

Decentralization of Social Networks Using Blockchain: A Review

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Abstract: *Online Social Networks (OSNs) have turn out to be one of the most famous applications of the everyday existence of users in the worldwide. Today the variety of Social Media customers is about three billion, and this vogue increases year per year with high influence on the privacy issue. During the ultimate years, decentralization of social services has been viewed a big possibility to overcome the primary issues in OSNs. Blockchain technology represents nowadays the most typical decentralized technique, which has been taken into account to enhance the new era of decentralized social platforms. Nevertheless, the real benefit of the introduction of blockchain technology in actual social platforms is nevertheless unknown. In this paper we advocate an overview of the principal Blockchain-based Online Social Media platforms. We describe in detail these structures by highlighting the major aspects and offerings they offer, but additionally the frequent drawbacks of these platforms.*

Keywords: Blockchain, Consensus Mechanism, Distributed ledger, Security, OSN

1.Introduction

People use Online Social Networks (OSNs) to share their personal information, as a daily activity. Today the range of Internet customers is greater than 4 billion, and the quantity of social media users is about three billion. This trend increases year per year through giving to Social Media and Social Networks a high importance, in unique in respect to the administration of the privacy issue. In fact, modern-day popular OSNs are centralized which potential they are primarily based on centralized servers storing all the data of the users. The centralized structure has several drawbacks because data can be managed, sell, or stolen without an lively manage of the owner of the data. The main scandal which concerned Facebook, one of the most used Social Network, is the Cambridge Analytica's scandal.¹ About 87 million of Facebook customers used an application posted on Facebook which was in a position to acquire profiles of customers and friends. Data were delivered to Cambridge Analytica which analyzed them for political goal. This is one of the most important instance of privacy disclosure, however it is now not the only problem. Indeed, another trouble of modern social systems is the censorship. Facebook has been banned in some countries, such as in China, Tunisia, Iran, etc., solely to mention a unique case. All situations represent the fundamental motivation which has lead to a decentralization of the social services. A Distributed Online Social Network (DOSN) [1] is an Online Social Network carried out on a disbursed platform, such as a network of trusted servers, P2P systems or an opportunistic network. During the final ten years, a number of DOSNs have been proposed [2-5], and these platforms represent the first evolution closer to a new technology of Online Social Networks. However, decentralization methods has been radically modified throughout the remaining few years, in precise when the Blockchain technology has been taken into account in numerous research fields, as the predominant revolution to overcome various issues problem the centralization. A blockchain is in actuality a public dispensed ledger of

documents that are shared among collaborating parties, and it can be referred as a chain of blocks. The first principal software of the Blockchain technology used to be Bitcoin [6], which can be viewed the motivation of why blockchain are so well-known today. The other main utility is Ethereum, ² which was once launched in 2015 with the novelty of smart contracts, pieces of code describing self- executing contracts with the phrases of the settlement between purchaser and seller. The lack of success of DOSNs, and the enlarge of issues concerning OSNs, such as faux news or records disclosure, has been the primary motivation to mix social structures with the blockchain technology. Several purposes have been proposed.

The most famous one is Steemit, ³ which has today more than 1 million of users. The essential common motivation shared between all these proposals is the want to supply price into generated content. Social Networks and Social Medias symbolize a goldmine of data, which are generally used through the centralized providers to enrich themselves. Instead, these systems furnish a way to supply a reward to the content creator. Nevertheless, the actual benefit brought by way of the blockchain in a social environment is nonetheless unclear, because the conduct of these platforms is unknown due to the lack of a actual analysis, and in some cases, like Steemit, the introduction of the beneficial method looks exchange the real conduct of a social platform (in example the usage of bots to retrieve extra tokens). In this paper, we recommend an overview of the principal Blockchain-based Online Social Media platforms by using highlighting the common characteristics of them. We describe in element why these systems are Social Media rather of Social Networks with the aid of describing the distinctive between Social Networks and Social Media. To better provide an explanation for how these systems work, we describe in element each introduced platform to show the principal points and offerings proposed. We advocate an overview of the foremost dilemma of Blockchain-based Online Social Media and which

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problems are still open. Finally, we advocate a new model of Blockchain-based Online Social Network, which takes into account the function of the person as the core of the system, as an alternative of the position of the content material as in present day proposals.

The relaxation of the paper is organized as follow. In Section two we endorse the kingdom of artwork of Online Social Networks and Decentralized Online Social Networks, and overview of the blockchain technology. In Section three we describe the specific between Social Networks and Social Media to clarify why current proposals cannot be regarded Social Networks. In Section 4 we recommend an overview of the current Blockchain-based Online Social Media, their traits and the open problems of this lookup field. In Section 5 we advise a first model for Blockchain-based Online Social Networks which exploits the blockchain technology as a device to manipulate the get entry to manipulate problem. Finally, in Section 6 we summarize our work by using offering a list of conclusion and future works.

