

Blockchain and its Scope in Retail

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Abstract - Blockchain is an emerging technology for decentralized and transactional data sharing across a large network of untrusted participants. It enables new forms of distributed software architectures. Although the technology was mainly adopted in digital currency in initial days, but it is a promising technology for other areas too. This paper provides an introduction to blockchain technology in a simplified manner. It also discusses about how blockchain technology can be used in some business processes in the retail sector to benefit the customers and the retailers to a great extent. The paper highlights the market trend in blockchain adoption and some of the challenges as well.

Key Words: Bitcoin, Blockchain, Cryptocurrency, Ethereum, Hash, Loyalty, Retail

1. INTRODUCTION

The world came to know about the Blockchain nine years back when Satoshi Nakamoto conceptualized it in 2008; but it got implemented a year later, through Bitcoin, a cryptocurrency and digital payment system. The concept was later generalized to distributed ledger that leverages the blockchain to verify and store transactions without cryptocurrency [1]. The term blockchain is extensively used these days to represent a new disruptive technology poised to be the next big thing across industries from healthcare to finance to retail. According to Gartner, their client inquiries on blockchain and related topics have quadrupled since August 2015.

Blockchain is a distributed database of records or public ledger of digital events or transactions that got executed and have been shared among participating parties across a large network of untrusted participants. It stores data in blocks that can verify information and are very difficult to hack [2]. It eliminates the requirement of a third-party verification and thus disrupts any sector that leverages it traditionally. Blockchain can replace a third party whenever the third party is involved in producing a transaction. Each transaction in the public ledger is supposed to be verified by consensus of the majority of participants in the system and once entered, information will never be erased as it is immutable.

Blockchain data structure is a timestamped list of blocks, which records and aggregates data on transactions that might have ever occurred within the blockchain network. So blockchain provides an immutable data storage that only allows insertion of transactions and no updating or deletion

of existing transactions on blockchain to avoid tampering and any revision. The entire network reaches a point of consensus before a transaction is included into the immutable data storage. The next writer of new records on the immutable data storage is decided through different mechanisms like Proof-of-work or Proof-of-stake.

Blockchain technology itself is non-controversial and has worked flawlessly over the years and is being successfully applied to both financial and non-financial applications. The design of a blockchain-based system is yet to be systematically explored, and there is little understanding about the impact of introducing blockchain into a software architecture.

Bitcoin is the most popular example that is based on blockchain technology. It is also the most controversial one since it helped enable a multibillion-dollar global market of anonymous transactions without any governmental control. A lot of scope is there to explore its use in various domains including retail. This paper aims at touching upon some of the areas in retail domain where blockchain technology can be utilized to benefit the customers and the retailers.

The paper is organized into few sections. Section 2 explains the technology behind Blockchain, whereas Blockchain's existing market is highlighted in Section 3. Section 4 explores its application in retail sector and Section 5 indicates some of the challenges. The paper is concluded in Section 6 finally.

2. BLOCKCHAIN TECHNOLOGY

A blockchain is a public ledger consisting of ordered and timestamped records of transactions arranged in data blocks which will use cryptographic validation to link themselves together. Blockchain is a way of recording data and transactions digitally. Each record is a block linked chronologically together into a chain. A block of one or more new transactions is collected into the transaction data part of a block. Copies of each transaction are hashed, and the hashes are then paired, hashed, paired again, and hashed again until a single hash remains there, the Merkle root of a Merkle tree which is stored in the block header [3]. It chains the blocks together and ensures that a transaction is modified without modifying the block that records it and other following blocks. The transactions are also chained together similarly.

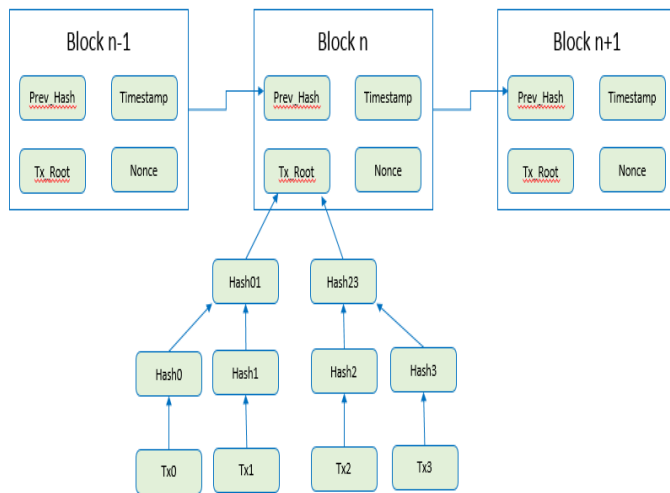


Fig -1: A typical blockchain

Fig. 1 shows a typical blockchain. The ledger, however, is not stored in a single master location or managed by any particular body, instead, it is made distributed that exists on multiple computers simultaneously such that anybody with an interest can maintain its copy. The block validation system ensures that nobody can tamper with the records and old transactions are preserved forever with new transactions added to the ledger irreversibly. Anyone in the network can check the ledger and see the same transaction history as others. Effectively blockchain is a kind of independent, transparent and permanent database coexisting in multiple locations and shared by a community; so the name mutual distributed ledger (MDL).

