BLOCKCHAIN FOR INTERNET OF THINGS


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Internet of Things (IoT) is reshaping various sectors, such as manufacturing, logistics, transportation, healthcare, energy and utilities. IoT essentially consists of various smart objects distributed throughout the whole industrial system to collect massive ambient data, which can be used to identify performance bottlenecks, trouble-shoot faults and detect malicious behaviours consequently enforcing effective control to the physical world.

However, intrinsic features of IoT also bring a number of challenges such as decentralization, poor interoperability, privacy and security vulnerabilities. On the other hand, blockchain technology featured with immutability, non-repudiation and traceability brings the opportunities in addressing the challenges of IoT. The integration of blockchain with IoT can potentially overcome the deficiencies of IoT thereby resulting in the feasibility of IoT in industrial sectors and smart cities. Both industry practitioners and academic researchers aim at realizing general, scalable and deployable blockchain based IoT platforms in various application domains while facing challenges like scalable consensus algorithms and data analytics with privacy preservation. To fill the gap, this special section aims to gather state-of-art advances in blockchain for IoT.

This special issue brings advances in blockchain for IoT, emphasizing on exploring the potential of integration of blockchain with IoT. This issue consists of seven papers organized as follows.

The first paper is entitled "HCloud: A Trusted JointCloud Serverless Platform for IoT Systems with Blockchain" from Shanghai Jiao Tong University. This work proposes a trusted JointCloud platform for IoT systems using serverless computing model, allowing to implement multiple serverless functions on an IoT server and to schedule these functions on different clouds. HCloud collects the status of each cloud and dispatches serverless functions to the most suitable cloud based on the schedule policy. By leveraging the blockchain technology, the proposed HCloud is enhanced while overcoming the shortage of faking cloud status and wrongly dispatching the target functions.

The second paper is entitled "Anti-D Chain: A Lightweight DDoS Attack Detection Scheme based on Heterogeneous Ensemble Learning in Blockchain" from Shandong University of Science and Technology. This work proposes a distributed anti-D Chain detection framework in the blockchain scene based on hybrid ensemble learning. This detection framework is much more generalized, universal and complementary for accurately identifying the onslaught features of DDoS attack in P2P network.

The third paper is entitled "A Decentralized Prediction Market Platform based on Blockchain and Masternode Technologies" from Huizhou University. This work presents a decentralized prediction market platform to by leveraging blockchain and masternode technologies. The maternode technology is combined with blockchain to serve as a decentralized node, with each masternode deployed on an edge server in mobile edge network. The masternode network serves as a decentralized prediction market platform, which can well deal with the problems of high energy consumption, expensive fee, and low system capacity.

The fourth paper is entitled "A Secure Mutual Authentication Scheme of Blockchain-Based in WBANs" from Hunan University of Science and Technology. This work proposes an anonymous mutual authentication scheme based on blockchain technology for wireless body area networks. The scheme, consisting of two protocols with

respect to the monitoring application types of physiological data in WBANs, can achieve cross-region authentication of a sensor node. The security of this scheme is analyzed by using formal security analysis and informal security analysis, and computation and communication costs are compared with relevant schemes.

The fifth paper is entitled "A Privacy-Preserving Mechanism based on Local Differential Privacy in Edge Computing" from Yantai University. User data in edge computing is usually stored and processed in honest-but-curious authorized entities, which can cause user privacy leakage. To protect user privacy, this paper proposes a privacy-preserving mechanism based on local differential privacy. In the proposed mechanism, a Voronoi diagram is constructed to divide the road network space and to determine the Voronoi grid region by using the Delaunay method. A random disturbance mechanism satisfying the local differential privacy is further utilized to disturb the original location data in each Voronoi grid. The effectiveness of the proposed privacy-preserving mechanism is validated through comparison experiments.

The sixth paper is entitled "An Algorithm Based On Markov Chain to Improve Edge Cache Hit Ratio for Blockchain-enabled IoT" from Beijing University of Posts and Telecommunications. Aiming at improving quality of service and reducing bandwidth wasting, this work proposes a content selection algorithm for edge cache nodes to properly allocate edge cache resources. This algorithm adopts a Markov chain model, improving the utilization of cache space and reducing the content transmission delay. The hierarchical caching strategy is adopted, in which the secondary cache stores contents to expand hit ratio of cached contents and reduce waiting time of users. The work further considers node cooperation to expand the capacity of edge caching and support regional preference of cached contents.

The last paper is entitled "A Distributed Computing Framework Based on Lightweight Variance Reduction Method to Accelerate Machine Learning Training on Blockchain" from National University of Defense Technology. To deal with the challenges of slow coverage rate and high resource requirement for distributed machine learning, this work proposes a distributed computing framework based on variance reduction for L-BFGS optimization algorithm, which is lightweight and parallelized during model training. A distributed scheme based on blockchain is further presented to guarantee security when supporting large-scale applications.

To sum up, this special issue has collected top papers from the main institutions, projects and standardization bodies working on blockchain for IoT. These works present a bottom-up view by exploring the potential of integration of blockchain with IoT.

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Biographies

Shangguang Wang, received his PhD degree at Beijing University of Posts and Telecommunications in 2011. He is Professor and Vice-director at the State Key Laboratory of Networking and Switching Technology (BUPT). He has published more than 150 papers, and played a key role at many international conferences, such as general chair and PC chair. His research interests include service computing, cloud computing, and mobile edge computing. He is a senior member of the IEEE, and the Editor-in-Chief of the International Journal of Web Science.

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Wuhui Chen, received the bachelor's degree from Northeast University, Shenyang, China, in 2008, and the master's and Ph.D. degrees from the University of Aizu, Aizu-Wakamatsu, Japan, in 2011 and 2014, respectively. From 2014 to 2016, he was a Research Fellow with the Japan Society for the Promotion of Science, Japan. From 2016 to 2017, he was a Researcher with the University of Aizu. He is currently an Associate Professor with Sun Yat-sen University, Guangzhou, China. His current research interests include edge/cloud computing, service computing and blockchain.