From Theory to Application: Block-structured Integer Programming meets Blockchain

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Abstract

This talk will cover my recent research in the algorithmic foundation of distributed systems, and its application in the security analysis, with a focus on blockchain. Security and scalability are major concerns in the design of a distributed system, yielding a series of optimization problems in scheduling, routing, resource allocation, etc. These problems become even more challenging when we need to deal with the uncertainty arising from various real-world applications. Block-structured integer programming is a strong mathematical tool for modeling a broad class of such problems under uncertainty. Recently, we have made significant progress by establishing a polynomial time algorithm for a broad subclass of block-structured integer programming. I will briefly talk about the basic idea of this algorithm. Then I will show how to utilize the theoretical results to develop a scalable blockchain-based smart contract system, to analyze the security of a multiagent system under uncertainty, and to establish the security threshold of newly developed consensus protocols for blockchain, e.g., the Proof-of-Elapsed-Time scheme proposed by Intel. At the final part of the talk, I will mention important future research directions in algorithms and distributed systems, e.g., the theoretical foundation of blockchain systems.

Bio

Lin Chen is a research assistant professor at University of Houston. Before joining UH, he was a postdoc at Technical University of Berlin, Technical University of Munich and Hungarian Academy of Science. He obtained his Ph.D. at Zhejiang University. His research interests include algorithms and complexity, security and privacy of blockchain systems, distributed computing. His research has been published in journals such as SIAM Journal on Computing, ACM Transactions on Algorithms, Journal of Computer and System Sciences, and in conferences such as SODA, SPAA, AAAI, AAMAS. He is currently the PI of an NSF grant on approximation algorithms and applications.