2. Background

In this area we recommend an summary of the state of artwork of modern Blockchain-based Online Social Media through introducing the blockchain technology with specific specialize in the most traits and therefore the essential applications. Furthermore, we endorse a precis of the most concepts and technology utilized in modern Decentralized Online Social Networks (DOSNs) by introducing the most Online Social Network problems. In detail, we describe the essential decentralized options proposed to face the privacy problem of centralized Online Social Networks, which signify the history of the Blockchain-based Online Social Networks, as worries the decentralization.

A. Blockchain technology

A blockchain is genuinely a public allotted ledger of data that are shared amongst collaborating parties. It can be referred as a chain of blocks where every block is constructed on top of the preceding block. Indeed it incorporates the cryptographic hash of the preceding block, a timestamp, and transaction data. After a block is added to the chain, it is impossible to tamper blocks because the ledger is distributed and can be viewed with the aid of all users, which are consistently replace and saved it synchronized. Indeed, when a new transaction wishes to be brought to the ledger, the transaction is encrypted and demonstrated via the other users in the network. Thanks to a consensus protocol, if there is a consensus among the majority of users, the transaction is regarded legitimate and brought to the ledger. The dispensed consensus protocol and the anonymity property can be regarded the two essential traits of the blockchain technology.

The version of Blockchain proposed via [6] combines three awesome technologies: Byzantine fault-tolerant systems, Digital time-stamping, and cryptography

primitives. More in general, a number of features of Blockchain protocols are listed in [7]:

- **Immutable.** It means that it is really difficult to tamper or alter a block. Data written to a blockchain can never be changed.
- **Distributed.** It means that a copy of the ledger is distributed among all the members of the network.
- **No Centralized Authority.** The structure does not depend on a central server, but it relies to a P2P network.
- **Resilient.** It shows that it is not prone to theoretic attacks.

Blockchains can be divided into two principal categories. It can be either permission-less, permitting anyone to use them, or private and permissioned, where a unique set of approved validator nodes (i.e., miners) is allowed to take part in the block validation process. As concerns the applications, Bitcoin [6] is the most famous one. However, in the final years, Ethereum [8, 9] has won countless recognition thanks to the possibility of define smart contracts. Smart contracts are basically packages that can robotically execute the terms of a contract. Despite cryptocurrencies and financial purposes have been the essential examples of blockchain applications, other essential research fields have tried to use this disruptive technology [10-13]. One of the predominant prominent research area is the IoT.

B. Towards the decentralization of OSNs

Current OSNs are based totally on centralized platforms, and they suffer of numerous problems which includes scalability, dependence on a provider, and privacy, as explained in [1, 16]. In particular, the rise and quick development of OSNs has led to two essential phenomena: the consumer privacy disclosure and the fast spread of information. OSNs have emerge as the epicenter through which character privacy is violated. The closing scandal concerning users' data is the ordinary Cambridge Analytica scandal4 erupted in early March 2018. In detail, the business enterprise had received and used non-public statistics about Facebook customers from an external researcher who had informed Facebook he used to be gathering it for educational purposes. Personal facts of tens of millions of Facebook users, in element 87 million users, have been acquired5 through a Facebook application referred to as "This Is Your Digital Life".

To overcome the principal problems of OSNs, and in particular the privacy issue, decentralized options have been proposed. Decentralized Online Social Networks (DOSNs) [16] are Online Social Networks applied by means of exploiting the decentralization of social offerings thanks to disbursed platforms. By decentralizing OSNs, the thought of a provider issuer is changed, as there is no single company but a set of peers that take on and share the duties wanted to run the system. This has several super consequences: in terms of privacy and operation, no central entity that decides or changes the terms of service exists. Moving from a centralized net service to a decentralized system also means that special

device models grow to be possible, as delay-tolerant social networks and/or P2P networks, to name some of them.

During the last ten years numerous DOSNs have been proposed [1]. Most of them count to a P2P networks, and are targeted on the privacy problem. The first huge venture in this location is Diaspora [17], established in 2010 via four students. Safe book [4] aims to resolve privacy troubles focusing on conversation anonymization by the use of the Matryoshka overlay network, which are specific buildings offering end-to-end confidentiality and allotted facts storage with privacy. Life Social [18, 19] provides a plugin-based structure in which person data are stored in a Distributed Hash Table (DHT) structure, and are reachable from various plugin-based applications. PeerSoN [5] exploits a two-tier architecture in which a DHT is used as a lookup carrier to discover content material stored on users nearby devices.

My3 [3] makes use of approach where users' data are hosted on a set of self-chosen trusted friends among their friends. DiDuSoNet [2] proposes to take advantage of relationships and the thought of trust to outline a Dunbar-based Social Overlay where particular storage insurance policies are defined. With the introduction of the blockchain technology, also the notion of a DOSN has been re-thinking by introducing this technology in two ways: as the baseline structure or as a support. Finally, a new era of DOSNs is proposed in [20, 21]. HELIOS represents a people-oriented social platform, which can be adapted to the consumer conduct via exploiting the smart environment. The foremost principles of HELIOS are: human-centric computing, computational believe with the aid of exploiting interpersonal trust models, and contextual networking.

