Real and Virtual Token Economy Applied to Games: A Comparative Study Between Cryptocurrencies

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Abstract. Monetization is a way to earn money from products, softwares or services. Many video game companies use monetization to sell items, bonus or even money to customize the user experience or achieve quests easily in their games. Even though the cryptocurrencies are becoming more and more popular, few games use cryptocurrencies as a real form of monetization, which means that there is a potential for its application. The purpose of this paper is to compare the most used cryptocurrencies for games, based on some important characteristics, discuss which is the most suitable cryptocurrency for gaming platforms and propose an architecture for gaming companies use inside the games using cryptocurrencies.

Keywords: Cryptocurrency · Blockchain in games · Game monetization

1 Introduction

According to Mishkin, 2015, monetization is the name given to the process of exchanging anything: a product, service or software, for a specific value that can be used to legally buy and sell goods. In the universe of video games, monetization is used to sell games and additional content to increase the custom user experience [5]. Every gamer has a different experience, making it necessary to adapt the game to the most suitable monetization, according to the user profile. More and more games are using custom monetizations to generate revenue and increase the way the player interacts with the game [3].

Since the beginning of Massively Multiplayer Online Games (MMO), the ideia of virtual coins was discussed, for example, in the game *Everquest from Verant Interactive*. Inside *Everquest*, the users populated a world named Norrath, where they could create an avatar and live their virtual lifes, using the game's currency; (Castronova, 2001) studied in details the social game mechanics and the macroeconomy of buying and selling items inside and outside the game (which was illegal from the company perspective). He concluded that inside the game, there was a supply and demand law on rare items: when a rare item was in high demand, its price rises in avatar-to-avatar market [4].

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Based on the context, the cryptocurrencies can co-exist with electronic games due to using them will make the transactions faster and trackable. The idea of this paper is to present in details how the games monetize their activities nowadays and to propose an architecture to explain how cryptocurrencies could be implemented in well-known games to increase security, tracking and monetization of anything inside the game. Besides, discuss some cryptocurrencies that are being used on games based on their technology and market cap, comparing similarities and differences between them. In Sect. 2, concepts and related studies about monetization in games are presented; in Subsect. 3 some concepts about crypto-games and applications are raised; in Subsect. 4, the authors present a comparative study between all gathered cryptocurrencies in the raised crypto-games and in the last section, the proposed architecture for cryptocurrencies and games is proposed.

2 Monetization

At the beginning of game's history, the games were created by laboratories or computer scientists at universities. Then, the arcades games came to life where players could exchange money for coins to play on machines. They were formerly sold on floppy disks at small hardware specific stores, then the evolution came after some years and soon the video games were created, in which games were sold by physical copies [7], the most used method to monetize games until today.

Monetization in games is one of the most important phases of designing a video game. It is becoming more and more important for publishers to earn revenue from their games, most of them have been using a "free-to-play" approach where the users can download the game without paying anything, expect if they want to customize their gaming experience by buying custom items, energy, weapons, etc. [6]: *Plants vs Zombies 2* allows the users to buy plant types to improve the gameplay and hence the score; in *Kingdom Rush Frontiers*, to level up easily, the user can buy power-ups to increase the character health and explode enemies [6]. Usually, the player does not buy these goods using cash or some kind of currency directly, the game has a proxy that connects to a third party financial company where the user can buy them using credit cards or another form of exchange [6] and that is where the cryptocurrencies could help the publishers. Despite mostly being a electronic game, some games sell physical goods to customize characters and improve gameplay mechanics, like the game *Disney Infinity* that sells physical toys representing new characters and environments [6].

Besides the "free-to-play" approach and the retail method to monetize games, there are many other forms of classifying monetization in this industry: David Perry, former CEO of a cloud gaming platform and Chief Creative Officer from *Acclaim Games*, in 2008 at the *Social Gaming Summit* mentioned 29 business models for game monetization based on the book "E-commerce: Business, Technology and Society" from Kenneth Laudon and Carol Traver [1,2]; Tim Fields and Brandon Cotton in their book "Social Game Design" explain many ways

to generate revenue from games using three basic models: the Classic Download Model, the Signature Model and the Freemium Model [7]. Scott Rogers presented eight models of monetization: Trial; Freemium; Free-to-play (F2P); Downloadable Content (DLC); Season Pass DLC; Membership; Premium and Subscription [6]. Basically, all forms presented by different authors aim to earn money from different types of games and can be summarized into major types: Retail Purchase, In-game Microtransactions, Digital Download, Subscription Model and Indirect Monetization [8]. In this paper five types of models are presented: Trial Model; Retail Purchase; Digital Download; Subscription Model and Freemium Model.

