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Evaluation of Ethereum End-to-end Transaction

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ABSTRACT

Ethereum is a conventional but evolving blockchain approach to support smart contract by enabling Turing-complete computations at miners. With smart contract as a back-end support, anyone can publish their Decentralized Applications (DApps), thus transfer the existing Internet services/applications onto the blockchain.The requirements of service quality for different services can be quite different, varying from bandwidth sensitive and end-to-end transaction latency sensitive. This paper experimentally evaluates the Ethereum end-to-end latency and the factors that affect latency on the Ethereum main-net.

INTRODUCTION

DApps (Decentralized Application) is a novel way to implement computer application in a decentralized manner based on the smart contract. The end-to-end transaction latency is one major factor affecting the response time of a DApp, understanding the latency and the factors that affect it is very important for the development of DApps. End-to-end transaction latency is the duration from the moment a transaction being sent out by the client to the time the transaction being recorded on the blockchain. End-to-end transaction latency is caused by the process that the transaction is sent by the client, broadcasted across the network, queued in Ethereum miners, and finally recorded in the blockchain. Generally speaking, two factors affect Ethereum end-to-end transaction latency, i.e. the transaction fee that the transaction sender needs to pay in Gas to the miners and the transaction volume that the miners need to process.

In our previous paper, we evaluated the end-to-end transaction latency in test-nets. Test-nets behave different from the main-net because of the different application scenarios, we do not need to consider Gas prices in test-nets.

Collected and analysed around 240,000 transaction data samples from Etherscan which is main-net. The data samples are analysed from different perspectives:

- The effects of Gas price on the average, median, maximum and variance of the end-to-end transaction acceptance latency.
- The relationship between Gas price and transaction amount, i.e. the popular Gas price chosen by the users.

The results show that the generally believed fact that a higher a Gas price will guarantee a shorter the transaction completion time is not held. At the same time, the experimental results show a lot of interesting phenomenon about the effect of Gas price on end-to-end transaction latency.

CONCLUSION

The experimental results show that the higher the Gas Price the sender is willing to pay does not guarantee a quicker transaction completion time. The transaction completion time does not decrease significantly when the users pay more Gas prices. The results also show that most users set the transaction Gas price to 1. However, this does not mean that higher Gas prices do not have benefits. The higher the Gas price, the shorter the maximum time for completing the transaction.