3. Blockchain-Based Social Networks or Social Media?

A frequent trend is to assume that the phrases Social Media and Social Networks are synonyms; instead they are referred to different concepts. The definition of social media is no longer a formal definition, certainly it is viewed a web-based or cellular application that permit the introduction and trade of User Generated Content. A Social Network, on the other hand, is a social structure with humans who are joined by a common interest. For sake of readiness, Social media is a area where you send information to different people, typically by means of sharing content. Indeed, the content is the baseline of a social media. Instead, Social Networks focus on human beings and their interconnections with the principal aim to connect people. They put interest on the human side, instead Social Media on the content material side.

The frequent definition of Online Social Network is described in [22], where it is described as an online platform that gives offerings for a user to construct a public profile and to explicitly declare connections between his/her profile and those of other users. Moreover, an OSN enables a user to share content that are no longer solely public but also non-public or limited to a

subset of users. By taking into account this difference, we can say that current Blockchain-based social functions are no longer Social Networks, but Social Media platforms, and we refer to them as Blockchain-based Online Social Media (OSM). Reddit⁶ is the Social Media Platform taken as instance to define most of the present day Blockchain-based Online Social Media. In Reddit, content material is public, available to anyone without the concept of relationships and friends. It does not require users to establish connections to use the service.

4. Blockchain-Based OSM Proposals?

Today, the blockchain technology is applied to various research fields, and during the last few years several Blockchain based Social Media have been proposed [11, 23]. Several of them are nonetheless under development, but platforms such as SteemIt, have surpassed greater than 1M of users.⁷ The fundamental goal of all these platforms is to overcome the issues of modern OSNs, in particular Facebook. We identify four common points which represent the most important traits of these structures:

- No Single-Point of Failure. Current OSMs are centralized and this means that they are vulnerable to attacks, such as data breaches and hacks. Instead, Social Media platforms based on blockchain do not have a single point of failure, thanks to the decentralization of data. Indeed, the decentralize nature eliminates the control by a single entity, and since every transaction is tracked, it becomes impossible to tamper with data.
- No Censorship. In countries like China, North Korea and Syria there is an active block of social media websites. This means that citizens can be blocked by the government from accessing social media and certain content. The concept of decentralized content offers a possible solution to overcome the problem of censorship, even if each user can still be found through the location, IP addresses, etc.
- Rewards for Valuable Content. A content creator or a simple social media user can be rewarded for valuable content with cryptocurrency payments. Thanks to the blockchain, the rewarding phase is transparent because transactions are tracked and audited by everyone. This represents one of the main points of a blockchain-based OSM because rewarding is considered the success key to give value to content, to build an economy model, etc. In particular, most of the current platforms take inspiration from the attention economy [24] and the token economy [25].
- Content Authenticity. People have been exposed to fake news, and current OSMs do not have specific solutions to face this problem. Instead, the usage of the blockchain technology is useful to treat this problem by using economic incentive to both rank and reward content.

All the Blockchain social proposals are based totally on these;

4 Common points. In detail, the Single-Point of Failure problem is faced by exploiting the blockchain science which is decentralized. Thanks to the blockchain, also the hassle of No Censorship is faced. Indeed, the immutability of the blockchain means whole freedom from censorship, and human beings are free to share information. As issues the other two points, they are strictly correlated to the content. The Content Authenticity is faced by means of introducing particular beneficial systems; rather to evaluate the cost of content precise mechanisms are proposed, such as the dislike button. In the rest of the section, we endorse an overview of the essential Blockchain primarily based OSM structures in order to highlight the major characteristics and how these systems are dealing with the most important drawbacks of current OSNs. Furthermore, we describe the social characteristics of Blockchain-based Social Media by using record a set of properties acquired from the centralized Social Media. Finally, we highlight the important traits about the decentralization of these platforms.

SteemIt

SteemIt is a social media platform where everyone can receive a reward for creating and curating content, in the form of the Steem cryptocurrency [26] Today, SteemIt is the most well-known Blockchain-based OSM with more than 1 million of users [23]. A difference between Steemit and other platforms is that there are three different kinds of currency units: Steem, Steem Power (SP), and Steem Dollars (SBD). Steem is the unit that is bought and sold for actual money on the open markets. It represents the principal cryptocurrency of the network and the other two kind of units are dependent on it. Steem Power is a kind of long term investment because people cannot sell this unit for 2 years. Who has the Steem Power Units has also the ownership in the network. Indeed, 90% of the new Steem unit generated every day is distributed among who already hold Steem Power Units. Moreover, the more Steem Power Units a user has, the more the user vote will count, as we explained in detail below. Steem Dollars are a stable currency which never loses its value, and people can sell it at any time. The main concept is that the community should be recognized for the value it adds. Indeed, the platform is based on three important principles, as emerged from [27]. The most important key principle is that who contributes with content should receive payment, or debt from the venture. The second principle is that all forms of capital are equally valuable, and the third is that the community creates value which is useful for the members of the community. The platform is based on the Steem blockchain, which is a social blockchain developed to support distributed social media applications. In SteemIt, the usage of the blockchain provides a robust platform without a single point of failure. Indeed, SteemIt is fully distributed. Steem is built upon Graphene, 9 which is able to sustain over 1000 transactions per second on a distributed test network. The first consensus protocol used was the Proof-of-Work (PoW), instead today, Steem uses the Delegated Proof of Stake (DPoS) [28], and it does not have miner, but witnesses to produce blocks. Block production is done in