In the Trial Model, the publisher launches a version of the game that is not complete, it is a sneak peek of how the entire game will be, including how the mechanics will work, the visual of the characters and the game's world. Players download it and can try the game without paying anything and the publisher hope they will pay for the full version [6]. This is a common way to attract players on consoles like *Playstation* [11] and *Xbox* [12]. For example, the games *Final Fantasy VII Remake* and *Far Cry 4* allow the players to play a limited time on the game (demo play).

The Retail Purchase Monetization is the most conventional way of monetizing games, the users pay for the physical copy of the game they want, like a CD and are ready to play the game [8]. It is a model that attracts few people each year due to the digital version of the games that sometimes is more affordable. That change of mind can be seen on the release of the new *Playstation 5*, where the player can choose between buying a more expensive version of the console with CD input or a low-priced version only for digital downloads.

In the Digital Download Model or Classic Download Model, the publisher makes an advertising campaign about the game that is being created, captivating and engaging the players to download the game and play it. Some examples are the mobile stores for phones and tablets [10,14]; the *Steam* website [15] containing a plenty of games with different characteristics, that diversify the target audience and the digital stores from consoles like *Sony Playstation* [11], *Microsoft Xbox* [12] and *Nintendo Switch* [13].

In the Subscription Model, there is a concept about game time. Instead of buying the entire game and additional packages as soon as the publisher launches some additional content, the users pay a monthly, quarterly, annual subscription to pay or only pay the time they will play [7]. The majority of games that use this kind of model are MMORPGs (Massively Multiplayer Online Role-Playing Game), like *World of Warcraft* from *Blizzard*, launched in November 2004, which can use the Freemium Model (to download only the base game) and Subscription Model for buying a specific period of time. Besides, the players can also buy mounts and mascots to customize the gaming experience and help them inside the game. Figure 1 and 2 show these two cases. Despite being an interesting way of monetizing a game, the real challenge of using it is to keep the player interested on the content of the game as the time goes by.

Fig. 1. Monetization using game time on *World of Warcraft* game

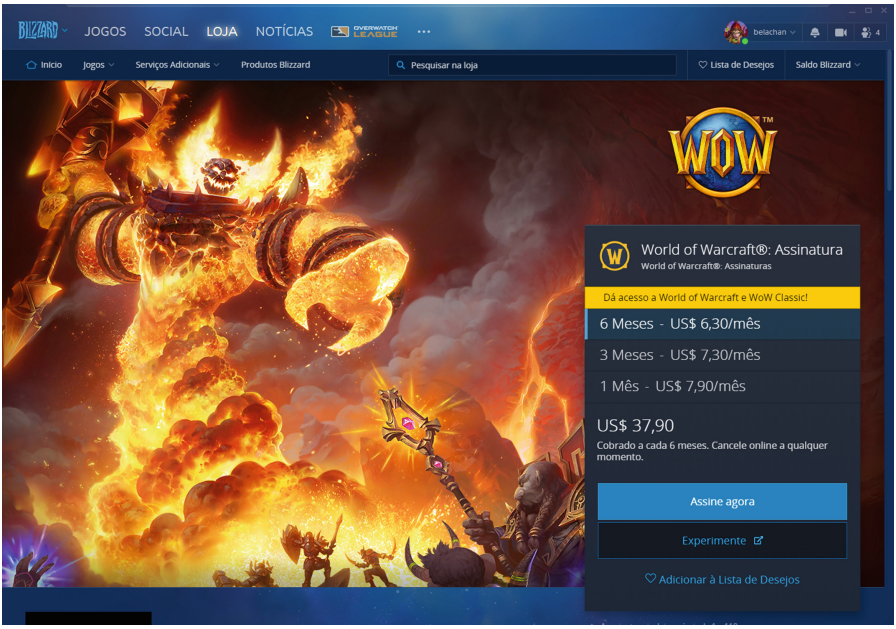

Fig. 2. Monetization using the subscription model on *World of Warcraft* game.

