Blockchain-based Collaborative Loyalty Program for Business Consortium

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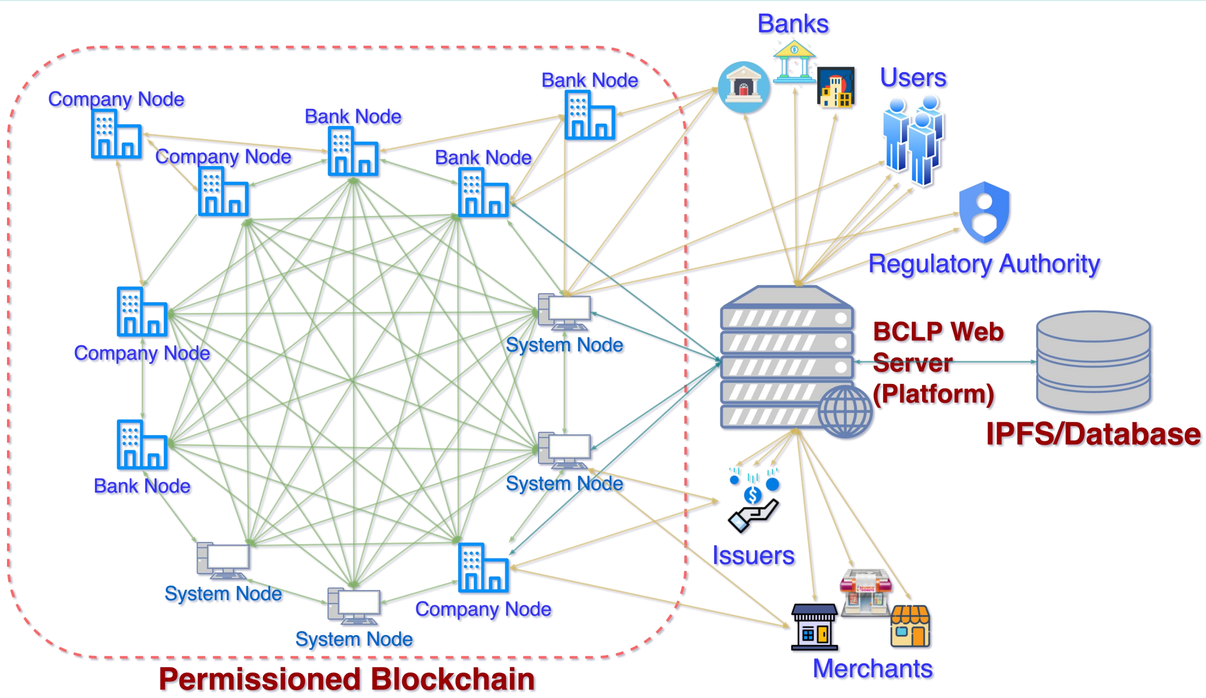
ABSTRACT

More and more brands or companies have implemented loyalty programs in recent years. However, there are too many types of reward points to circulate, and most may have expired before they can be redeemed. In addition, small merchants cannot develop robust loyalty programs on their own like large corporations, and if they join a consortium loyalty program, they will be limited to a certain extent.

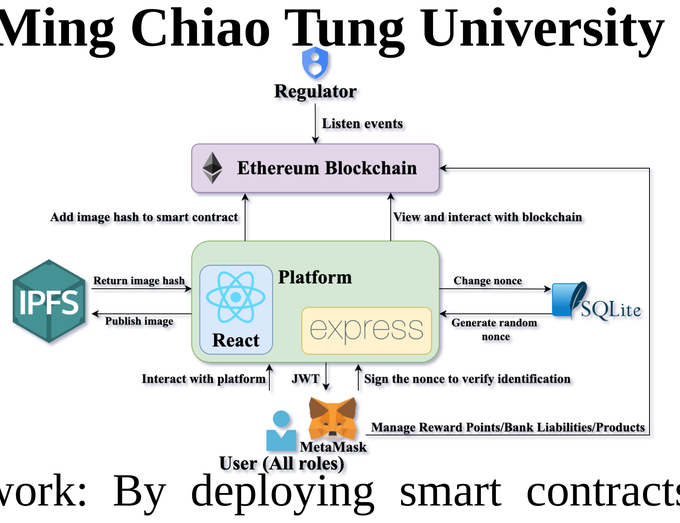
To address these issues, we propose a blockchain-based collaborative loyalty program for a business consortium (BCLP). The system allows enterprises to integrate into the business alliance independently, without the need for the central party to dominate, and customers can exchange one point for various items at any time, without worrying about the point expiration. Ethereum smart contracts can record our core information: reward points (RP) in a decentralized way, and provide anti-tampering, auditing events, and other functions to avoid attacks. The main contributions of this paper are as follows: Bank Point Liabilities: Banks recognize funds deposited by issuers as accounts payable, allowing funds to be used more freely; ERC-20 to- ken standard: RP in our system are derived from the ERC-20 token standard; P2P transaction: Thanks to blockchain technology, every role can conduct peer-to-peer transactions securely in real time; User Point Exchange: Users can exchange reward points on our platform for other points issued by other loyalty program issuers and vice versa; Regulatory Authority: Regulatory authorities are required to monitor abnormal behavior in the system.