rounds, and for each round, 21 witnesses are selected to create and sign blocks of transactions. The 21 witnesses are shuffled every round to prevent one witness from constantly ignoring blocks produced by the same witness placed before [27]. Any witness who misses a block and has not produced in the last 24 h will be disabled until its block signing key will be updated [27]. A witness who is not able or do not want to produce blocks can set its block signing key to the null public key, and it will no longer be scheduled. As concerns the reward, 10% of the block reward goes to the witnesses and 90% of the block rewards goes to content creators, curators. In Steemit, users play a key role in distributing rewards that depend only on their votes. The protocol that regulates the rewarding process is called Proof of Brain. The rules of the protocol define that the value of a content is based on users votes, and afterwards the total value of the content is distributed among the users who contributed to its creation and curation. Steemit operates on the basis of one-STEEM, one-vote, instead of one-user one-vote, as in other platforms. Within this model, individuals who have contributed the most to the platform have the most influence over how contributions are scored. Content value is determined by the votes it received after 7 days from its creation. There are two types of vote: upvote, that increases the content value, and downvote, that decrease it in order to manage the fake news issue (a user can express that the content is not good enough). In addition to the number of upvotes and downvotes, the value is also influenced by curators Steem Power and by how many Voting Power they decide to give to their vote. Voting Power (VP) is a mechanism to limit the number of contents voted by a user in a limited period of time. Each user has his own VP, or Voting mana, and, for each vote he gives, a curator can set a weight w , from 0% to 100%, to associate with it. The higher w is the more influential the vote will be. The total payout for a content is $RS \cdot rb/rc$ where RS is the total shares accumulated by the votes, rb is the reward balance, and rc is the recent claims and they are global variables.

A peculiarity of the SteemIt community is that users are divided into categories based on their amount of Steem Power:

- Plancton: They are the newly registered users on the network, with less than 25 SP.
- Minnow: With an amount of Steem Power between 25 and 500
- Fish: They are the users with at least 500 of Steem Power, but less than 5000. This is an important result for many users, because whoever has at least 500 SP can decide what weight to give to their vote.
- Dolphin: This category contains users with a SP amount between 5000 and 50, 000. These users have some influence within the network and their 100% vote is worth at least 0.1\$.
- Orca: Some of the most influential users of the network, with an amount of Steem Power between 50, 000 and 500, 000; their votes have a value greater than or equal to 1\$.
- Whale: They are the most influential users of the network, with more than 500, 000 Steem Power. Their vote is worth at least 10\$, which is why they often grant

it only upon payment. The inequality of this classification is one of the most important criticisms made of SteemIt.

Lit

Lit10 is a platform created to integrate social media offerings and cryptocurrencies, similar to Instagram and SnapChat. The principal feature of Lit is that customers can share tales by means of Lit Stories and their stories allow to acquire Mithril tokens (MITH), taken by considering the affect and affect of these tales across the network. Stories are any content a user can share: photos, slideshows, videos, posts and many others [29]. Lit platform is based on the Ethereum Blockchain, and all transactions will be secured and validated via Ethereum clever contracts. The consensus protocol is the PoS The rewards of precious content is primarily based on the social mining concept.

Social mining represents the key concept, and it is primarily based on the concept that customers who produce content need to be rewarded with the aid of taking into account various factors. Indeed, the greater network price users carry to the platform, the more MITH they will earn. The rewarding value, has a aggregate of a number of parameters: views, likes and watches, selected to consider the recognition of a content material and to compute ore. ore is defined as uncooked mined variety of some kind of rankings that can be exchanged for real tokens. Special weight functions are delivered to the feature that defines ore to provide a unique significance to the three parameters. There are three users: David, Bob, and Carol. They are new users to Mithril and have zero MITH each. During the day by day activity and in the span of one week, David contributes four tales and receives 400 views and 0 hearts, Bob contributes 5 tales and receives 200 views with 80 hearts, and Carol contributes nothing to the network. Using the social mining algorithm, and by using fixing the per view weight at 1 and the per coronary heart weight at 5, David will have mined 400, Bob at 600, whilst Carol has mined 0 Through a particular computation, the total Mithril Reward for one week was mechanically determined to be 10, 000 MITH: 4000 MITH to David, 6000 MITH to Bob, whilst Carol will acquire nothing. Beside the ore score, there is the Purity score that distinguishes the share of creator's contribution from all different contributions inside a described period, the variety of all tokens distributed among content creators at some stage in a length of time, and finally the range of tokens, obtained by the content material creator. The Social Mining mechanism is no longer transparent, and can be changed at any time. Moreover, the system does no longer consist of any mechanics to protect from Sybil attacks, so we can't be sure that there is a trustworthy distribution between the content producers who create treasured content. At the fine of our knowledge, no express mechanism for content authenticity is proposed. This capacity that the solely way to evaluate a content material is the like button, and that bad impact about a unique content material cannot be expressed. MITH tokens are stored in the Mithril Vault and they can be used to pay for

services, or they can be exchanged for Bitcoins (BTC) and Ethereum tokens (ETH). As difficulty the content storage, it is no longer clear which technology is used, however it is clear that content is saved outside the blockchain. Probably, the platform uses a allotted file system, like IPFS [30]