In the Freemium Model or Free-to-Play, the users do not pay for downloading the game [6,7]. One of the greatest example of this kind of model is the game *FarmVille* from the *Zynga* company. The players could play for free, but could speed up some boring tasks that need friends to complete or time to wait. The publisher encourages the players to pay for time, virtual goods, locked contents and DLCs (Downloadable Content). It is becoming more and more popular, specially on mobile games.

Despite being completely distinct models, some games can benefit from more than one monetization model to specific parts [6,7]. The *Word of Warcraft* game is a fine example: beyond the subscription monetization, the player can also buy mounts and pets.

In 2009, *Facebook* created a system called *Facebook Credit* so all the games inside his platform could use a common currency, with the idea to earn a percentage on the revenue of the games and also increase security on user's transactions. A few developers were against the idea due to the *Facebook*'s fee to do that: almost 30% of the transaction [7], on the other hand, the community as a whole accepted the idea well. One of the benefits of *Facebook*'s system is to give friends a gift with credits to spend in any game they want [7].

After the creation of Blockchain and the cryptocurrencies, some games using the Blockchain's technology appeared and attracted attention to how this type of technology can impact the industry of games. The next section will discuss more about it.

3 Crypto Games

From the very beginning of the history of cryptocurrencies, there are ideas on how to use them for games. Some examples are: *Dragon's Tale*; *MinecraftCC*; *Gambit*. In 2010, the most famous indie game to use Bitcoin was called *Dragon's Tale*: a mix of MMO with casino, which had several activities based on four categories: Luck; Skill; PvP and Tournament [17]. For example, the Luck category has an activity called Palace Garden, in which players dig eight holes in the Chinese imperial garden. Each hole may or may not contain Bitcoins and when it finds two or three holes that have Bitcoins, the number increases.

In 2012 the first server to run Bitcoin was created along with *Minecraft*, the so-called *MinecraftCC*, in which players earned fractions of Bitcoins in exchange for building blocks and killing monsters. Despite community support and advertisements to maintain the project, in 2016 it was discontinued. After a while, in 2013, *Gambit appeared*, in which players could bet against each other in classic board games or cards using Bitcoin, it functioned as a form of virtual casino. As can be seen, in the early history of cryptocurrencies, almost all applications for games were some kind of virtual casinos or gambling applications.

Following this trend, a cryptocurrency appeared with this goal in 2014: DigiByte, which runs on top of the Blockchain technology [16]. The idea was to establish a connection between digital games and the tokens generated by the cryptocurrency. Even with all the effort to create this environment, projects using DigiByte were paused in 2017.

A year after the creation of the DigiByte cryptocurrency, *Blizzard* created an internal *World of Warcraft* game token for players to exchange their real coins for virtual gold so they could spend or sell at auction houses. Security has been improved, because if a player bought tokens at the auction house, he could use it only after thirty days, which helped prevent fraudulent accounts [18].

Looking at the potential of game monetization and all the applications above using crytocurrencies, some companies developed researches allying cryptocurrencies/Blockchain with games, as it can be seen on Table 1. The Blockchain Game Alliance was founded in 2018 with the main aim of spreading crypto games and exploring the creation of games with distributed ledger technologies.

Table 1. Table with some cryptocurrency patents in the gaming industry. Taken from Google Patents (https://patents.google.com/).

Patent number	Patent name	Publication Year
TW201922325A	Blockchain gaming system	2018
US20190303960A1	System and method for cryptocurrency generation and distribution	2019
US20180114405A1	Digital currency in a gaming system	2019
US20190122495A1	Online gaming platform integrated with multiple virtual currencies	2019
US20180197172A1	Decentralized competitive arbitration using digital ledgering	2018
US9997023B2	System and method of managing user accounts to track outcomes of real world wagers revealed to users	2019

Analyzing all the history of gaming application with cryptocurrency, that is how the Crypto Games were born. Crypto Games is the name given to every game that uses distributed ledgers to operate the game and a cryptocurrency for exchanging items or characters for money.

There are many benefits of using blockchain in games, some researchers have already raised them [19,20]: the rules of blockchain games are transparent, everyone can see what the game is about and what the player can do or not; it guarantees the ownership of items, characters or whatever element that the player owns inside the game [19]; with this guarantee, the owner of them can reuse these elements in other games inside the same Blockchain, like *CryptoKitties* and *KittyRace* [19]. *KittyRace* reuses some elements of the *CryptoKitties* game, so you can play both games with the same account [19].

