Review of IOTA Foundation as a moving force for massive blockchain adoption in different industry sectors

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Abstract – [PLACEHOLDER]

***Index Terms* – Blockchain, industry, economic sectors,**

I. Introduction

In these times, humanity is constantly being driven forward by the discovery, diffusion and improvement of the technologies that surround us and shape our way of living. From smart devices like phones and televisions, passing through automated appliances like lightbulbs and coffee machines, to self-driving cars, technologies like Artificial Intelligence and Machine Learning seem to be slowly seeping through the cracks of our routines to fill the most mundane duties. But what we should wonder is on how difficult these duties can become, how technologies might permeate into more and more of the economic sectors and drive industry forward, and we must look no further than blockchain to observe an example.

Blockchain is a cryptography-based way of safe and decentralized data transfer between peers, where data is packed into *blocks* that are identified by a cryptographic hash and a reference to the hash for the previous block.[1] Different blockchains make use of various consensus mechanisms for the majority of nodes to decide what is the correct content for the next block in the chain. The nodes that participate in the consensus process are called *miners* and are the ones that keep the blockchain working as intended.

One of the most popular examples of blockchain is cryptocurrency, as the original concept was described in the original whitepaper for Bitcoin released in 2007[2] and plenty of different currencies have worked as testing grounds for many diverse consensus algorithms that work on improving the time and workforce required to process the state of the chain at any given time, a process that has benefitted greatly from the huge amount of users and enthusiasts.

But decentralization can go beyond payments and financial transactions, and that is where projects like IOTA come in, a foundation of developers from all around the world that focus on the implementation of blockchain into new technologies and the creation of protocols that will help with their goal. In this paper we will discuss the history, projects and influence of the IOTA Foundation, and how it may shape the way we imagine our future.

II. Background and Vision

The IOTA Foundation started in 2015 as a successful fundraising campaign that gathered over $500.000[3] in Bitcoin, with supporters from all around the world, in order to begin the development process of what they called the Tangle technology, which we will further explain in section *III.a*. To reward the participants of this crowd sale, the Foundation decided to openly distribute the entire supply of tokens among them.

Image 1. IOTA Foundation logo, representing the Tangle model explained in section *III.a*.

Later on, in 2017, the company was forced to ask for donations once again, this time relying on the token

holders for backup, as the entirety of the tokens was already split between them. They found the support they needed, recovering 5% of the total token supply and using said funds for the endowment of what is now known as the IOTA Foundation, which is chartered in Berlin, Germany.

As a whole, the Foundation's goal is to enable the true Internet-of-Things through verification and transaction settlements to incentivize the creation of devices that have all their properties and data available at all time, following the way distributed ledgers work, in order for technology to evolve around unified truths.

This would not only build on top of the principle of data ownership, making sure every user is aware of what segments of the data they generate is shared and distributed, but also help to spread a new economy where every connected device can be lent or borrowed for small fees due to the fact that every transaction will be easily traceable and completely safe from tampering.

III. Base Technologies

In order to properly implement their vision, the IOTA Foundation has developed the necessary technologies to counter certain aspects in which current blockchain models fall behind and could hinder their plans. These technologies are the Tangle, a redefinition of the data transfer mechanism that does not rely on blocks or chains, and Coordicide, a currently in-development algorithm that would replace coordinators in the Tangle, making it entirely decentralized.

III.a. Tangle technology[4]

The IOTA Foundation believes that the current model of blockchain, which segments data into blocks to make the best use of their consensus mechanisms and cryptographic hashes, does not have enough room for improvement in terms of scalability and transaction times, especially when internet speeds are limited by the electromagnetic spectrum.

Enter the Tangle: IOTA's revolutionary data structure based on Directed Acyclic Graph (DAG) instead of blockchain, where different branches can exist simultaneously to merge later on in the process,

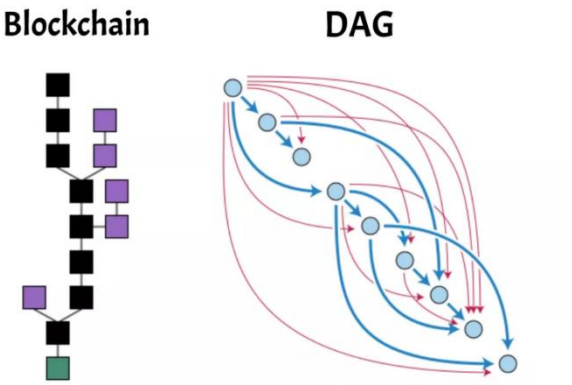

Image 2. Comparison between blockchain (left) and DAG (right) models. Notice the linear nature of blockchain vs. the branched design of DAG.

instead of having nodes agree on the correct chain to later discard branches or forks. In this model, each transaction represents a vertex and the approval of each transaction draws an edge between two vertices. Once a new transaction enters the DAG, it is linked to two other transactions and *approves* them, by checking there are no double-spends or illegitimate creation of tokens.

Given these features, the Tangle is similar in spirit to a blockchain but overcomes some of its fundamental limitations: Scalability is worked on because of the lack of a built in maximum point, while the absence of miners solves the overcrowding of the network, the raising of fees and the entry barrier for potential users.

