



Digital State of Aluminium

By **Sergey Belskiy***

Sometimes grandiose changes happen imperceptibly. Everything seems to remain the same, while in reality, things are developing at a rapid speed. It is especially applicable now that humanity has created a new space, which is actively reshaping our standard notions of creation and ownership.

The name of this space is Blockchain. Developed at the dawn of the 21st century, Blockchain has been called the main technological breakthrough of humanity since the invention of the Internet. Society now has two habitats - physical and digital.

We cannot touch and see objects in Blockchain. But they exist and are just as real as the physical world around us. Like discovering a new land, exploring the potential of Blockchain and its fascinating cryptography can pave the road for yet unrealized potential. It applies to all aspects of our life and industries that we operate in, including the aluminium market. I'd like to invite you for this exploration together, but before we dive into the visualization, let's get clear on

the basics to ensure smooth sailing on our voyage.

What is Blockchain?

Let's see how this new crypto land works for us. Blockchain was first used in 2009 for Bitcoin cryptocurrency to record transactions in the system and prevent double-spending without any regulatory authority. Its concept was proposed by Satoshi Nakamoto. But even today, it is still unknown who is standing behind this name: Was it one person or a group of developers? The only thing we can say for sure is that the Blockchain has forever changed our understanding of information storage and transaction security.

In a way, the name itself - Blockchain - explains the tasks and mechanics of this technology. Blockchain is a distributed database with no storage devices connected to a shared server. This database stores an ever-growing list of ordered records called blocks.

All blocks in a blockchain registry are interconnected, and each subsequent block contains information about the

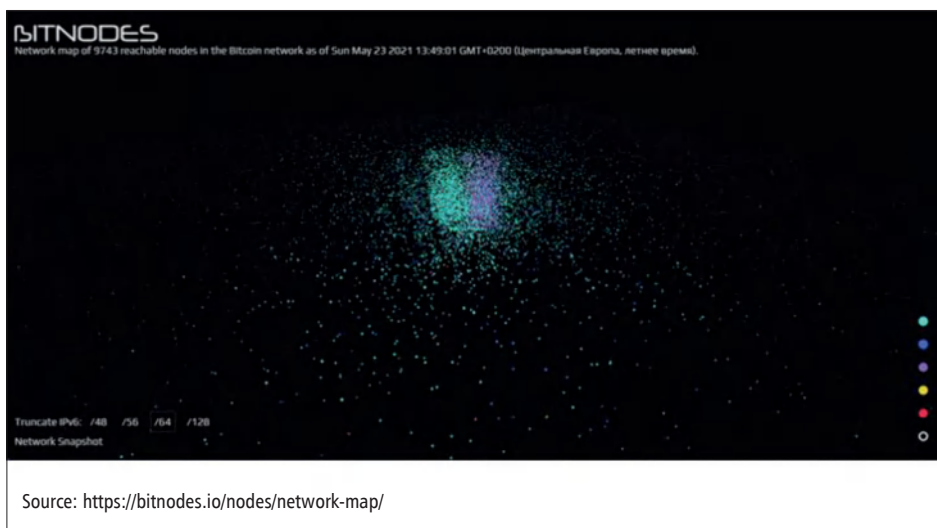
previous ones. Thus, data is accumulated and forms a constantly updated database.

One of the key features of Blockchain is decentralisation. Information about blocks is simultaneously stored by all network users, is constantly updated, and refers to previous blocks. Therefore, if someone tries to change, delete or replace information in the blockchain registry, the system will compare the data in the table with thousands of other versions of the registry and find inconsistencies.

Another important advantage is cryptographic encryption, which ensures that the information held within the system is secure and contains a timestamp and link to the previous block. Encryption validates user access and allows them to modify only those parts of the chain blocks that they "own". This is done through private keys, without which file overwriting is impossible. Additionally, encryption ensures that copies of the distributed Blockchain are synchronized for all users.

This base is secure and virtually unlimited, making it possible to create an

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infinite amount of information, which can take numerous shapes: from transactions with cryptocurrencies to the creation of digital analogues of physical world values – for example, aluminium.