HyperSpace

HyperSpace, earlier Synereo, is described as a blockchain- based OSM based on the Attention Economy to reward precious content. HyperSpace provides community-owned spaces where registered customers can create and share content material which has a cost inside the community. Indeed, customers are rewarded and identified for their activity. The attention economy is a subset of the data economy which concerns in the definition of a marketplace where consumers agree to receives services in exchange for their attention [24]. In [31] the logic behind the attention is linked to both the quality and quantity of information. The hassle of attention affects Social Media in general, and in specific blogs [32]. HyperSpace is at the forefront of integrating Universal Basic Income (UBI) into the attention economy space. UBI is a mechanism for distributing financial energy among people equally, allowing them a minimal participation in the economy.

The cryptocurrency used inside the system is AMP. The modern version of the gadget is based on WildSpark, which works as a distributed meta layer. Wildspark is a new modern decentralized platform which lets in to easily reward humans who share content. It permits content material creators to monetize their present works besides relying on centralized systems [33]. HyperSpace does no longer provide detailed statistics about the beneficial system. When a consumer discovers a good on line content, the Attention Economy Layer permits he/she to make investments a positive amount of AMPs and share it with different customers in the platform. "Amplifying" is an action handy to each consumer that means balloting a content, as the basic like button. Amplifying a piece of content material on Wildspark means that a consumer is able to share a hyperlink concerning the published content with others. Friends and followers, who acquire and click on the link, will be directed to this content embedded in WildSpark. Thanks to the amplification process, one 1/3 of the amplification goes to the creator of the content, another third to the curator who shared it, and the final AMPs go to a frequent pool called Fractal Reserve [34]. Thanks to the Amplifying action, customers can be rewarded for their content. In detail, the mannequin provides: the 60% allocated to the creator, the 20% allotted to put up engagement participants break up between the pinnacle ten contributors, the 18% allocated for Space Managers and the Space Admin, and ultimately the 2% is allocated to help that the HyperSpace economic system and the number of AMPs circulating remain proportional to the amount of endeavor taking place. Additionally, people can share content material from HyperSpace to other social networks, and creators are rewarded when a friend, of every other social network, clicks on the link and amplifies the post. The creator

receives 85% and the buddy obtains the 15%. For sake of readiness, the amplifying motion is the solely way to assurance the authenticity of the content. Top contributing customers are got with the aid of exploiting the User Power. The User Power score is updated every time an engagement match takes place involving the user. To avoid that the same customers continue to be dominant due to their previous activity, the User Power decays over time.

The system is a little contradictory as issues the no censorship problem even if the blockchain helps to face that problem, because the system offers the possibility to create a non- public space, and the moderator of the area can approve publish manually.

At the fantastic of our knowledge, records are saved in a decentralized cloud, in detail IPFS. A new submit is uploaded to HyperSpace's centralized server as well as to HyperSpace's IPFS node. The publish is disseminated to other IPFS nodes and becomes retrievable from the cloud. The most important issue of the system is that the gadget is no longer totally dispensed due to the centralized server, wished for rapidly response. This potential that it may want to be a viable single point of failure, even if the decentralization of data permits to easily repair the system. As issues the blockchain, HyperSpace have changed few technologies. At the beginning, it used the RChain blockchain. Afterwards, the platform has been renamed, from Synereo to HyperSpace, and launched, in Beta, at the starting of 2019. It is based on Omnilayer, 11 which is a software program layer constructed on top of the Bitcoin blockchain. Omni transactions are Bitcoin transactions.

Sapien

Sapien is a social news platform with the principal intention of fighting pretend news by giving users more control over their data. Instead of the use of Twitter, YouTube, Facebook, etc. for different forms of news and media, users can use Sapien for everything. Users are capable to decide which personal facts they share and with whom. Moreover consumer has the energy to control the information they obtain via tailoring received news with their interest. One of the imperative standards of the platform, in terms of fake news and precious content, is to prepare the first Democratized Autonomous Platform. This means that users are in a position to vote on proposals within a virtual community, facilitating democratic choices at the neighborhood level. The Sapien platform is flexible and permits users to have a public or private identity. This means users can function with their actual identities or in anonymity whenever they want. Indeed, Sapien allows storage of identities on the Blockchain for the purpose of identification. Sapien uses the Ethereum blockchain and introduces a new cryptocurrency, the SPN token. In order to be rewarded for contributions, a user ought to have staked SPN. Unstaked SPN can be staked through locking it into a separate clever contract for a fixed length of one year [35]. Upon completion of the staking contract the SPN will be returned to its unstaked form. A peculiarity of

