analyze their performance on different underlying blockchain systems and deployment parameters. The authors develop the containerized Indy and Aries components from the official Hyperledger repositories deloyed in a private cloud and compare these with the Indy ledger running on the Google Cloud Platform. The experiments show that the performance of the local Indy ledger is better than the public cloud.

The fourth paper [7] reviews the recent progress in blockchain consensus algorithms. The authors describe the general principles of the blockchain consensus process and classify the consensus algorithms. To improve blockchain consensus algorithms, the authors review the progress of consensus algorithms, and compare the characteristics, scenarios, and possible shortcomings of different blockchain consensus algorithms. The development trend of blockchain consensus algorithms is also presented.

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