Reliable Blockchain Based Stochastic Game System

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Abstract. Recently, due to the development of network and the development of hardware, users can enjoy games anywhere, and as a result various games have been developed so that items in the game using cash and game cache have skyrocketed. The user (participant) uses his cash and game cache to estimate the probability and make the investment. However, there is a problem that the item does not come out even though the number of times of approaching the probability is reached. The reason is that developers can manipulate the probability information stored in the database, and the data of the probability game can be recorded uncertainly so that users can suffer damage. In this paper, we propose a reliable system based on a blockchain for a random item in a game. The developer marks the probability in the blockchain. The user can verify the information stored in the blockchain. Since the event that the user participates in is also stored in the blockchain, the user verifies/checks the information stored in the blockchain, thereby enhancing the reliability of the corresponding game.

Keywords: Blockchain · Stochastic game

1 Introduction

The recent development of wired and wireless networks and the development of hardware that allows games to be played, users can enjoy games regardless of location and time. Developers develop various games to satisfy users' needs. Developers needed funds to maintain their games, and developers have made many attempts to cover them. To make a purchase of a game, to purchase a piece of the update at the time of an additional update, or to sell an item in a game for a fee. Among them, the items in the game occupied a lot of demand, and the developers applied the probability to the items in the game to induce the user to make a lot of demand. The user (participant) uses his cash and game cache to estimate the probability of the item and make an investment. However, there is a problem that the item does not come out even though the number of times of approaching the probability is reached. The reason is that developers can manipulate the probability information stored in the database, and the data of the probability game can be recorded uncertainly so that users can suffer damage. In this paper, we propose a reliable system based on a blockchain for a random item in a game. The developer marks the probability in the blockchain. The user can (participant)

verifies the information stored in the blockchain. Since the event that the user partic-ipates in is also stored in the blockchain, the user (participant) verifies/checks the information stored in the blockchain, thereby enhancing the reliability of the corre-sponding game.

2   Related Work

2.1   Game Market

The game market is experiencing explosive growth with the addition of traditional PC, video and mobile gaming environments due to advances in network and hardware. Mobile cloud enabled us to implement high-performance mobile games in our mobile environment [1], and PC and video games are now available thanks to the development of GPU. Table 1 lists game revenues worldwide. China spends about 37,945 M dollars on games, followed by the United States and Japan [2]. As such, the game market represents a large industry. Game companies make consumers pay the right price for maintaining the game, and the first is that they pay for the game when they buy the game. Second, every time a game is updated, consumers pay for the update. Third, there is a different way of paying the price depending on the amount of game users use. Finally, there is a way to make profits by selling paid items in games.

Table 1. Game market consumption ranking

Rank	Country	Region	Internet population	Total revenues in US dollars
1	China	Asia	850 M	37,945 M
2	United States	North America	265 M	30,411 M
3	Japan	Asia	121 M	19,231 M
4	Republic of Korea	Asia	48 M	5,647 M
5	Germany	Western Europe	76 M	4,687 M
6	United Kingdom	Western Europe	64 M	4,453 M
7	France	Western Europe	58 M	3,131 M
8	Canada	North America	34 M	2,303 M
9	Spain	Western Europe	39 M	2,032 M
10	Italy	Western Europe	40 M	2,017 M

2.2   Blockchain Technology

A blockchain is linked to a chain based on a technique for creating a block that stores transactions. It is stored in a distributed data store. Any public blockchain can read transaction data and add transactions. The data stored in the blockchain is verified from other nodes after the block is created, and the recorded transaction cannot be deleted. Therefore, it is possible to prevent the forgery and alteration of the data, If the block is not occupied by more than 51%, the block will be reliable [4]. There are public

blockchains, private blockchains, and consortium as types of blockchains. In the public blockchain, the bitcoin and ethereum are typically used, and transaction details use a proof-of-work method to verify the modulation by an attacker and to detect and generate an abnormal block [3]. The private blockchain is available only to a specific user, and if it is not possible to disclose the data, it will use the private bloc chain. The private blockchain may not focus on cryptography, and instead uses a competing algorithm such as the Federated Byzantine agreement (FBA) instead of the PoW to validate in the public blockchain [5]. It also has fast processing speed and high data throughput, so it can have fast response speed [6]. Consortium blockchains are only available to consortium users, and data write and read permissions and block creation are only available to consortium participants. Because it has the advantages of public blockchain and private blockchain, it is mainly used between government and private enterprise, it has some anonymity, and it can have fast processing speed [7] (Table 2).

Table 2. Blockchain type

Type	Public blockchain	Consortium blockchain	Private blockchain
Operator	None	Consortium member	Specific operating entity
Read, Write data permissions	Blockchain participants	Consortium member Blockchain participants	Specific operating entity Blockchain participants
Block creation	Blockchain participants	Consortium member	Operator
Block generation algorithm	Proof-of-Work	Practical BFT	Proof-of-Auth
Throughput	Low	High	High
Latency	High	Low	Low
Examples	Bitcoin, Ethereum	R3 Corda	Self-development

3   Conclusion

Recently, the game market has grown rapidly due to the development of network and hardware, and various game services have been operated in a form in which users pay for the maintenance of their games. Players are paying more money from users by adding the odds on the items in the game and the items in the game. In this paper, we propose blockchain based random item acquisition to provide reliable game service. The proposed blockchain based service stores the intrinsic probability of an item in a blockchain. When a user (participant) participates in acquiring a specific item, the user's information is also stored in the blockchain transaction, And the probability of manipulation of the developer can be prevented. Future research will implement a service framework for preventing probability data in other environments.

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