

CONNECTING BLOCKCHAIN TECHNOLOGY WITH LIBRARIES: OPPORTUNITIES AND RISKS

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This study describes a systematic investigation of blockchain technology and its applications across various domains with main focus on libraries. The concept and working of blockchain technology are discussed with respect to multiple domains to emphasize how the peculiar attribute of this technology can revolutionize 'library practices'. Opportunities and Risks of blockchain are also discussed to guide the users of blockchain technology. Based on this study, the authors tried to make library professionals aware of this emerging technology and assist them in taking some initiatives for its appropriate application in libraries.

Keywords: Blockchain, Libraries, Bitcoin, Hash, Decentralized network.

INTRODUCTION

In the year 2008, an anonymous group named as Satoshi Nakamoto, which was responsible for Bitcoin, described how the blockchain technology working behind the bitcoin could be exploited to tackle the problem of double-spending and administering the order of transactions (Nakamoto, 2008). Right from the discovery of the steam engine or electricity or Information and Communication Technology, Blockchain concept or technology is considered as a segment of the fourth industrial revolution. Blockchain is the major technological aspect behind cryptocurrency based present day products (Chung and Kim, 2016; Schwab, 2016). Bitcoin combines various inventions like b-money, time-stamping, Hash cash and Merkle Tree to create a decentralized system that does not depend on the third party for the authorization of currency issuance or validation of the transaction (Miau and Yang, 2018). "A blockchain is an electronic ledger of digital records, events, or transactions that are cryptographically hashed, authenticated, and maintained through a distributed or shared network of participants using a group consensus protocol" (Condos et al., 2016).

In the age of digital era, Internet users face one major challenge of doing financial transactions in a system where they are unable to trust or know the other party. Due to the development of cryptocurrencies like bitcoin, some of the trust issues have been solved. Including cryptocurrency,

blockchain ledger has many potential uses outside of the currency market like distributed ownership records, creating a tamper-proof document, and universal medical records (Hoy, 2017). Blockchain technology has the capability of transforming the current Internet from “The Internet of Information Sharing” to “The Internet of Value Exchange.” (Chen et al., 2018). Library professionals and users are not untouched with the technological changes, in fact, they are highly influenced by these changes. So, it is very important for them to understand emerging technologies like “Blockchain”, how it works? where to apply? to satisfy the needs of users and what are its potential benefits and risks?

The structure of this article is: In section 2 Literature review of blockchain technology and its potential uses has been discussed. Understanding of blockchain technology and how it works has been described in Section 3. Section 4 establishes the connection between blockchain technology and libraries. Risks and opportunities of the blockchain technology are elaborated in Section 5. Finally, Section 6 concludes this article with suggestions and the future of this technology.

LITERATURE REVIEW

Blockchain is an emerging technology and yet have to be developed to reach its matured state. In recent past, many researchers have strived to review the literature on Blockchain (Cao et al., 2017; Conoscenti et al., 2016; Karafiloski and Mishev, 2017; Yli-Huumo et al., 2016) by focusing on its concept, research methods and applications in the specific field, such as big data and IoT. Blockchain has many potential applications due to its immutable, transparent and trustworthy nature of transactions performed in

a blockchain network (Underwood, 2016). For example, in the field of education by realizing “learning is earning,” blockchain technology can foster student’s learning motivation (Chen et al., 2018). According to Hoy (2017), blockchain is a new fundamental technology that could transform transaction-based activities, as did by networking protocols during the inception of the Internet. Bheemaiah (2015) points out the main differences between blockchain and those networking protocols and specifies that “TCP/IP allowed instant transmission of information but the blockchain protocol allows the instant transfer of value”. Similar to artificial intelligence and other disruptive technologies, blockchain has the capability to change many of the institutions that are built by humans (like insurance companies, banks etc.) and to dislocate the administrative workers that nurture those institutions (ALA, 2019).

