

3. SUMMARY

The growing interest and adoption of cryptocurrencies has put the world in the midst of a new financial paradigm shift. Over the years, there has been a significant increase in the value stored in cryptocurrencies. A payment solution facilitating secure and cost-efficient cryptocurrency payments can be utilized by merchants to expand their client reach and integrate a gateway to a novel financial technology.

There are still several difficulties impairing cryptocurrency payments. Existing solutions facilitating point-of-sale cryptocurrency payments are often centrally managed, meaning customers must trust the intermediaries and relinquish control of their assets to be able to make payments. To remove such necessity, the field of decentralized finance has emerged, offering traditional finance services without central intermediaries by using the smart contract technology on blockchains. Regarding decentralized POS cryptocurrency payments, arising difficulties include slow and costly transactions on the largest decentralized blockchain networks, improper and volatile digital assets are not attractive to merchants and security issues regarding smart contracts.

This thesis addresses the contemporary problems in the industry of point-of-sale cryptocurrency payments, with the purpose of proposing a solution for secure POS cryptocurrency payment system in a completely decentralized manner. In the frames of design science research, the payment system is built and optimized for speed and cost-efficiency. Author has initially set the following target parameters for the payment system:

- Minimal possible transaction amount: 0.01\$
- Transaction fees: < 1% of payment amount
- Average transaction time: < 15s

From analysing the decentralized blockchain networks, it became clear that the three largest networks by market capitalization, Bitcoin, Ethereum and Binance Smart Chain, cannot be used for the payment system due to their network transaction fees being too high for POS payments. As an alternative, xDai blockchain was found to be the most suitable for fast and cheap POS payments, due to its native stable asset xDai also maintaining stable transaction fees. Transaction cost and processing speed of xDai blockchain are extremely low in comparison to the largest blockchain networks. xDai has functional asset bridges to Ethereum and Binance Smart Chain, making cross-chain value transfer possible. For these reasons xDai blockchain was chosen to facilitate the payment solution.

In order to maintain the decentralization in the payment system, the merchant is required to accept cryptocurrency instead of traditional FIAT currencies. Considering the

unattractiveness of receiving cryptocurrencies for merchants due to price volatility, stable value maintaining cryptocurrencies or stablecoins are proposed to be the solution for that. xDai is the native stable asset for the chosen blockchain network, it maintains a 1\$ price peg and has the cheapest transaction fees, hence this is recommended for the merchants to use as payment receiving token.

The payment process is managed by a smart contract system deployed on xDai blockchain. The customers are able to pay using xDai, Bitcoin, Ethereum and USD Coin, provided they own the assets on xDai blockchain. Merchants can choose to receive any of those cryptocurrencies as well. Since payments will often require asset conversions, a decentralized exchange is used to provide such functionality. Since DEX uses an automated market maker, several adaptive safety features are implemented in the smart contract to provide secure and fair conversions for the customer.

The payment solution was tested with payment amounts ranging from 0.01\$ to 50\$. The average transaction time for payment confirmation was 2.236 seconds. The initial target of average below 15 seconds was an underestimation of the blockchain transaction speed, as even the slowest transaction time recorded was only 7.7 seconds. Testing revealed that while minimal payment amount of 0.01\$ is possible, it is not practical, since the total transaction fees take up a large percentage of the payment amount. Adhering to the target of transaction fees to be below 1% of payment amount, calculations reveal the following minimal payment amount limits:

- Direct token payments: > 0.08\$
- Single token conversion payments: > 0.96\$
- Two token conversion payments: > 2.21\$
- Three token conversion payments: > 10.5\$

Comparing the built payment solution to the industry standard of point-of-sale cryptocurrency payments, several beneficial factors for customers and merchants emerge:

- 1) All users are in full control of their own assets.
- 2) Payments are fast, cost-efficient and enable asset conversions.
- 3) The value for payments through this system is almost instantly received by the merchant, whereas receiving value for debit and credit card payments takes longer, because bank settlements can take hours or even days.
- 4) Utilizing these type of payments, the merchant is not a subject to fees for payment processing and validation, as this is done by the customer and the payment smart contract.
- 5) Customers paying with cryptocurrencies do not have to give up the control of their assets, but instead pay a small transaction fee to execute their payment.
- 6) The payment solution is decentralized and trustless.

