

Privacy-Preserving Multi-hop Payments with Constant Collateral

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I. INTRODUCTION

In recent years, permissionless cryptocurrencies, have emerged as a novel means to facilitate secure and reliable payments within a decentralized framework, garnering significant attention from both academia and industry. These cryptocurrencies employ a consensus mechanism to verify each transaction, which is then recorded on a publicly distributed ledger known as blockchain. Unfortunately, the widespread adoption of cryptocurrencies is hindered by notable scalability challenges. Complex consensus mechanisms, like Bitcoin’s Proof-of-work(PoW), and the limited block size of the blockchain contribute to the issue. The theoretical throughput of Bitcoin stands at approximately 10 transactions per second(TPS), with a transaction confirmation time of around 1 hour. In contrast, traditional decentralized payment networks, such as Visa, boast the capability up to 47,000 TPS. Furthermore, the presence of high transaction fees renders small-value payments impractical for cryptocurrency users.

One promising solution proposed to tackle the issue of scalability is the implements of payment channels(PCs). PCs are off-chain payment protocols that enable two parties, who have established a channel, to conduct quick and validated transaction off-chain. To elaborate, the overall process can be divided into three phases. Firstly, during the channel-opening phase, both users commit a portion of their coins to a shared

address as initial funds, which is executed on-chain. In the subsequent channel-updating phase, the involved parties have the flexibility to engage in numerous off-chain transactions. They can adjust the allocation of funds between themselves by generating and exchanging signed transaction message. Ultimately, when the participants opt to settle the channel or encounter a dispute, they initiate the closing process by broadcasting the latest signed transaction to the blockchain. This transaction represents the most up-to-date distribution of funds within the channel.

II. BACKGROUND

In this section, we provide an overview on the background and the notations used throughout the paper.

A. UTXO model

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B. Payment channels

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C. *Payment channel networks*

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III. SOLUTION OVERVIEW

In this section, we present our key idea.

A. *Security and privacy goals*

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B. *Key idea*

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IV. CONSTRUCTION

A. *Building blocks*

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B. *Protocol description*

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V. ANALYSIS

A. *Security*

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B. *High level functionality description*

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VI. EVALUATION

The implementation and evaluation.

VII. DISCUSSION

Some arguments

VIII. CONCLUSION

Conclude the paper.

REFERENCES

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