Lemieux (2016) suggested that in the present and near future, the issues related to information integrity can be easily addressed with blockchain technology if there is a presence of proper security architecture and information management control. However, the reliability of information is not guaranteed and would have certain limitations for maintaining trustworthy digital records. Governatori et al. (2018) studied the relationship between contract and blockchain system. Christidis and Devetsikiotis (2016) gave a detailed description of how smart contracts and blockchains work, various pros and cons are also identified when blockchain is introduced to a system and highlights the ways through which blockchains and IoT can be used together. Blockchain can be utilized for voter registration

and validation, to ensure the legitimacy of votes by developing a publicly available ledger of the recorded vote (Sarmah, 2018). Nicholson (2017) analyzed the literature to understand the problems faced by developing nations and how Bitcoin and blockchain could be used to reverse some of the corruption or socio-cultural issues faced by these countries. He suggested that public library systems in these countries can act as facilitators for this technology as they provide access to the Internet and desktop computers, which narrows the digital divide. There is an investment of about \$1 billion by firms providing financial services on blockchain-related entities (Condos et al., 2016). A mind map of various applications based on blockchain technology has been depicted in Figure 1.

WHAT IS BLOCK CHAIN AND HOW IT WORKS?

The Blockchain revolution may be categorized as Blockchain 1.0, Blockchain 2.0 and Blockchain 3.0. Cryptocurrencies are an application of Blockchain 1.0 which is related to day to day digital payment-based systems. Blockchain 2.0 is related to the whole economical market, where Blockchain technology is used to expand traditional transactions like bonds, stocks and smart contracts. While Blockchain 3.0 includes all those applications which are not included in the scope of Blockchain 1.0 and 2.0, like digital health records, digitally vote counting and digital art (Swan, 2015). According to Chen et al. (2018), the current applications of blockchain technology is still in the 1.0 and 2.0 stages.

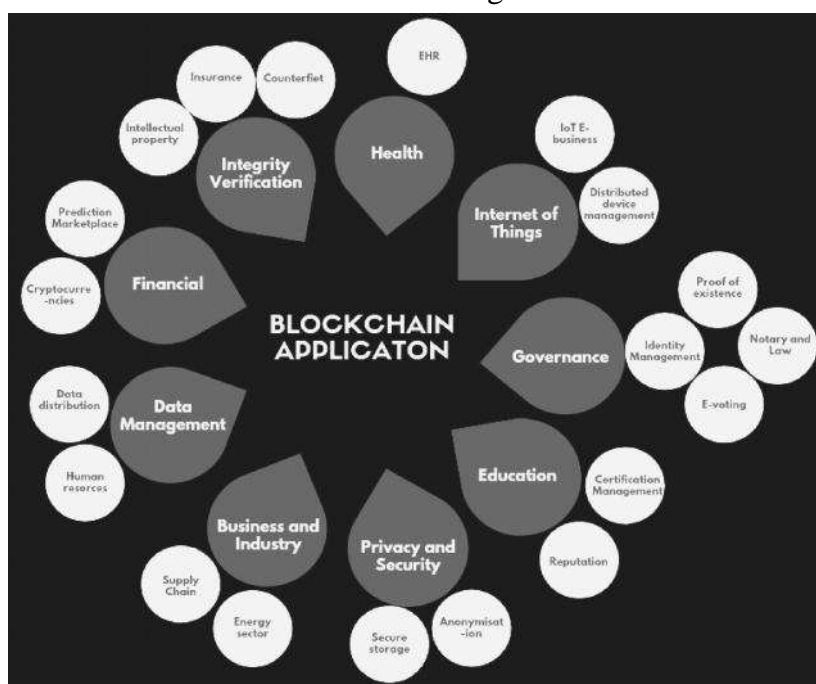


Figure 1: Mind map of blockchain-based applications

Blockchain technology is normally attached with cryptocurrencies like Bitcoin. It is a distributed database of records of performed

transactions, and which is maintained and validated by a network of computers (nodes) around the world. The records are handled by a large

community of people and no individual person has control over it and none of them can go back and erase or change a transaction history. Like a contemporary centralized database, the information in it cannot be changed due to blockchain's distributed structure and confirmed guarantees by peers. Blockchain facilitates anyone on the network to access everyone else's records which makes it difficult for one central individual to gain control of the network. Whenever a transaction is performed, it goes to the network and the authenticity of the transaction is determined by a computer algorithm. If the transaction is verified by the computer then this new transaction is linked with the previously performed transactions and results in a chain of transactions. This chain is called the blockchain.