Although it is a good strategy to use blockchain for designing games, [19] raised some restrictions about the visual design of the game due to technical limitations. It is a promising application but huge companies are still at an advantage on this aspect.

4 Cryptocurrencies in Games

Nowadays there are a large variety of crypto games on the internet for everybody who wants to play: they goes from gambling games to RPG games (Role-Play Games) [20]. Exploring deeper the cryptocurrencies atop of the most popular games to date, the authors present a table (Table 2) with some of these games and the cryptocurrencies they use as a base for transactions.

Table 2. Popular crypto games and their respective cryptocurrency.

Name of the game	Cryptocurrency
CryptoKitties	Ethereum
KittyRace	Ethereum
Satoshi dice	Bitcoin
TronBet	TRON
EOS knights	EOS
0xUniverse	Ethereum

As seen in the table above, there are four main cryptocurrencies used in games: Ethereum, Bitcoin, TRON and EOS. Bitcoin was the first cryptocurrency created and yet is used in various gambling games [17]. Although the market capitalization of the bitcoin is the biggest one with $ 96 billion dollars, according to Coinbase platform, Ethereum has a lot of potential since the majority of games operates atop of it. One of the reasons why Ethereum (second-largest cryptocurrency by market capitalization) is the most used in games is because of its functionality of smart contracts and the DApp infrastructure to build a game or a application on it easily. DApps are becoming popular on the blockchain world since anyone can make an app with an interface to interact with the user in any programming language and contact the server in which the blockchain is running [9]. Another advantage of using Ethereum instead of Bitcoin is the transactions time: Ethereum can handle more transactions per time than Bitcoin, it also can support any type of computation and the creator of the DApp can make his own rules [24,25].

Other cryptocurrencies like TRON and EOS also use the concept of DApp application. An annual report made by Dapp.com informed that TRON is the second most used DApp, losing only to Ethereum, which represents the majority of gaming platforms [26]. In Table 3 the authors bring a brief summary of the

Table 3. Dapp market summary in 2019 with Ethereum, EOS, Steem and TRON [26].

	All	ETH	EOS	Steem	TRON
Total number of dapps	2,989	1,822	493	92	520
Active dapps	2,217	1,129	479	80	482
Active users	3,117,086	1,427,093	518,884	120,560	967,775
Transactions	3.26B	24.52M	2.81B	85.72M	290.28M

DApp market in 2019 by Blockchain, emphasizing the number of DApps on Ethereum.

Analysing this data and the proposal of each cryptocurrency whitepaper [27–30], the authors come up with four main important characteristics for a gaming cryptocurrency: Transaction Fees (if the cryptocurrency has fees to transact); Smart Contracts (whether it has the possibility of implementing a smart contract to make the game smarter); Scalable (it refers to the ability of the cryptocurrency to scale in terms of numbers of transactions) and Performance (if the decentralized network bears many transactions per time). The results of rising these characteristics are on the Table 4.

Table 4. Comparative between the main important characteristics raised by the authors and the cryptocurrency.

Cryptocurrency	Transaction Fees	Smart Contract	Scalable	Performance
Bitcoin	X			
Ethereum	X	X		
TRON	X	X	X	X
EOS		X	X	X

From the scenario raised above, the cryptocurrency that is most suitable for games is EOS. It does not have any fees to play, so the player does not need to transfer funds to the account to make any small transaction, it scales and performs better than the others, since uses a Proof-of-Stake consensus algorithm, differing from the others that uses Proof-of-Work (Bitcoin [27] and Ethereum [29]), Delegated Proof-of-Stake (TRON) [28].

Besides EOS, TRON can also be another candidate for gaming as it is growing in Dapp applications in 2019. The number of active Dapps in EOS are almost the same as TRON Dapps, this comes from the fact that these two cryptocurrencies are mostly used for casinos platforms that involves gambling, Table 5 illustrates the market dominance by category on a daily basis.

Even though Ethereum is not fully scalable, it represents the majority of dominance in gaming category (28%), followed by EOS (15%), TRON (12%)

Table 5. Daily market dominance by category [26].