The Double-Spending Problem

Let's try to figure out how Blockchain works and take any object from our physical world. It could be a coffee mug on your table, or an apple in your hand, or whatever you can touch and see. But since we are looking at the possibilities of Blockchain in relation to aluminium, let's take aluminium. So imagine that I have 1 mt of aluminium, and I am selling it to you. Now you have 1 mt of aluminium, and I have 0. An elementary example, but now let's take a closer look at what happened and compare it with the possibilities within a blockchain.

The aluminium was physically delivered to your warehouse, for example, in Rotterdam, and this fact of transfer does not require proof. We have all the needed evidence in the physical delivery. Now you own the aluminium and have complete control over it, but I don't. This is how the transfer of physical metal looks. And as you might guess, it works not only with aluminium but, for example, with fiat currencies.

Now, let's pretend my aluminium was digital. The situation is getting more complicated. How can you be sure that this aluminium is now really yours and only yours? Maybe I sent this aluminium to my friend by email first? Or, perhaps, I multiplied this lot of aluminium, and thousands of copies are stored on my computer? Or I might have uploaded it to a website, and millions of people have already downloaded it?

The exchange of digital assets has its complexities, and it is much more complex than the transfer of physical aluminium. For a long time, leading IT specialists

have been looking for a solution to this problem and even gave it their name - the double-spending problem.

The answer was Blockchain technology.

The Double-Spending Solution

As we have already understood, to make sure that digital aluminium has been transferred, we need a system that can confirm the transfer. For example, we can create an Excel spreadsheet where each transaction with aluminium will be recorded. Such a table would be similar to a notary or ledger.

In this table, one can note all the required data: who sold the aluminium, who was the buyer, when the transaction took place and what quantities were involved. Here several problems immediately appear. If this table is stored only on my computer, what prevents me from editing existing transactions or writing off a few extra tons of aluminium for myself?

The solution is to hand out the spreadsheet to everyone. In this case, I will not be able to give you more aluminium, or change the transaction history, because then my record will not correspond with the other tables in the system, and everyone will notice the substitution. Deception would be very difficult since one person does not control the system. And the more people connect to the network, the harder it gets.

Everyone can download the spreadsheet for themselves, check everything that is written by other participants, and even receive a reward for checking and maintaining the network. We have just created our own antediluvian Blockchain! It is important to note that the identities of the blockchain participants are not disclosed, which makes the Blockchain absolutely anonymous.

Of course, this is a significantly simplified explanation, but this is how Blockchain works if you do not go into the technical

details. Blockchain is a similar database that is constantly updated and open to all, like an Excel spreadsheet. All transactions on the network take place in public. All users know how much aluminium was available originally, to which digital address and when it was transferred. Blockchain verifies all transactions in the system. It makes digital asset transactions as easy and secure as the actual transfer.

Now, even without the physical transfer of aluminium, you can still be sure that it is yours - after all, thousands of people can confirm this.

It means that we can carry out digital transmission to each other from 1 kilogram to thousands, millions of tons of aluminium. And, all this can be done literally with one click, even if I am in New Zealand, and you are in Europe or anywhere else in the world.

Blockchain and Miners

Now let's dive a little deeper into the technical details. As you remember, Blockchain is nothing more than a chain of blocks of information. Each block has its own title, its key, and the key to the previous block. The block will be included in the main chain only if users, using computational operations, were able to find a cryptographic signature for the block key (hash). By doing so, they will confirm that all operations written to the new block do not contradict that have already been included in the chain.

This process essentially keeps our Blockchain in check, just like hundreds of people were verifying the data in our imaginary spreadsheet from the previous example. In the crypto world this process is called mining, which is hard work but this time done by unbiased computers. It results in a slow accumulation of resources – just like mining for precious minerals.

Miners (people behind this process) create new blocks on Blockchain using computing technology, for example, powerful processors or video cards. They form a large P2P network supported by computers around the world. The computers that support the network are called communication nodes.

