Chapter 50
Comprehensive Study on Incorporation of Blockchain Technology With IoT Enterprises

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ABSTRACT

Unprecedented advancement in wireless technology, storage, and computing power of portable devices with the gigabyte speed of internet connectivity enables the possibility of communication among machine to machine. IoT has a different way to connect many nodes simultaneously to store, access, and share the information to improve the quality of life by the elimination of the involvement of human. Irrespective of unlimited benefit, IoT has so many issues that arise to eclipse IoT in reality because of its centralized model. Scalability, reliability, privacy, and security challenges are rising because of the huge numbers of IoT nodes, centralized architecture, and complex networks. Centralized architecture may lead to problems like a single point of failure, single way traffic, huge infrastructure cost, privacy, security, and single source of trust. Therefore, to overcome the issues of the centralized infrastructure of the IoT, the authors diverted to decentralized infrastructure. It may be the best decision in terms of performance, reliability, security, privacy, and trust. Blockchain is an influential latest decentralization technology to decentralize computation, process management, and trust. A combination of blockchain with IoT may have the potential to solve scalability, reliability, privacy, and security issues of IoT. This chapter has an overview of some important consensus algorithms, IoT challenges, integration of the blockchain with IoT, its challenges, and future research issues of a combination of blockchain and IoT are also discussed.

INTRODUCTION

The Internet of Things (IoT) is a most recent technology to connect and facilitate to communicate among numerous things simultaneously for providing different benefits to consumers that will change user's interaction with the technology. The concept of IoT is not new. "The Internet of Things has more potential

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than the internet which changes the world, just as the internet did in the last few years (Hong-Ning Dai, Zibin Zheng, Yan Zhang, 2019). The core concept behind IoT is establishing a system to store all the data on the cloud without having the requirement of human efforts in collecting it. It is believed that the impact of IoT on the world will be immense in the upcoming years. Though the presence of IoT offers a cutting-edge opportunity in fully automated systems, traffic management, and solutions, it comes with certain limitations that we cannot ignore. IoT offers a universal model of sharing information to enhance society, enabling advanced services by interconnecting things based on existing wireless communication technologies. A study confirms approximate 60% of companies are already engaged in developing IoT projects. Recently more than 30% startups are at an early stage of deployment of IoT. More than 69% of these IoT based companies are now focusing problems like, how IoT operational cost can be reduced? Cisco says, 74% of organizations have failed with their IoT startups. It is happening due to the involvement of humans in IoT implementation, beyond the functional elements of sensors and network complexity. Data reliability, security, and privacy are rigorous issues in cloud-based IoT applications.

Heterogeneity, centralization, the complexity of networks, interoperability, privacy vulnerability, and security vulnerability are the root cause of security, privacy and reliability issues in IoT systems. To overcome problems of security, privacy, reliability, and the trust of the IoT system; there is a requirement of the new advanced techniques. The blockchain is one of the best emerging technology. It may ensure the privacy and security issues by using a public ledger, cryptographic and hash algorithms. Blockchain is an incorruptible decentralized digital public ledger of economical transactions that can be programmed to record not just only for financial transactions but also virtually everything which have value to facilitate data decentralization, transparency, tamper-proof, replicated ledger, immutability, and improved trust in peer to peer network. The blockchain has emerged as one of the major technologies that have the potential to transform the way of sharing the huge information. Improving trust in a peer - peer environment without the requirement of a trusted third party is a technological challenge to transform present scenarios of the society and industries. Decentralized and distributed nature, transaction verifiability, transparency and immutability features of blockchain can tackle challenges of IoT. Without considering the heavy computational load, delay, storage, bandwidth overhead of blockchain can lead to a new set of challenges in the integration of the blockchain with IoT (A. Baliga, 2017). Blockchain uses the technique of hash function, Merkle Tree, Nonce (to make the hash function harder to retrace) and others to provide Data Centralization, Transparency, Security and Privacy, Tamper proof replicated ledger, Immutable Ledger Non-Repudiation, irreversibility of records, Automation and Smart Contract, a new way of storing (M. Conoscenti, A. Vetro, and J. C. De Martin, 2016). Figure 1 shows the component of blockchain.

Issues of IoT are like security, privacy, scalability, reliability, maintainability. Blockchain has decentralizations, persistence, anonymity, immutability, identity and access management, resiliency, autonomy, apriority, cost-saving as attractive features.

These features may address challenges of IoT, Big data and machine learning. Blockchain pushes centralized network-based IoT to blockchain-based Distributed Ledger. Blockchain mainly can tackle scalability, privacy, and reliability issue in the IoT system. This chapter proposes a trusted, reliable and flexible architecture for IoT service systems based on blockchain technology, which facilitated self-trust, data integrity, audit, data resilience, and scalability (A. Panarello, N. Tapas, G. Merlino, F. Longo, & A. Puliafito, 2018).

The concept of Hashcash was suggested by Adam Back in 1997 (Z. Zheng, S. Xie, H. N. Dai, X. Chen, H. Wang, 2018). Hashcash is a mining algorithm used as Proof-of-Work Consensus algorithm (Used for Permission less blockchain Technology i.e. Bitcoin). It is used to restrain email and save such a system