	All (%)	ETH (%)	EOS (%)	Steem (%)	TRON (%)
Game	22	28	15	12	12
Gambling	27	20	56	7	37
High-risk	21	24	4	0	38
Exchange	4	5	8	3	4
Finance	4	5	2	3	1
Social	6	3	3	52	2
Art	2	3	1	1	0
Tools	7	5	4	18	2
Others	8	7	10	4	4

and Steem (12%). Since Ethereum came before the others, this may be the reason why developers prefer using it, for security concerns.

5 Proposed Architecture

This section provides some problems that cryptocurrencies could solve in games, along with a explanation about the proposed architecture and strengths of using it.

The video game industry is one of the biggest industries in the world. According to *New Zoo*, a research company about game market insights, the global games market has a market cap about $159.3 Bi only on 2020, which is a growth of 9.3% compared to last year [21].

As a well-known fact, the descentralized applications, the blockchain technology and its cryptocurrencies represents a world where third-party companies will not have much influence on markets. Instead of using the services from this companies, like credit card, the video game companies could benefit from services from blockchain and cryptocurrencies to ensure the security of the player's money and its personal data [19,20], which means it will reduce the third party's partnership.

There are many problems on the actual finance structure of the games: first, the players need to trust their credit card data or bank account to a third-party company, which could lead to vulnerabilities and information leak if a hacker attacks the company, what has happened recently with some games [22,23]. On 2020, hackers modified some game's database to generate items or virtual cash for their own account, so they could sell on a market [22]. During the coronavirus pandemic, these attacks are becoming more frequent, due to the fact that the players are often online and unsuspecting any attack. The attacks range from pishing to theft of sensitive information such as credit card data [23].

The proposed architecture of this paper could solve the theft of credit card information, since the player does not need to enter any credit card information, only the cryptocurrency address. Figure 3 presents our proposal of solution.

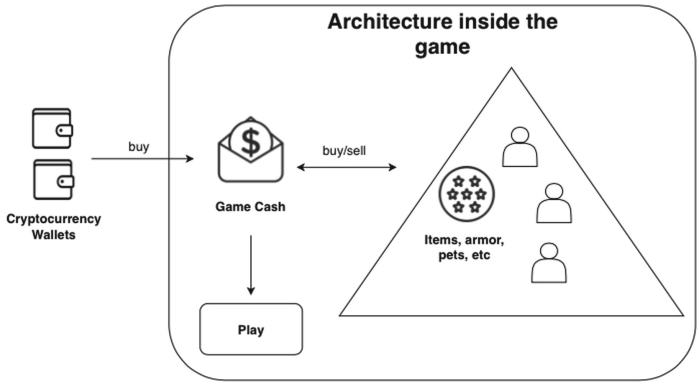

Fig. 3. Proposed architecture.

In the solution, the publisher of the game only needs the blockchain to guarantee the ownership of the items between players and secure the player's game cash. The player can buy the game cash using the address of his cryptocurrency wallet: he transfers funds between his wallet and the game's wallet. As appointed in the previous section, some cryptocurrencies that could be used on the game is EOS and TRON, due to their beneficial features and network hashrate. When the transaction is approved by the blockchain, the player has two options: buy or sell items, armor, etc. using his new balance from other players or just play the game. He could also receive his game cash back in form of cryptocurrency for his wallet.

This type of architecture can ensure the security by using blockchain for validating transactions: the hackers will not be able to attack the monetary system or the trading system, because of the immutable feature of blockchain. And also, they will not be able to steal the player's credit card information or his balance from the wallet, since the cryptocurrencies use Asymmetric Encryption Cryptography, Hashing and Consensus Algorithms to secure the wallet, the network and personal data of the users.

6 Conclusions and Future Work

Since the beginning of the game's industry, monetization is a way of earning money from the players. Each game use a different type of monetization or combine different types to achieve a better game experience.

In this paper the authors discussed about the importance of the crypto games and their benefits, as well as the different types of cryptocurrencies that could

be used in games based on some important features. The proposed architecture demonstrated what could be done in the financial structure of the game to prevent hacker attacks and information theft, which guarantees the integrity of the whole system and could be used in any games, even the ones that already exist.

For future work, the most suitable type of games for blockchain will be analysed, other crytocurrencies not raised on this article will be compared and a further research DApp platforms for games will be done.

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