Online Algorithmic Channel Design

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1 Introduction [1]

Cryptocurrencies such as Bitcoin or Ethereum have big scalability issues. Blockchains are highly inefficient when comparing its number of processed transactions per second to the one of non-blockchain technologies. Several proposals have been made. Micropayment-channels (payment networks) are the most promising solution to the scalability problems of blockchains. They are widely accepted as a good solution and their efficiency is undisputed. But there are downsides to it, micropayment-channels are capital-hungry. A central Payment-Service-Provider (PSP) will face the challenge to maximize profit and reduce the capital that is locked in the channels. Avarikioti et. al [1] studied this problem and modeled the micropayment-channels as a graph where an edge between two parties u and v (vertices) represents a channel.

They mainly focused on the offline version of the problem, where all future transactions are known beforehand. It was shown that maximizing the profit (earned by transaction fees) with given capital assignments on each edge (where capital is the capital that is locked in on both sides of a channel) is NP-hard even for a single channel. A polynomial time approximation scheme for the single channel case was a presented. Additionally, it was shown that a star graph is a 2-approximation with respect to the capital when executing all transactions.
They briefly studied the online version of the problem. It was shown that there is no deterministic competitive algorithm for adaptive adversaries for the online single channel case with limited capital that decides for each incoming transaction if it should be accepted or not. Furthermore, they presented a $\Theta(\log C_{\text{opt}})$-competitive algorithm with respect to the minimum locked capital assuming that the payment network is going to accept all future transactions.

2 Thesis Proposal

The work will be a continuation of the work mentioned in the introduction. The online single channel will be the first task. Later, a core goal will be to improve the competitive ratio of the previously proposed online algorithm or

prove a lower bound. Additionally, there is a extension goal which is looking at the more general problem with more variables.

References

[1] Georgia Avarikioti, Yuyi Wang, Roger Wattenhofer. Algorithmic channel design. In *29th International Symposium on Algorithms and Computation(ISAAC 2018)*, 2018.