Reflecting on the results achieved, the development of the payment solution was a great success. Initially set goals were achieved, by tackling the contemporary issues with point-of-sale cryptocurrency payments and based on research done, implementing the most suitable solutions to construct a fully decentralized POS cryptocurrency payment system. The payment system evolved to be very fast and cost-efficient, enabling safe asset conversions mid-payment, while satisfying the needs of both customers and merchants. Compliance with target parameters was reached and new metrics and limits were identified to provide qualities and features of POS payments unmatched by the standard industry solutions.

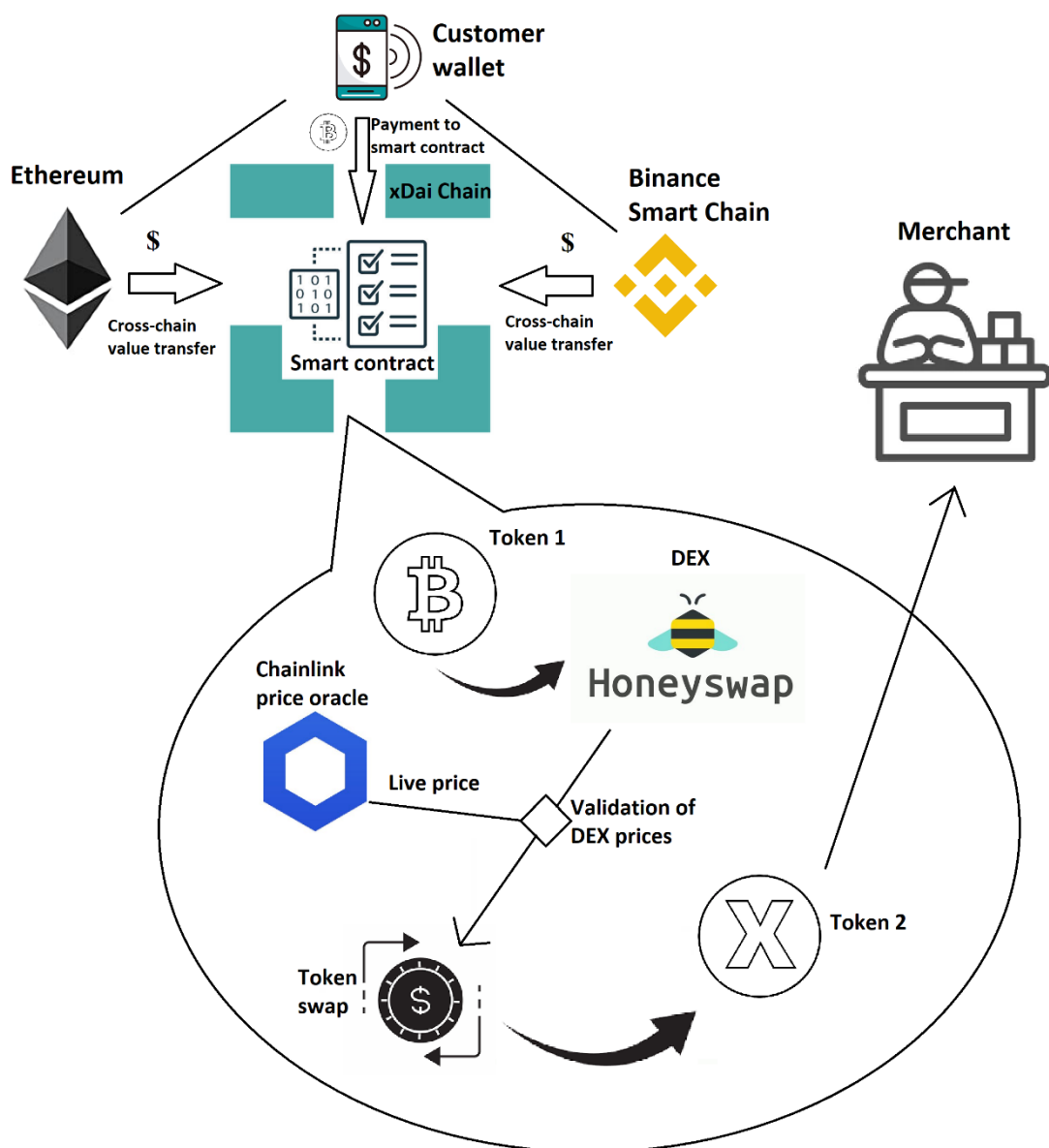


Figure 3.1: Simplified visual depiction of the payment system.