SYSTEM DESIGN



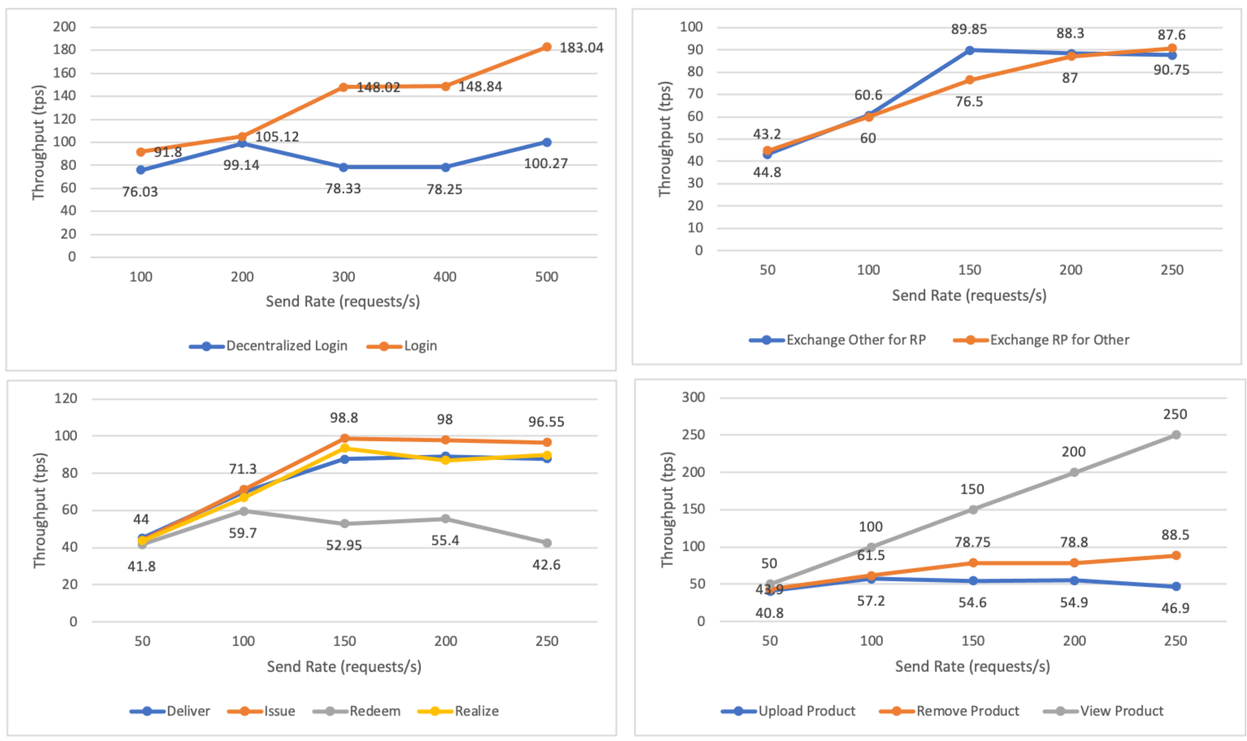
Our proposed system is to build a cross-bank collaborative loyalty program for business consortium, so we have five main roles: Bank, Issuer, User (Customer), Merchant, and Regulatory Authority, as shown in the figure above. It forms a robust permissioned blockchain by joining multiple nodes from platform and loyalty program members. Our BCLP web server (platform) is responsible for providing services that help everyone easily interact with the blockchain, storing images in IPFS, and storing login information in a database. Additionally, it requires providing multiple nodes to maintain the blockchain network. Since we set gasPrice to 0, transaction fees on the blockchain are free. However, our platform may charge fees based on how much RP is transferred in transactions by roles other than the user.

Our proposed blockchain-based collaborative loyalty program for the business consortium is mainly made up of four components:



- Ethereum blockchain network: By deploying smart contracts, banks can transfer point liabilities, merchants can manage their reward products, and users (all roles) can manage their own RP.
- Platform: The platform can interact directly with Ethereum nodes via RPC, as well as view data on the blockchain network. This means that users can make transactions themselves through MetaMask. Our platform also provides users with different functions based on their roles.
- IPFS: IPFS is a peer-to-peer network for storing and sharing data in a distributed file system. It uses content addressing to uniquely identify each file in a global namespace that connects all peers on the network, which means that the same file will return the same hash value. In our system, we use IPFS to store and share images.
- SQLite database: The SQLite database is responsible for recording the user's public address and nonce for authentication.

EVALUATION



Figures above show the throughput of functions at different send rates. We use the Apache JMeter tool to stress test system features and modules. We divide the evaluation results into four parts:

- Login System
- Transfer RP
- User Point Exchange
- Reward Product Module

CONCLUSION

In this paper, we propose a collaborative loyalty program based on blockchain smart contracts for a business consortium. Banks can use the money more freely compared to the traditional method, "trust fund", and are more willing to join. Small and medium-sized merchants can have the freedom to create the promotion strategy they want and enjoy the benefits of a well- established business consortium loyalty program. Customers can redeem a variety of items with one point at any time without worrying about the points expiring. As various brand companies join the business alliance, more reward products can be redeemed, thereby attracting more customers and increasing the exposure of merchants. Every role can use the various features of our platform more safely and conveniently than ever before.