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 hidered by notable scalability chanllenges. 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 overrall process can be divided into three phases. Firstly, during the channel-openning 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.

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II. Background

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

A. UTXO model

Transaction output is the fundamental component of Bitcoin transaction,which is an indivisible Bitcoin currency recorded on the blockchain and recognized as valid by the entire network.123456.

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. Constrution

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 implementtion and evaluation.

VII. Discussion

Some arguements

VIII. Conclution

Conclude the paper.

References

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