Sapien is the Content Authenticity. Indeed, to protect the works of the content material creators on the platform, customers observed guilty of leaking top class content, will have 100% of their tokens frozen, the account banned, and IP address permanently blacklisted. The rewarding machine is based totally on the Proof-of-Value. The Proof-of-Value protocol is the major approach to distinguish and reward treasured content via preventing the proliferation of pretend news. Contributions of users are evaluated and users accumulate a score that displays the popularity they have. Reputation is represented by a recognition score that is saved in the SPN token, and it is at the start set to one. The fee of the reputation score can expand or limit depending on the fee the person provides to the platform. In order to provide a greater accurate illustration of the fee of a contribution, consumer votes are weighted through taking into account the user's perceived fee within a community. The recognition system implements the Proof- of-Value protocol with the aid of using the Backfeed Protocol.¹² Rewards are disbursed by a vote casting process, referred to as Charges. Charges are votes assigned to users based on their Sapien Staking Tier. The extra Charges a post receives, the extra SPN Rewards that put up will receive. Charges are additionally the sole identifying element on how a content material is treasured or not. Indeed, when a person gives a post a Charge this capacity that specific submit is adding fee to a community and it deserves to be rewarded. Another important function is the introduction of a marketplace. Indeed, customers are able to buy and promote physical and virtual goods, services and content on the marketplace the use of SPN tokens. Reputation scores are built-in into the marketplace, enabling users to be assured that the vendor they are buying from is dependable.

SocialX

SocialX, as all the previous platforms, is decentralized and permits customers to provide feedbacks to content material and reward tokens. SocialX is absolutely decentralized as described in [36], which skill that all media (photos and videos) and information (messages, posts, etc.) are saved in a decentralized manner. The primary aim of the platform is to face the trouble of pretend accounts, fake followers, and fake votes (likes, etc.). Indeed, the selection energy is given to communities, which can figure out what content material is valuable. The community is the principal notion which can decide which content can be rewarded because the platform has the property of self-governance. In detail, when a consumer uploads a content, SocialX reads it as a uncooked file, and creates a reproduction to optimize the performances of the platform Then, the software uses IPFS to decentralize and keep the two files, in specific Infura, ¹³ which is a hosted Ethereum node cluster that lets users run the SocialX utility barring requiring them to set up their own Ethereum node or wallet. Blockchain nodes are used to retailer transactional operations and to function clever contracts. Finally, the utility uses friends and exquisite friends nodes in the structure in order to have sufficient computational power and storage, allowing SocialX to run as correctly and secure as

possible. In terms of privacy, SocialX makes use of zero knowledge proof technology to gain bi-directional encryption, and to allow one celebration to verify what the different celebration is announcing except without a doubt trusting that party.

The token used inner the device is SOCX, which is a special token that can be used in a number of ways: to engage with your pals on SocialX, or to make purchases. The assessment of a precious content and the content authenticity are strictly correlated, and they evaluated through taking into account the community. Indeed, SocialX provides to the person the preference of a ordinary like, Superlikes and Dislikes. Whenever a person is rewarded via the upvote system, the transaction is recorded on the Ethereum blockchain. No all moves can be rewarded, for instance registration and dislikes are no longer rewarded, due to the fact SocialX defines Dislike and Superlike as special actions which can be given to customers in a limited amount. For this reason, customers can like as many photographs and videos they want, however they have only a confined quantity of Superlikes and Dislikes. The variety of Superlikes and Dislikes can increase based on the amount of followers an character user has, as well as, based totally on how a user is related in the SocialX community. The Dislike characteristic is useful to identify spamming, low-quality content, license abuses or inappropriate content, pretend news, etc. Unfortunately, the details about how the rewarding system is applied are still unknown. Censorship is not allowed thanks to the decentralization of data, as for the other platforms. The judge of the content material is the neighborhood which can forbid content material that does no longer admire the community tips through the use of tools and algorithms to without difficulty get right of entry to content and flag it as inappropriate.

Forestring

FORESTING is a new Blockchain-based Social Media consisting of the social media ‘FORESTING’, the digital banking services for participants, ‘FORESTING Bank’ and the ‘FORESTING Lab’ to support the community and content creators [37]. The system, as all the other platforms presented before, is principally focused to reward valuable content and to guarantee content authenticity. FORESTING relies on blockchain to deliver and reward valuable content by using a distributed consensus protocol. In FORESTING, users can benefit economically just by getting ‘Likes’, called PICK, through the blockchain. PICK counts should be used wisely as each user is given 24 PICKs a day. By clicking PICK, a user can increase the value of his/her favorite contents. Charging time is 1 PICK per h. Users can also tap ‘Shooting’ to donate to their favorite contents and content providers. This feature is one of the way to directly support other users and can be sent with a message. The rewarding system of the platform is based on how active users are. Content creators receive Berry rewards based on how many PICKs (votes) they collect. The system uses the FORESTING Interaction (FI) index to evaluate the entirety of each user’s activeness and the reactions they receive for their contents. The user’s level

increases based on the FI index, and Berrys are rewarded according to the level the users reaches. In short, the higher the level a user reaches, the greater the benefits the user receives. FORESTING Network is based on the PTON Token. Users do not receive PTON for their social activity. Indeed, they collect Berrys which is a point obtained in Foresting by PICKing others’ contents, being PICKed by others, and receiving Shooting. Berrys can be exchanged for PTON. The rewarding system provide the 50% of the value to the creator of a content, the 25% to the curators, and the last 26% to all the participants. The purpose of FORESTING Bank is to support financial services required by users. Indeed, users can contribute to the platform through a variety of activities, and the contribution is computed by using a new contribution assessment model presented by FORESTING Bank. The FORESTING Lab is an offline collaborative space for users which is accessible to any participant of the FORESTING Network.