III.b. Coordicide[5]

On top of the Tangle network exists the figure of the *Coordinator*, a figure that oversees the addition of new transactions by preventing double spend in the early stages of the network, when it still does not contain enough branches to be secure by itself. At certain intervals of time, a *Coo* issues a transaction called *milestone*, and these become the main reference point where every transaction must be traced to before it becomes approved.

However, the presence of such a figure comes with a number of issues regarding the decentralization of the platform itself, like giving the Foundation a theoretical ability to give priority to certain transactions or become a focal point to attack in order to halt the entire network. But these reasons are not enough to justify an

instantaneous removal of the Coo, and the IOTA Foundation has already found a possible solution.

The process they call *Coordicide* is a gradual removal of the Coo from the platform when the team becomes satisfied with the state of the Tangle regarding self-sufficiency at the time of transaction validation. The correct implementation of the process can achieve true decentralization without boundaries, like the processing/monetary ones present in models like Bitcoin, along with setting the bases for future-proof scalability, reliable governance and feeless operations.

IV. Areas of Operation

The IOTA Foundation is driven by the possibility of widespread adoption of their technologies in different economic sectors and industry areas, including the following:

IV.a. Mobility and Automotive Industry[6]

With smart and self-driving vehicles becoming more and more popular by the day, it was only a matter of time before someone proposed implementing blockchain as a means of interconnection and an enabler for IoT networks between cars, drivers and passengers[7]. And with IOTA working directly on scalability and low processing times, they represent a great candidate for bringing these visions into reality.

Starting with the most obvious outcome, Tangle implementation will make platooning for semi-autonomous trucks incredibly easier, allowing fast and constant communication between the units in self-driving state for synchronized movement, representing faster delivery times and reduction in risks and costs, due to the trucks taking advantage of the air drag generated by the ones in front of them. This same

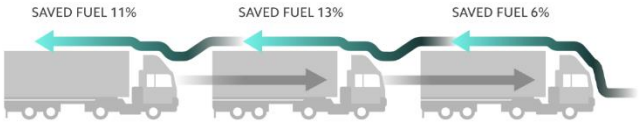

Image 3. Diagram displaying the benefits of Tangle-based platooning for cargo vehicles in self-driving state.

principle can be applied to line-switching in smart highways.

Speaking of other driving-related services, full blockchain implementation will turn transactions like tolls, parking fees, vehicle sharing services and fuel refills become seamless and almost automatic, while securing each owner against double-spends or fraudulent attacks. But, as the IOTA Foundation tends to do, they think beyond it, and propose a system of micro token transactions to support a completely autonomous driving service. This, along with providing a secure platform for firmware and software updates for smart cars, makes IOTA a potential powerhouse in the mobility department.

IV.b. Global Trade, Supply Chains and Industrial Internet-of-Things[8, 9]

Probably the second most usual way to implement blockchain besides monetary transactions, having a decentralized, secured and auditable ledger for storing trade data will push supply chains to the next level, allowing for more efficient and cheaper manufacture of products[10].

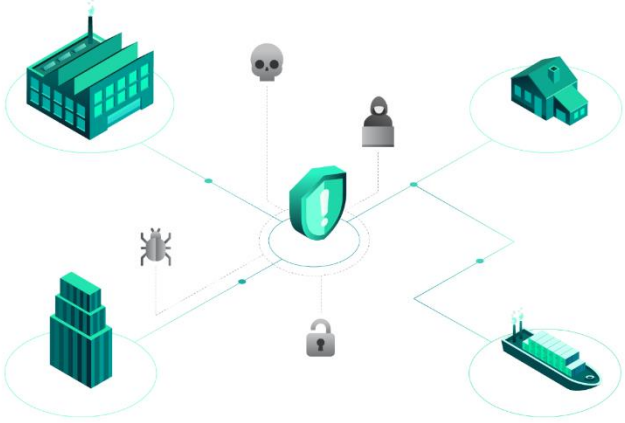

Image 4. Representation of the expected network to be built around manufacturing facilities, where the factories, offices, delivery services and final customers having access to the data of every step in the process.

Not only that, but a solid IoT platform might be the keystone for building up completely automized factories ruled by trustless consensus mechanisms. This may later lead to private factories built to offer their functions as a service, where every project could find

the necessary equipment to manufacture a batch of products without having to make such an investment.

IV.c. eHealth[11]

Healthcare is probably one of the most data-driven markets in the world[12], and the IOTA Foundation wants to provide that data with new levels of trust, which is a high priority in these times of digitization of medical records. The volume of medical data is rapidly increasing, and having such personal information be under the watch of centralized institutions gives potential attackers a single point to attack.

Decentralization brings this threat to a halt by creating an immutable network of records that are entirely protected against any kind of malicious tampering, while being readily available for every specialist that needs it without having to request the records from a different medical center, accelerating response times in emergencies and making the life of patients, specialists and caregivers easier.

V. Future Potential

We see in IOTA an ambitious platform, driven forward by a talented group of people that strives for a seamless, yet quick, implementation of blockchain-like technologies into some of the most important aspects of our everyday life, with hopes of such improvements fixing most of the problems we see today regarding data management and synchronization between machines.

Looking at the future, we might be grasping at systems that may even enable the trade of energy from all around the world, helping rising economies by facilitating the trade of an asset that is usually generated with natural resources, while helping vulnerable areas to gain access to some benefits that have now become basic.

Of course, it is a matter of time before we see any significant change in how we experience the world, but the IOTA Foundation is setting the bases, and it will be up to us to build a solid future on top of them.

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