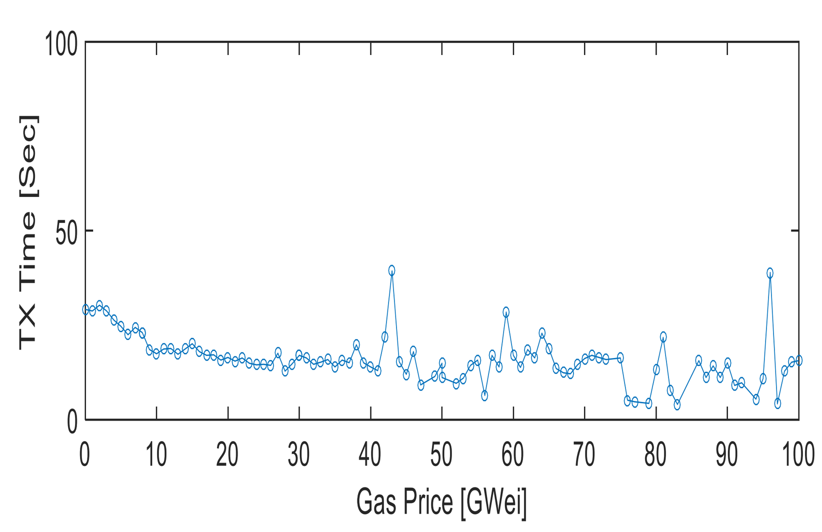

Fig.1 Gas price vs the average end-to-end transaction latency

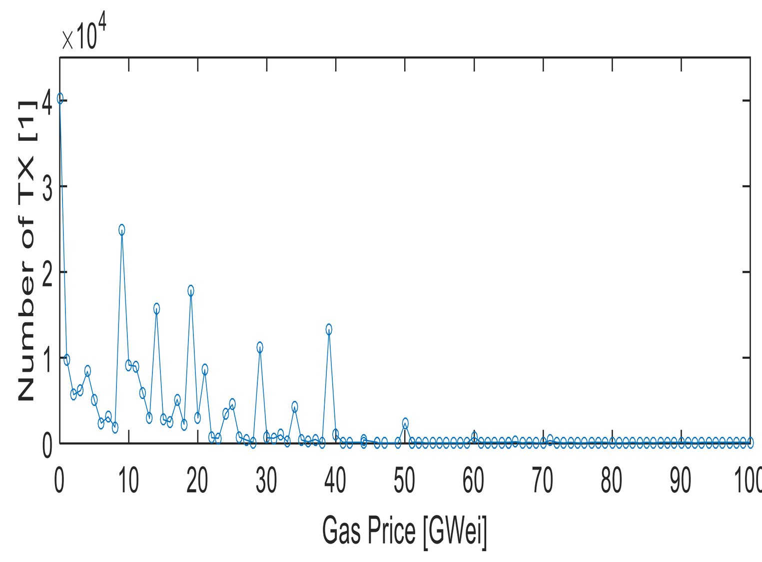

Fig.2 Gas price vs transaction amount

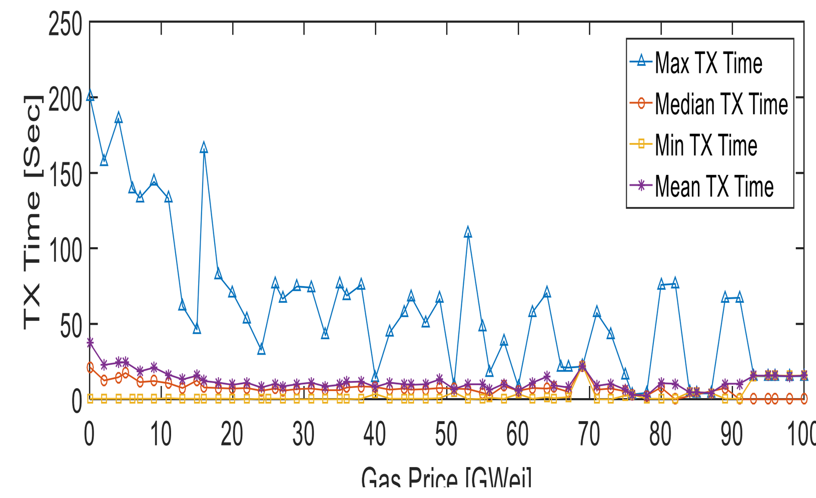

Fig.3 Gas price vs the maximum end-to-end transaction latency

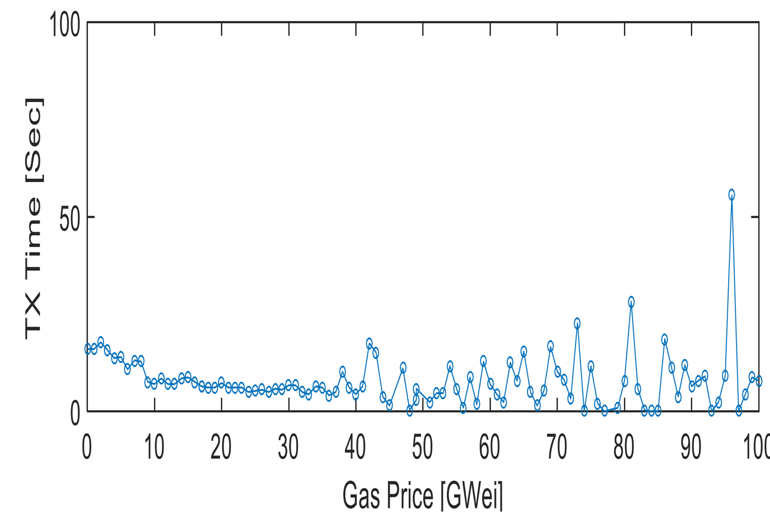

Fig.4 Gas price vs the median end-to-end transaction latency

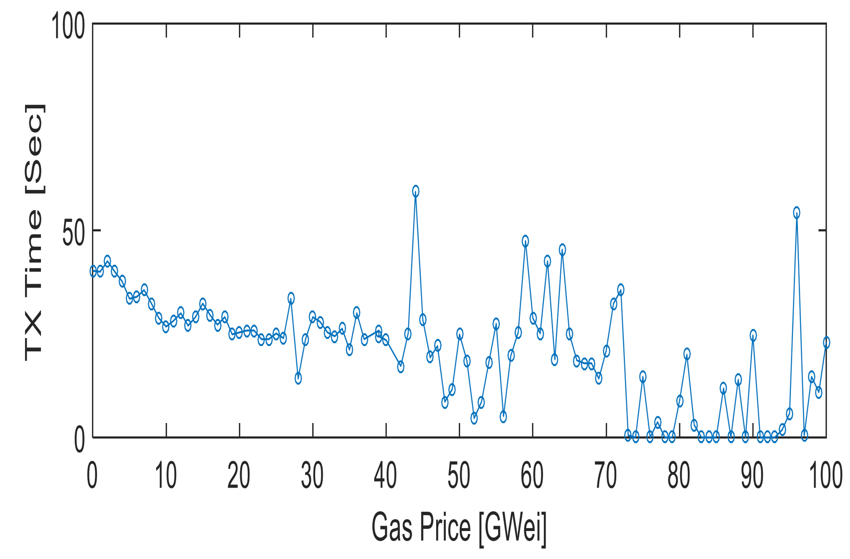

Fig.5 Gas price vs the standard derivation of end-to-end transaction latency

RESULTS

Fig. 1 shows these are no significant differences in the average transaction completion time with a Gas price between 1 and 100. When the Gas price increases, the latency fluctuates more. Fig.2 displays customers like to choose integer Gas prices, and the largest transaction volume occurs at Gas price 1. As the Gas price increases, the transaction volume decreases. The trade volume is close to zero when the Gas price is greater than 60. Fig.3 shows that the values decrease while the Gas price increases, but the slope of decreasing reduces.Comparing Fig. 1, Fig. 2, and Fig. 3, the transaction volume is relatively large when the Gas price is 1, 10, 20, 30, 40 (as shown in Fig. 2), however, the average and maximum transaction completion time does not change too much if compared with the transactions with a similar Gas price (as shown in Fig. 1) Fig. 4 display when the Gas price is between 1 and 11, the median time for transaction completion reduces while the Gas price grows. Whereas when the Gas price is more than 11 and lower than 38, the median time for transaction completion time is relatively constant. For the Gas prices higher than 38, the time to complete a transaction latency fluctuates significantly. Fig. 5 shows when the Gas price moves from 1 to 28, the variance time for transaction completion decreases, the variance fluctuates not too much; However, when the Gas price is more than 28, the variance fluctuates much more significantly.

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