A decentralized network is an idea behind this technology which means it is based on peer to peer network (Sarmah, 2018). The computer algorithm which checks the authenticity of transactions is based on the concept of 'hash'. When the transaction is performed, the contents of the specific transaction are encrypted using an appropriate mathematical algorithm. In the end, the output which is obtained with a short digest of data is known as a hash. The hash of a transaction found outside the specific blockchain and the hash which is registered within the blockchain will be very much same if said transactions are identical. On the other hand, if the transactions are different, the hashes will mismatch (Condos et al., 2016). The pictorial representation of the overall concept is depicted in Figure 2.

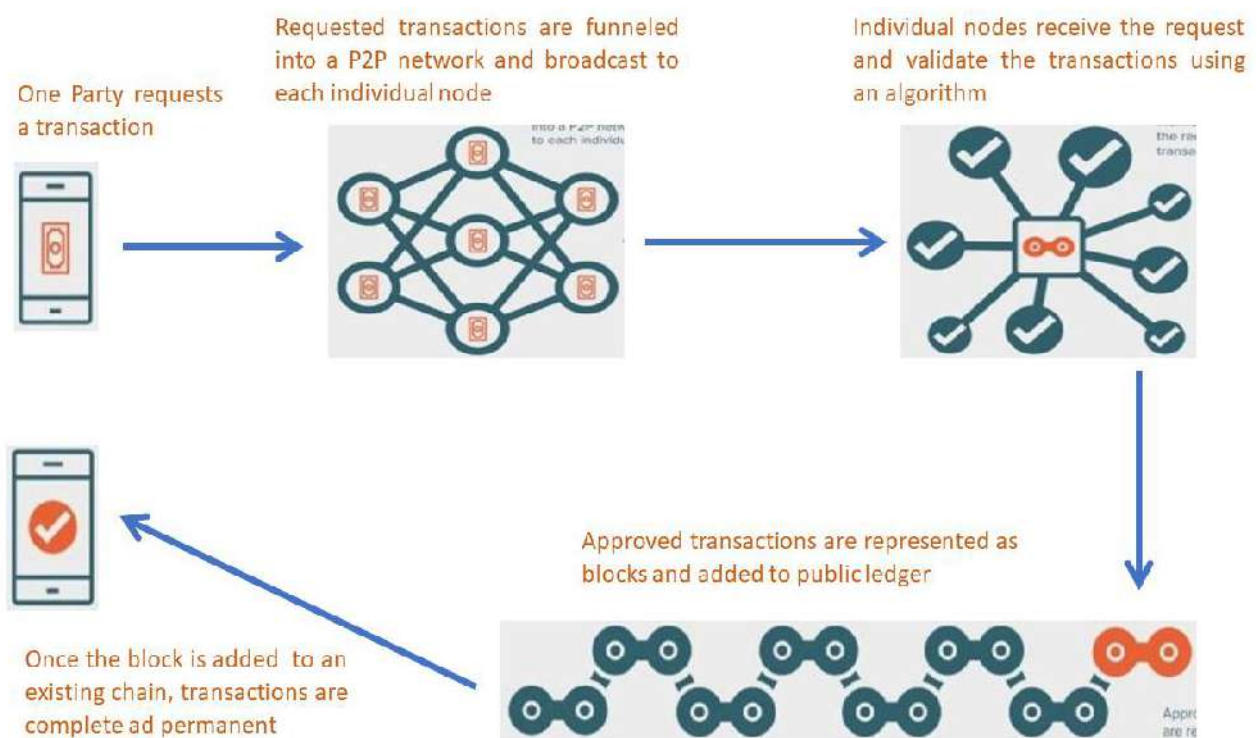


Figure 2: Picture depicting workflow of Blockchain technology. (Source: G2 crowd (<https://www.g2.com>))

CONNECTION OF BLOCKCHAIN WITH VARIOUS ASPECTS OF LIBRARIES

Emerging technologies provide librarians with a unique opportunity to promote and facilitate collaboration among libraries and their users, and to enhance user-centred services. It provides an opportunity for library professionals in identifying, collecting, organizing, customizing and delivering information products and services to the users on-demand or anticipation (Ragavan et al., (n.d.).