This space provides a place for users to create good quality content to provide support for content creation. The initial FORESTING system is built on the Ethereum blockchain, and all the activities are recorded on the it. If a malicious user posts too much, or goes beyond the limits of the activity that the blockchain can serve, the service may become paralyzed. For this reason, the number of posts that an individual can produce is limited. One of the main goal of FORESTING is improving the performance of the PoS consensus algorithm by minimizing the discarded blocks that appear while creating blocks via stake. It also boosts the synchronization speed and throughput rate among nodes by minimizing the generated blocks by delayed nodes.

The other main strong points of FORESTING are:

- Real-time Trade Function through Embedded Exchange. Provide real-time trading function by embedding major exchanges around the world;
- Master Node-based P2P Transaction. Minimum of 10 coin openings per user. There is an RPC module provided for each coin access. It provides basic operations and master nodes for node operation. These master nodes, or wallets, can be connected to FORESTING by payment channels, state channels, etc.;
- Coin Shooting. In addition to the ‘PICK’ button, users can also donate Berrys by the Shooting action;
- Open Market Advertising. Advertisers and advertising agencies can upload their advertisements and advertising proposals to the advertising pool category. Content creators can select the advertisements they want and post it on their content pages for rewards.

Minds

Minds is a free, encrypted, and reward-based social networking platform based on Ethereum, and launched in 2015. Minds has been developed as a blockchain application with the intent to face the censorship problem.

Indeed, content are free, without the risk to be censored or subverted. As for the other Blockchain Social Media, the blockchain technology guarantees the decentralization by excluding the single point of failure, and the immutability property helps to face the censorship. Today, Minds has over 1.5 million registered users. For what concerns the other two important points, listed at the beginning of Section 4, Minds rewards users for their activities on the site. In particular, the current rewarding system has been proposed in 2018, and the tokens, called Points, are built upon the Ethereum ERC-20 standard. Each action on the site is worth a different number of points. These points are then added up to the daily contribution total and the total amount of tokens are given by the following Equation:

$$UserTokens = \left(\frac{User_Contribution_Score}{Totale_Net_work_Score} \right) * Daily_Reward_Pool$$

5.Social Properties of BOSM

The proposal platforms are defined as Social Media platforms because, as just explained in Section 3, there is a big difference between Social Media and Social Networks. For sake of readiness, Social Networks can be considered as a specific type of Social Media. Indeed, Social Media can be classified into 13 different types, as described in [38], and the Social Network is a type.

Social Media platforms have several social properties strictly related to the provided social services [39, 40]. We identify a set of social characteristics, which can be identified in current BOSM, in order to better characterize the social value present in BOSM. Table 1 reports the identified social characteristics. In detail, we analyze the content visibility, which is really important in terms of privacy. Indeed, current OSNs give the possibility to decide the type of visibility a content has: public, which means that the content is visible for every user of the platform; protected, which means that the visibility can be restricted to a subset of friends explicitly selected by the content owner; finally private means that the content are accessible only by the owner. Furthermore, we analyze the Social Media communication model (“Comm. model” field): symmetric, as in Facebook, where a relationship between two users is established when the two users accept to be friend; asymmetric, as Twitter, where users can follow other users without them following back. Then, we evaluate the integration with current OSNs (“OSMs Links” field) to share content outside the BOSM. We evaluate the type of Social Media by taking into account the 13 different types presented in [38]. We analyze if the proposed platforms provide mobile application (“Mobile App.” field). This is an important feature by considering that more than 3.4 billion people in the world’s social media users, access social platforms via mobile devices.¹⁵ Finally, we highlight which OSNs are taken as model to develop the, BOSM in order to understand the social activity of the platform (“Inspirational OSM” field). Instead, the others are classified as Discussion forum because the provided social services are similar to Reddit, Medium, etc.

6.Summary and Open Problems

Blockchain-based OSMs are different from most of the other blockchain applications, such as BitHealth as health records storage, BitCongress as voting system, or BitCoin and Ethereum, because users do not need to sacrifice money or hardware to earn a significant profit. The main aim is to provide meaningful and interesting contents rewarding with tokens by taking into account the social impact of content in the network. The analysis of the platforms provided in Section 4 has highlighted two important technical considerations concerning the usage of the blockchain and the level of decentralization. In details, there are different levels of decentralization and different types of usage of the blockchain, For sake of readiness, with the term “Integration” we refer to how the platform is integrated with a blockchain. Indeed, most platforms are only partially integrated, other platforms are not using the blockchain at all, and another set of platforms entirely runs on the blockchain. Furthermore, with the term “Decentralization” we refer to the fact that many platforms need to start off much more centralized, and the decentralization is fully or partially integrated.

