Lecture by

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Harmonization of Competition and Cooperation in Consensus Algorithm: Toward a Solution to the Blockchain Scalability Problem

Since Bitcoin appeared in 2008, the word "blockchain" has been used in a variety of contexts. On the other hand, it is sometimes heard that blockchain is still not clearly defined, which may give the impression that it is a difficult technology. However, the essence of blockchain technology is not difficult to understand and does not require any knowledge of difficult mathematics or physics (except for the details of cryptography). In this talk, we show that the essence of blockchain technology does not lie in the database called blockchain, but in Internet-scale open participation of an unspecified number of nodes and consensus algorithms between them.

In blockchain systems, there is a serious problem in scalability, which is called the blockchain scalability problem. It is estimated that the transaction processing capacity of Bitcoin is only seven transactions per second at maximum. However, it is known that the credit card company VISA, whose cards are often used for payments in our daily lives, has a capacity of 56,000 transactions per second. This problem hinders innovative applications of blockchain technology, such as micropayment and blockchain for AI and IoT. By harmonizing consensus algorithms of existing distributed systems with Bitcoin's Nakamoto consensus or other variants, the blockchain scalability problem can be solved. The latest results of our theoretical consideration and experimental performance evaluation using a cross-referencing method will also be discussed.

About the author

Akihiro Fujihara received the Ph.D. degree in science from Yokohama City University, Japan, in 2006. He was a Post-doc Researcher at Kwansei Gakuin University for seven years since 2007. In 2014, he joined Fukui University of Technology as an Associate Professor. In 2017, he joined Chiba Institute of Technology, where he is currently teaching graduate and undergraduate courses in the area of information and communication systems engineering. He is a Full Professor with the Department of Information and Communication Systems Engineering, Chiba Institute of Technology. He has authored or co-authored over 50 publications of research articles on stochastic processes, human mobility and communication behavior patterns, IoT, and blockchain. He has also been giving a number of invited talks on them. His research interests include blockchain architecture to solve the blockchain scalability problem and the use of blockchain technology in combination with AI and IoT for smart city services. He is a member of the IEEE and IEICE. He was a recipient of the COMPSAC Best Paper Award of 2014 and the International Conference on Intelligent Networking and Collaborative Systems (INCoS) Best

Paper Awards of 2011 and 2018. He served on the editorial boards for the IEICE transactions on communications (EB).