In some cases, separate blocks within the chain can be generated concurrently creating a temporary fork. Apart from a secured hash based history, a blockchain follows a specific algorithm for scoring different versions of the history so that one with a higher value is selected over others. Some blocks are orphan blocks as those are not selected for inclusion in the chain. Peers supporting the database have different versions of the history at all times keeping the highest scoring version of the database. When a peer receives a higher scoring version (the old version with a single new block added) it extends or overwrites its own database and retransmits the improvement to its peers. In a blockchain using the proof-of-work system, the chain with the most cumulative proof-of-work is always considered as the valid one by the network.

Blockchain is of two types generally, viz., permissioned and unpermissioned. Unpermissioned one uses open distributed ledger technology that means the information is not owned by any one person or database, rather it is shared across various computers in the network. Anyone can join the network and view those transaction records. Once a transaction is recorded, the data stored is timestamped, so that it can't be deleted or updated further [4]. The subsequent

additions to the ledger or new records are tracked and updated in real-time for everyone with the access. Due to its distributed nature blockchain is difficult to hack as all the copies are located at different places. Permissioned ones work exactly the same way, but are capable of restricting who in the network can authorize the transactions. A blockchain facilitates secured online transactions through the use of cryptography by creating cryptographic key pair with a wallet software [5]. In blockchain, a digital signature is employed to provide authentication and non-repudiation so that only the key-controlling entity can perform transactions from its associated account.

Distributed ledgers will also enable the coding of simple contracts which will be executed when specified conditions are met. Ethereum [6] is an open source blockchain project that has been built specifically to realize this possibility [7]. It is in its early stages, but has the potential to leverage the usefulness of blockchain on a truly world-changing scale.

3. BLOCKCHAIN MARKET

Blockchain technology will offer a lot of benefits including the following ones. As a result, the technology finds its use across financial and non-financial areas both.

- Decreases transaction cost and improves robustness vs. centralized solutions - Communicates peer-to-peer in a “trustless” environment.
- Immutable public ledger allows tracking ownership of real-world/digital assets - Transactions provide the transparent evidence of provenance.
- Conditional payments and complex business logic using smart contracts - Non-repudiation on both assets and business processes.
- Enables true autonomous entities (IoT devices, distributed organizations) - Entities can create rules, responsibilities and permissions.

According to a market research report, the global blockchain distributed ledger market has accounted for \$228M in 2016, and is anticipated to reach \$5430M by 2023, growing at a Compound Annual Growth Rate (CAGR) of 57.6% from 2017 to 2023 [8].

Transparency, immutability and reduced total cost of ownership are the major forces driving this market. The blockchain technology market is growing fast because of the increased adoption of this distributed ledger technology across various applications spanning smart contracts, exchanges, digital identities, payments, documentation and other similar entities [9].

Blockchain solutions have been deployed to various industry verticals including banking, financial services, and insurance (BFSI), government & public sector, healthcare & life sciences, retail & ecommerce, automotive, media &

entertainment, and others [10]. The media and entertainment vertical is expected to witness the highest CAGR as the industry is being transformed with digital technology. As per Goldman Sachs, the use of blockchain technology in stock trading may result in \$6B in industry cost savings globally a year [11].

4. BLOCKCHAIN IN RETAIL

Data is driving the retail industry these days. The retailers are trying to focus more on personalized retailing to enhance their customer base and improve services to the customer. The blockchain technology will act as an enabler to help the retailers achieve their goals efficiently. In retail domain, the blockchain can contribute a lot to assist the retailers in improving their existing business processes that will lead to their business growth and few such processes are explained here.

Supply Chain: Shipment tracking plays an important role in supply chain. Blockchain can be used to store data about the shipment at every stage of tracking including location, date and time, shipment handling person details, temperature, condition of the package/product, etc. This will help one check in real-time if the shipment has been handled properly and it has arrived on time at any given location. It will also assist the retailers in finding the lost or damaged products in the shipments. During the product recall, an accurate record of supply chain will allow the retailers to identify the source of the issue, the products that are affected, that contain the problems, etc. In addition, blockchain-based exchanges will allow the retailers to buy or sell from each other as well as distributors through the blockchain-shared ledger.

