BLOCKCHAIN TECHNOLOGY: THE NEW INTERNET LOGISTIC BRAIN

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Abstract— Everyone in any collaborative business or industry has been discussing how to tap on the blockchain technology. While we are still trying to get a grasp of concepts such as consensus algorithms and distributed ledgers, top-notch industry developers are expanding and strengthening blockchain technology with highly complex, promising and intriguing innovations. Blockchain technology becomes the new logistic brain of the Internet as it involves the creation of data “blocks,” detailing actions for a given business transaction or actions, and such information is finalized and locked into a chain. The chain is only added to with each transaction, so the origin of transaction details, such as financial records, product details, and location, can be traced. Thus, all subsequent business transactions can be verified and tracked, enhancing transparency and visibility into the transaction. In addition, blockchains may be public or private, granting or denying access to the chain details based on authorization, so private information can be protected, while allowing addresses to authorized parties. The future of using the Internet as the supply chain is limitless with the power of blockchain technology.

Keywords— Blockchain Technology, Supply Chain Management, Human Centric Internet, Logistic Support

1. INTRODUCTION

Blockchain is not a buzzword. It is a whole new technology that is going to significantly transform the world around us including finance, business and collaboration. It is a technology that removes the need for trust. With no need for external verification of an activity or event, the permission less nature of the blockchain technology has numerous applications across industries and communities. The basic mechanism of blockchain is to provide a distributed, authenticated messaging system that tracks all events and is tamper-resistant while maintaining a log of collaboration and transactions. Blockchain technology in that sense is a form of distributed ledger technology (DLT) that acts as an open and trusted record of transactions from one party to another (or multiple parties) and is not stored by a central authority. Instead, a copy is stored by each user running blockchain software and connected to a blockchain network, also known as a node. All nodes have a copy of the ledger and updates to the ledger are propagated throughout the network in seconds, enforcing the approved contract between the collaborators. The groundbreaking feature of distributed ledger technology is that the ledger is not maintained by any central authority. Updates to the ledger are independently constructed and recorded by each node. The nodes then vote on these updates to ensure that the majority agrees with the conclusion reached. This voting and agreement on one

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copy of the ledger is called consensus, and is conducted automatically by a consensus algorithm. Once consensus has been reached, the distributed ledger updates itself and the latest, agreed-upon version of the ledger is saved on each node separately [1]. Actually the distributed ledger technologies drastically reduce the cost of trust. The architectures and structures of distributed ledgers can help us mitigate our dependence on banks, governments, lawyers, notaries and regulatory compliance officers. Moreover, the integration of promising technologies like IoT and cloud computing with the DLT has proven to be invaluable. DLT can enrich the IoT by providing a trusted sharing service, where information is reliable and can be traceable. Data sources can be identified at any time and data remains immutable over time, increasing its security. In the cases where the IoT information should be securely shared between many participants this integration would represent a key revolution. Therefore, the use of DLT can complement the IoT with reliable and secure information [2]. Figure 1 illustrates the two phases used in designing and implementing DLTs suitable for collaboration. The design phase is accomplished by answering key questions like; How transactions are triggered by future events?, What tokens can be exchanged?, How parties agree on trust?, What transactions are replicated? and Who have the control over changes made to the ledger? The implementation phase will also require answering key questions like; How the transactions will be stored and whether topological order is required? And How multiple transactions will be timestamp and if order of the event will be used instead? Reference [3] describes the most popular DLT implementation frameworks like DAG, Blockchain, Hashgraph, HoloChain and Tempo. Based on the two phases we will end in developing a DLT for the whole collaboration ecosystem which will provide the functionalities of dynamism, immutability, security & decentralization for any collaboration used in business or industry.

Fig. 1 The Building Processes of Distributed Ledger Systems.

The main purpose of DLT is to provide the network of participant's access to a shared, synchronized record of transactions. The DLT governance allows no false entries and thus reduces transaction costs paid out to third parties or the need for a trusted central party. DLT networks are either public, private or a consortium. A public or "permission less" DLT network allows anyone to interact with the network. Any party can be a trusted participant, or "node" in the network, or choose to verify transactions ("mine"). Tokens are awarded to participants for their contributions to the network. If the DLT network uses the blockchain, then the distributed ledger is updated in groups of transactions called blocks, which are chained sequentially. As such, there is no way to alter an entry. It can only be reversed, although those reversals only happen under rare circumstances. In contrast to public DLT networks, private DLT networks can only be updated by trusted nodes, which are often chosen and regulated by the developer or central party. This central control means private DLT networks are similar to conventional systems in their reliance on specific institutions as the ultimate source of trust. Consortium DLT networks, however, are a hybrid between private and public DLT networks. Rather than concentrating power within a single entity, a consortium or group of partners controls the consensus process. Each partner has its own node on the network and a pre-selected number from the group must sign every block for that block to be valid. The public may be able to read the network, or it may be restricted to the participants [3]. However, the application of blockchain based on various DLT technologies will exhibit a variety of complicated problems and new requirements, which brings more open issues and challenges for research communities.