An impressive online 3D visualisation of all the Bitcoin nodes and the node density presented by Addy Yeow from "Bitnodes": <https://bitnodes.io/nodes/network-map/>

Miners perform an essential function in the Blockchain - they fill each new information block of the network with recent transactions and get reward for each block found. How this happens in practice in real-time on the Ethereum network can be seen at: <http://ethviewer.live/>

Transaction Fees

Transactions on the blockchain network are conditionally free; however, demand-driven and some amounts will have to be deducted for transfers. These amounts go as a reward to miners participating in the network, and the sender pays for the size that his blockchain transaction takes in one block.

Here you can see the average commissions in Ethereum blockchain by day: https://ycharts.com/indicators/ethereum_average_transaction_fee

Digital Aluminium Tokens and Smart Contracts

But let's get back to aluminium.

The revolutionary nature of Blockchain technology allows it to represent value and get rid of the "extra link" of intermediate logistics, create an ecosystem of tools available to everyone in the market, and increase the privacy and security of market participants.

Such tools in the Blockchain are tokens, or in other words, entries in the register distributed in Blockchain. There are different types of tokens, but we are interested in an Aluminium token, which represents the value of aluminium.

Now that we have clarified our ask for the token design, we need to decide on token management and its regulations.

Token management is usually implemented using Smart Contracts. Tokens are getting transferred from one account to the other, thanks to the continuous recording of values and balances in each involved account. The bulk of the tokens that exist today are formed in Blockchain protocol from Ethereum following the ERC-20 standard.

Ethereum was created and launched in 2015 by Vitalik Buterin, a 21 years old Canadian-Russian programmer. Ethereum became one of the global blockchain networks with the broad participation of exchanges, traders, and investors. Ethereum and the ERC-20 standard provide security guarantees that are virtually unattainable in the physical world. But the main advantage of Ethereum, like the entire Blockchain, is accessibility. Anyone with an Internet connection can become a user of the Ethereum blockchain.

The legal support of smart contracts is not yet clear around the world. Still, more and more countries worldwide understand the need to regulate cryptocurrencies and various crypto and token instruments. The tokenisation market is developing very fast. This development can be accelerated by government regulation, attracting prominent market participants, and providing vast competitive advantages and new incentives for further developing

the technology.

Digital Aluminium

Now we have decided on the concept of a token and its habitat.

So, in a nutshell, here is our refined vision for Digital Aluminium:

- It should be the universal digital meaning of value, tied to aluminium market price and equivalent to one metric ton of primary aluminium.
- It should be a digital instrument for payment and storage of aluminium value and should be considered only if it will be possible to convert it to metal.
- The Digital Aluminium market will act on a par with the physical metal market.
- Digital Aluminium holders should have the right to exchange, sell or store Digital Aluminium at their discretion and personal choice.

Opportunities for Digital Aluminium Holders

New "State of Matter"

Aluminium is a unique product due to its distinctive properties, continuous production cycle, and exceptional importance in the development of human civilisation. The consumption of aluminium and its prices could be considered the "breath of civilisation", reflected in the relentless striving of humankind for innovation and perfection.

Crises can sometimes hamper aluminium market development, but such painful conditions quickly disappear (in comparison with other commodities and oil) and do not affect the sustainable growth trend as a whole. Global consumption and aluminium prices are less susceptible to subjective and speculative non-market factors than many other commodities. Aluminium engulfs, perhaps, the broadest range of markers, which are instrumental for the

civilizational development of humanity.

Digital Aluminium will actually be the new "State of Matter". Digital Aluminium will be subject to the same market laws as aluminium, composed of atoms and located somewhere in a warehouse or the hold of a ship. That is, Digital Aluminium will have its own value on a par with material aluminium and will not be a "digital reflection", a subject of pledge or any obligations concerning physical metal.