Customer Profiling: Blockchain can be used to accumulate data related to customer buying pattern, order placement trend, etc. This data can be used to forecast the location specific demands, suggested stock on hand to enhance their just-in-time inventory facility. Again, advanced data warehousing systems can be developed for the retailers using blockchain technology since the records are immutable and a number of analytical tools can run on it. In the payment front, blockchain will reduce the risk of fraudulent monetary transactions. As blockchain stores each and every transaction, it can help institutions check for payment patterns in real-time when needed. Reward points, cash back, personalized retail price & promotions and other offers on customers' payment modes can be evaluated and different offers can be shared with them on real-time basis.

Transparency: The information stored in blockchain will be visible to customers, retailers, suppliers and they will be able see the product source, whether the products are made through child labour or if any dangerous or hidden components are present; all these helping the retailers/customers decide about the products. This

blockchain improved transparency will indicate customer behavior patterns more accurately.

Authenticity and anti-counterfeiting: One can use blockchain to validate the product authenticity so that customers can walk through the records on the products and avoid counterfeiting, thus increasing the customer confidence about the product quality.

Loyalty: Blockchain can revamp the loyalty system by storing the encrypted customer data, coupons and discounts and making the data available to all the stores providing deeper analytics on customer records. A loyalty warranty on blockchain will also let customers view all their loyalty information in one place across the retailers.

The above mentioned blockchain enabled processes will lead to higher customer satisfaction, improved customer buying habits, more secured transactions and higher profit margins for the retailers.

5. CHALLENGES

Blockchain technology is still emerging and is in the proof of concept stage of development and not many blockchain based systems got deployed at industrial scale, so real threats with blockchain may not be apparent for next few years till it becomes mainstream more. This technology needs to be carefully analyzed before being adopted and its adoption should not be rushed. A failure in implementation may lead to major consequences, and even systemic risks. Being a shared ledger systems, blockchain is supposed to host sensitive data as well. Hence, it must ensure that its cryptography and cyber-protections are robust and in line with the industry best practices. Data protection and segregation should be taken care of for cloud based retail solutions as well.

6. CONCLUSION

This paper has discussed about the blockchain technology along with some of its significant features and benefits. The technology is still evolving with a lot of scope for different domains and industries and is set to change the world. But it is not free from challenges; some of them have been highlighted too. Although blockchain is the technology behind Bitcoin, but its use is not limited to financial domain only. Retail industry will start reaping the benefits of blockchain through improved transparency of products, more efficient supply chain management, better loyalty management system, improved customer profiling, fight against counterfeiting etc. leading to increased customer satisfaction and higher profit margin for retailers. The year 2016 revealed blockchain as more disruptive technology to the retail industry than any other industry, and in 2017 blockchain is gradually becoming the dominant hype phrase for retailing.

REFERENCES

- [1] F. Tschorsch and B. Scheuermann, "Bitcoin and beyond: A technical survey on decentralized digital currencies," IACR Cryptology ePrint Archive, 2015:464, 2015.
- [2] C. Decker and R. Wattenhofer, "Information propagation in the Bitcoin network," In P2P, Trento, Italy, 2013.
- [3] R. C. Merkle, "Protocols for public key cryptosystems," In Proc. 1980 Symposium on Security and Privacy, IEEE Computer Society, pp. 122-133, Apr. 1980.
- [4] S. Haber and W.S. Stornetta, "How to time-stamp a digital document," Journal of Cryptology, vol. 3, no. 2, pp. 99-111, 1991.
- [5] "What Are The Advantages And Disadvantages Of Bitcoin?," CoinReport. N.p., 2016. Web. 14 Nov. 2016.
- [6] A. Kiayias, H.-S. Zhou, and V. Zikas, "Fair and robust multi-party computation using a global transaction ledger," 2015.
- [7] Ethereum. <https://ethereum.org/>
- [8] "Blockchain Distributed Ledger Market Expected to Reach \$5,430 Million, Globally, by 2023" - Allied Market Research.
- [9] G. Wood, "Ethereum: A secure decentralized generalised transaction ledger" - Homestead draft. Technical report, 2016.
- [10] Wang, Kevin; Safavi and Ali, "Blockchain is empowering the future of insurance," Tech Crunch. AOL Inc., 2016.
- [11] Goldman Sachs, "BLOCKCHAIN - Putting Theory into Practice," Profiles in Innovation - May 24, 2016 (1).

BIOGRAPHIES



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