The information stored in the blockchain environment is distributed and have tamper-resistant setting. Conventional librarians always use to gather, preserve and share authoritative information, which has a similar nature like blockchain. In the case of journal articles blockchain has a potential use of creating verifiable and time-stamped versions of it (Hoy, 2017). Another use of this technology can be seen in the field of scholarly publishing where it can be used for managing submission process of manuscripts, reviewing manuscripts in a timely manner and for its further verification (Casino et al., 2019). Blockchain can also be used for transferring funds from libraries to vendors and maintaining contracts and records (Coghill, 2018). According to Hoy (2017), Irving and Holden successfully examined the use of the blockchain “as a low cost, independently verifiable method that could be widely and readily used to audit and confirm the reliability of scientific studies”. So, in a similar pattern, it can be applied for the audit purpose of the libraries. Reliability and accuracy of record are not assured by Blockchain technology. Instead, it can assure transaction authenticity by confirming party/parties submitting a record, record content, date and time of the submission (Condos et al., 2016). So, this

can be used by the libraries for the purpose of the transactions through various vendors.

Blockchain transactions support any kind of information sharing. So, schools, libraries or universities may share information of their patrons/students with other similar organizations using Blockchain. Blockchain technology may be a solution wherever the need arises to exchange sensitive information which requires encryption (Coghill, 2018).

Libraries may exploit blockchain technology as DRM (Digital Right Management) tool for digital resources present in the libraries. Nowadays most of the libraries and publishers face a problem of reproducibility of digital resources. But, this problem can be tackled if blockchain technology is tied up with digital resources, because this will make these resources to be identified, controlled and transferred uniquely (Griffey, 2016). Through this, publisher could be assured that no copies were being made, but the question arises that prices would decrease or not fixed accordingly? (Hoy, 2017). If the libraries use this blockchain technology than this might change the scenario of buying and paying of the e-resources (Coghill, 2018).

ISSUES TO BE KEPT IN MIND: OPPORTUNITIES AND RISKS

Opportunities

For confirming the date, time and content of record submitted to the blockchain by a party, a valid blockchain transaction is a reliable way. It is nearly impossible to attack/hack the entire system based on blockchain technology because of the distributed nature of this technology. So, blockchain is a tamper-proof technology. At present, securities clearing operations take two to three days to settle the transaction which may lead to credit and liquidity risks. On the other hand,

blockchain authenticated trading takes minutes (Condos et al., 2016). Blockchains provide immutability and transparency to the transactions because all the transactions performed in the past cannot be altered or deleted. Sensitive data which have an end to end encryption can be protected with the help of blockchain technology. As all the transaction in a blockchain is digitally stamped so, it is very easy to trace the history of any transaction. In blockchain technology, multiple copies are stored, which helps users to store sensitive data at one place (Sarmah, 2018).

Risks

Blockchain technology provides null support when it comes to the accuracy and reliability of records contained in the blockchain. As long as the correct protocols are followed any kind of data (good or bad) is accepted by the network and added to the blockchain (Condos et al., 2016). One of the major problems among libraries and other institutions is how to convince the purchasing office to accept the Bitcoin/Blockchain transactions (Coghill, 2018). Blockchain technology is expensive and resources intensive because every node in the chain repeats the task to achieve consensus. Blockchain technology has no way to reverse/switch the transaction even if both the people/party involved in the transaction are ready to do so. For a general human being, it is very complex to understand blockchain technology. So, at present, it is not ready to be used for mainstream tasks (Sarmah, 2018). Implementation of blockchain technology at present is environmentally unsustainable and inefficient because in the current version the ‘proof-of-work’ requires a huge amount of electricity. Approximate 1.5 American homes can be powered through a single bitcoin transaction (Malmo, 2015). Cryptocurrencies have a bad image in society because hackers demand

ransomware in Bitcoin. On ‘dark web’ when people buy commodities, they used to pay in Bitcoin. So, this hinders the acceptance of blockchain in society (Hoy, 2017).

CONCLUSION

Blockchain technology is an emerging technology which provides a reliable way to confirm transactions performed by the party, the date and time of its submission and the content of the transaction without involving the third party for verification. At present, blockchain technology is at nascent stage and researchers are trying hard to exploit its potential applications in various fields as shown in Figure 1. Library professionals may be highly benefited if they use it for paying vendors, subscribing journals and manuscripts from publishers and exchanging sensitive records/information with other parties. Although Blockchain technology has many disadvantages, we all know that every concept or technology has a past where it is weak and full of pitfalls. But, with the passage of time, hard work of researcher and advancements in the S&T it becomes strong and solves many tasks easily. One of the best examples of recent time is Artificial Intelligence. Now it is a little bit early to guess what lies ahead, but the future of Blockchain technology looks optimistic.

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