The evaluation considers two different states for both Blockchain Integration and Decentralization level: Partially or Fully. As we can see, Steemit and FORESTING are the only analyzed platforms which exploit a fully distributed architecture and they are fully integrated with the Steem Blockchain. The other platforms are classified as partially, because in some cases, they store data offchain and only during a second step, data are stored in the blockchain. HyperSpace is the worst one due to the possibility to approve every post manually given to the moderators, which drastically reduce the level of decentralization.

Furthermore, as concerns the problem of fake news and the quality of content, only a subset of the proposed platforms provide a way to express a negative opinion. SteemIt, SocialX, Sapien, FORESTING, and Minds provide the downvote action. In particular, SteemIt provides a weighted downvote, where the weight can be decided by taking into account the user’s category (whales, dolphins, etc.). For all the other platforms, the only way to express a negative opinion on content is the not voting. This means that a negative opinion is equal to a neutral opinion. To summarize the main goal of this analysis, there are a plethora of new blockchain-based OSM platforms which really re-thinking the way content can be shared and who should be the main beneficiary. To focus our attention on current proposals, and in particular on the characteristics we highlight a list of problems:

- Identity checking. The blockchain is an open database and anyone can register more than one account, but also bots programmed to have specific malicious behavior. Few blockchain-based OSMs are facing this problem seriously. Steemit’s solution at the beginning, to avoid Sybil attacks, was to have people who have staked a lot of tokens to get more rewards and dictate the hot/trending feed. But that completely destroy the ability of the system to find the best content as Reddit

does (aka the Wisdom of the Crowd). So the solution to solve abuse while providing high-quality content to the end users as yet to be found and implemented.

- Scalability. In OSNs, the frequency of the user activity is very high. For example, Facebook has about 52, 000 likes per second, without include posts, comments, replies, or shares. Blockchain social platforms should take into account this high content creation by facing the problem of finding a scalable blockchain technology.
- Decentralization of content. The problem of using a blockchain as storage is that the content could be too large in terms of size to be stored on it. For this reason, several current proposals rely on distributed storages, like IPFS. This is similar to the previous approaches proposed in DOSNs [1], in which Distributed Hash Table are used to store or to index content. This does not resolve the problem of control over data, because also in this way users need to trust in users who store data.
- Content Visibility. The visibility of content is public in each current proposals described in Section 4. This is good for the monetization of content, but it is completely in contrast with the socialization of users which should provide public communications, but also private ones.
- Blockchain technology. Another problem is the choice of the blockchain technology. Current proposals use Ethereum, but they show the drawback of this choice. Indeed, they are still investigating a specific solution. There is the need to find the best blockchain technology and the best consensus algorithm, which takes into account the need of social network users, which spend several minute per day on these platforms, but the session length is short [41, 42].
- No censorship. The problem of using the blockchain is that a concrete control of data is necessary to verify the legality of content. This does not mean that there is the need of a centralized control, because the users participation can help to retrieve illegal content. However, when content is published, it is stored into the blockchain, and by considering the immutability property, it cannot be deleted. The user can be banned, but the content is still available. This a big problem concerning the no censorship adopted in those systems. For sake of readiness, Steemit is the most popular front-end interface to the Steem blockchain. SteemIt would have banned a controversial user, censoring his content, which, however, is still available on Steem's blockchain.

These open issues characterize actual issues which do not provide a clear motivation to the need of blockchain as storage or as aid to supply a public view of the content. Furthermore, these platforms are not completely decentralized which means that one of the four frequent factors is now not absolutely faced.

This capability that the problem of the single point of failure cannot be excluded. Steemit is the only platform which depends to the Steem blockchain in a thoroughly decentralized way. The primary specific between all the platforms worries the rewarding system used to reward users. The analysis of the small print of which beneficial system is the fantastic one is out of the scope of this paper, alternatively we can say that the introduction of crypto values changes the primary aim of these structures which are basically primarily based on the beneficial barring an interest to the first- class of content, as instead BOSNs want to do.

7. Conclusion

Blockchain technology is considered one of the main disruptive technologies of the millennium. Several research fields have tried to use it by exploiting its intrinsic characteristics. In this paper, we propose a survey of Blockchain-based Online Social Media, by explaining the main characteristics both technical and social, and we described the current platforms. We listed several current problems of these platforms and we proposed a possible new model which faces the problems listed above concerning the usage of the blockchain. In particular, the content visibility and the privacy issue. We described how the proposed model represents an extension of the Decentralized Online Social Networks and how the Blockchain, as a tool to manage the access control. We are analyzing the proposed model, in another work, in order to evaluate the impact of privacy policies on Social Media. We plan to evaluate various privacy policies approaches, and we plan to investigate more in detail current BOSNs, such as Steemit, by retrieving data from the blockchain in order to evaluate how the social activities of BOSM's users is far from the current OSN one.

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