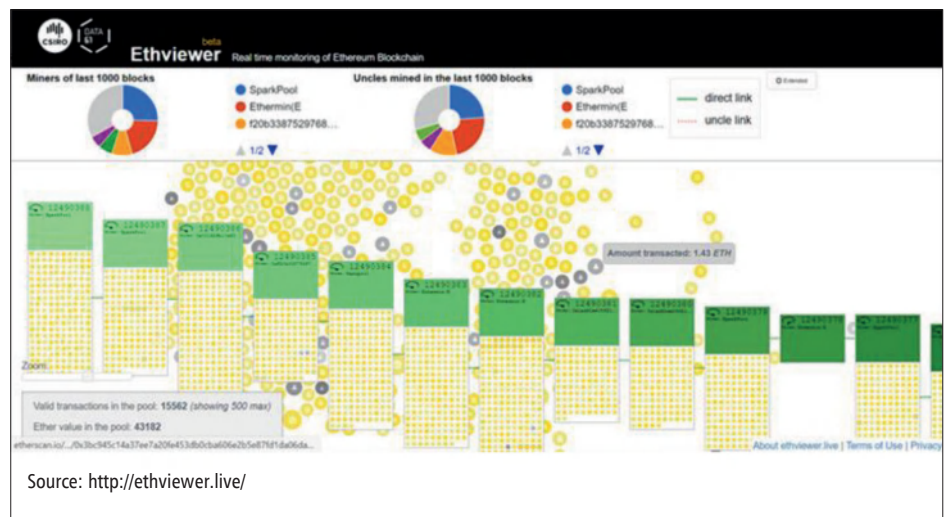
As you understand, such a "Digital State of Matter" is equally applicable to any other object. With the help of blockchain technology, we can have a digital coffee mug or digital apple. Only we will not be able to touch and see them since they will not consist of atoms but electrons in the blockchain network.

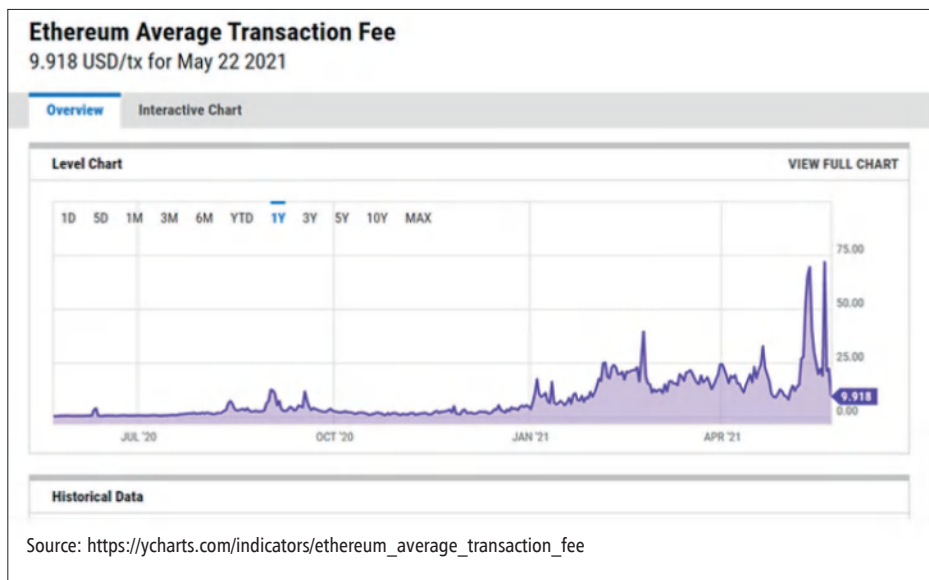
No Intermediate Storage and Logistics

The holder of Digital Aluminium will not pay for the intermediate storage and logistics of aluminium but will pay for the "blockchain logistics" only, which will significantly reduce costs and make them more competitive. Thanks to this structure, the holders will need to store only Digital Aluminium in their accounts, not Aluminium stocks in warehouses, which will significantly reduce the costs for the holders when buying aluminium products.

Digital Aluminium Trading in the Market

The increase of aluminium market participants may lead to an increase in market liquidity. However, an increase in market participants will require a transition from bilateral to multilateral transactions. While this is burdensome in the traditional world, Digital Aluminium, built on the Ethereum Blockchain and the ERC-20 standard that supports smart contracts, will allow even complex multi-





party transactions to be settled safely and almost instantly.

Entire Aluminium Market Access

The high entry barriers of the aluminium market restrict access to the need for many participants. Digital Aluminium will allow for fractionation, reducing entry barriers, and expanding access to new markets for smaller players.