2. THE LOGISTIC DLT:

A distributed ledger gives control of all its information and transactions to the users and promotes transparency. DLT is set of generic technologies that have variable level of trust in the institutions they deal with. At the far end of NO trust, the DLT technology will depend on blockchain; whereas at the other end of HIGH trust, DLT will use censorship resistance techniques [4]. Figure 2 illustrates the spectrum of DLT technologies. In general, a distributed ledger is a database that is spread across several nodes or computing devices. Each node replicates and saves an identical copy of the ledger. Each participant node of the network updates itself independently. The groundbreaking feature of distributed ledger technology is that the ledger is not maintained by any central authority. Updates to the ledger are independently constructed and recorded by each node. The nodes then vote on these updates to ensure that the majority agrees with the conclusion reached. This voting and agreement on one copy of the ledger is called consensus, and is conducted automatically by a consensus algorithm. Once consensus has been reached, the distributed ledger updates itself and the latest, agreed-upon version of the ledger is saved on each node separately [5]. Actually the distributed ledger technologies drastically reduce the cost of trust. The architectures and structures of distributed ledgers can help us mitigate our dependence on banks, governments, lawyers, notaries and regulatory compliance officers. The decision to go from no trust to more trust may depend on several key questions that have been summarized by Pablo Junco at the end of 2017 [6].

Fig. 2 Different Types of Distributed Ledger Systems

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3. DLT IS REPLACING ERP/EDI IN GLOBAL MANUFACTURING

In an environment of ever-changing consumer demand, the manufacturing business needs to leverage every competitive advantage it has at its disposal. Modern global businesses rely on electronic data interchange (EDI) solutions to maximize operational efficiency and maintain market competitiveness. EDI is messaging protocol (point-to-point) which part of the manufacturing firm ERP (Enterprise Resource Planning) system to facilitate and manage the flow of information throughout all the business functions within the boundaries of the organization and to manage all the interactions to outside partners. But the point-to-point messaging systems have their own issues, as they are often like a slow-moving ship where there are no benefits for a single company in a partner network to change, unless the other partners also follows. EDI thus is often out of sync and move data only one stop down the supply chain resulting in inventory that seems to be in two places at once. However, the use of DLT promotes uniformity through the use of multiway secure communication that allows all parties to upload and encrypt the physical documents typically involved in a manufacturing transaction and enabling all stakeholders to view such documents simultaneously and securely. This eliminates the need for stakeholders to manage and reconcile physical documents which will dramatically reduce costs and increase the speed in which a trade financing transaction can be completed. In the case of a vehicle industry, a distributed shared ledger could underlie all interaction and transaction information associated with the car. Such information could be shared and permissioned across the myriad parties including OEMs, Parts and component manufacturers, Vertical software providers, Distributors, Fleet providers, Dealerships, Municipal services and agencies, Mechanics, Insurance companies, Car buyers and Drivers. The main purpose of DLT is to create a distributed peer to peer network architecture that improves the security and scalability of the manufacturing. Figure 3 illustrate the role of DLT in the emerging global manufacturing [8].

Fig. 3 DLT in Manufacturing

Actually, any type of manufacturing that executes and works with a supply chain, will need to design and build a DLT. A manufacturing firm that uses supply chains are responsible for making products, distributing products and goods from beginning to end—, which could be another company or a consumer. Any given supply chain can be made up of hundreds of different checkpoints where goods are transferred from party to party, making it extremely difficult to know for sure all the little things that happen along the way. Moreover, collaborating manufacturing can benefit from DLT based on smart contracts that ensures trust and efficiency. Figure 4 illustrate how DLT are in use for the manufacturing.

Fig. 4 The General Use of DLT in Manufacturing

3. CONCLUSIONS

The world is rapidly moving toward a post-digital era, where decision makers will need to set their sights beyond the ongoing digital transformations. The digital capabilities alone is no longer serving as a differentiator and the future-minded business leaders will need to embrace a group of emerging technologies to succeed and drive the next waves of innovation and growth including the distributed ledger technology (DLT), artificial intelligence (AI), extended reality (ER) and quantum computing (QC). However, the DLT is probably going to disrupt the decentralization of manufacturing processes, B2B and B2C interactions even more than the advent of the World Wide Web. A distributed ledger gives control of all its information and transactions to the users and promotes transparency. DLT is set of generic technologies that have variable level of trust in the institutions they deal with. At the far end of NO trust, the DLT technology will depend on blockchain; whereas at the other end of HIGH trust, DLT will use censorship resistance techniques. DLT offers the opportunity to create a global logistic platform of performance and trust; however, scaling the technology still requires overcoming some hurdles like handling very large transaction volumes need to be enhanced.

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