Digital Aluminium should be divisible (for example, the smallest part into which Bitcoin is divided is called a satoshi, after its creator Satoshi Nakamoto. There are 100 million satoshis in one Bitcoin).

In such a case, it can become a Digital Aluminium token for all types of aluminium products - primary aluminium, slabs, primary foundry alloys, billets, wire rods, foil, etc. Digital Aluminium holders can use their Digital Aluminium for purchases of physical aluminium products.

Any Goods or Services may have their value in Digital Aluminium

The divisible nature of Digital Aluminium may be used in payments not only for aluminium products but also for service operations related to aluminium.

Almost any goods or services without restrictions can have value in Digital Aluminium.

Each Digital Aluminium token will eventually go through the entire payment chain until it is converted to physical metal directly for its user.

Digital Aluminium and Environmental Protection

When we are speaking about the developments of the new age, it is important to keep in mind sustainable growth. Digital Aluminium will create a unique opportunity to achieve two reasonable goals at once - to significantly

reduce environmental issues and, at the same time, to substantially optimize and reduce the supply chain and costs for the aluminium market participants.

Digital Aluminium Eliminates the Intermediate Logistics Issues:

Digital Aluminium will allow supplying aluminium products directly to end-users. Digital Aluminium makes intermediate operations and costs unnecessary, making business turnover cheaper and faster, saving and protecting the environment.

Intermediate aluminium logistics annually leads to a colossal lengthening of logistics routes and unnecessary reloading of aluminium products, which costs humanity hundreds of thousands of kilometres of sea and land freight and hundreds of thousands of tons of burned marine and truck fuel. Thousands of cubic meters of pine forest are cut down and fumigated with pesticides solely for fastening such additional shipments in the holds of sea vessels and containers.

Digital Aluminium Eliminates the Internal Logistics Issues:

Eliminating internal logistics in intermediate warehouses and storage areas will significantly reduce energy costs for lighting, security, accounting, and logistics of the aluminium products inside the warehouses. It will allow more rational use of huge areas previously allocated exclusively for long-term aluminium storage.

Digital Aluminium Eliminates Wastes Disposal Issues:

Digital Aluminium will reduce contamination of the aluminium products surface during open storage and movement, eliminating the problem of wastewater disposal when washing

aluminium in case of long-term storage of aluminium products in warehouses. It also helps to reduce the number of transport operations and associated inevitable damage to aluminium products and their packaging. The problem of sewage treatment, replacing and recycling worn-out plastic and polyethylene packaging of aluminium will be primarily solved with the help of Digital Aluminium.

Digital Aluminium Meets Low Energy Consumption and Heat Dissipation Demand:

Cryptocurrency mining is known to cause significant damage to the environment due to high energy consumption and heat dissipation.

The nature of Digital Aluminium as a blockchain token will exclude the possibility of mining it. Digital Aluminium will be exchanged and sold in the market, ultimately buying aluminium, but will not be mined.

Digital Aluminium holders will pay a transaction fee to the blockchain miners, but Digital Aluminium nature can't be a mining tool.

It is appropriate to compare Digital Aluminium with an electric car - an electric vehicle does not harm nature with its emissions and does not have a carbon footprint. Still, it drives on roads made of asphalt. Therefore, Digital Aluminium directly will not harm the environment, being a "green token."

Conclusion

Digital Aluminium is likely to play a crucial role in the aluminium market's long-term development, transparency, and competitiveness. While the creation of international regulatory mechanisms may take some time, it is important to recognise that cyber development is an inexhaustible source of progress for humanity as a whole. Though impossible to touch, Digital Aluminium will exist and represent aluminium's value until the holder is ready to exchange it for the fruits (or metal) of the physical world.

Digital Aluminium's colossal impact on the global aluminium market in the future is hard to overestimate, and any new developments in this sphere will surely revolutionise the way we see our business as a whole.

This article contains the author's thoughts solely on the potential digital opportunities in the aluminium market and is not a description of any specific project (existing or planned). The opinions and judgments of the author are his personal opinions and judgments and should not be interpreted as the official position of the persons with whom he is professionally connected. ■