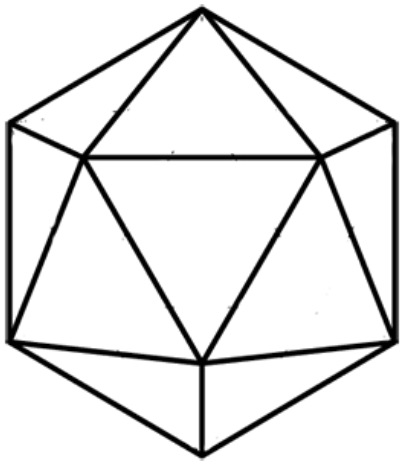

TIMEUS

First verified blockchain for mass adoption

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Abstract

Timeus is a protocol and decentralized application platform. It meets the requirements of industrial applications for high throughput, low latency and scalability taking into account security. The main feature of Timeus is a mandatory verification before use. We offer limited blockchain anonymity. Otherwise its adoption and legal recognition are impossible.

In addition to use values, Timeus implements special technical solutions such as Proof-of-fortuity (POF) consensus algorithm, unique cloud nodes structure and Merkle tree ledger structure. The Snapshot Chain structure in Timeus can make up for the lack of security of the Merkle tree ledger. The unique consensus Proof-of-fortuity (POF) algorithm, through which writing and confirming of transactions, provides high performance and scalability. Proof-of-Fortuity is designed so that the network primarily exchanged a hash of the main block, and all other data would be loaded sequentially from the selected super-node. This allows making the network fast and handling an unlimited number of transactions in fractions of a second. Also Timeus will support smart contracts and smart contract construction.

Teus-environment is a public system that will be built using Timeus blockchain. It will grow at the expense of new users, developers of Dapps and other contributors. We expect that verification will allow attracting new participants and overcoming blockchain associations with an underground economy.

Why we started Timeus

At the end of 2017 we started to create b2b SaaS e-commerce platform that could integrate all the parties of supply chain: manufacturers, distributors (wholesalers and retailers) and consumers all over the world. All platform clients could use promotion, workflow, analytical and etc services prepared by platform. We called it Torgim. At the final stage of Torgim development we understood that blockchain could be an efficient technical solution for our platform. We could store all transaction and reputational story of users, use smart contracts for deals procedure, provide Torgim economy with internal digital currency for international payments etc. And we wondered what blockchain to choose for our needs.

Firstly we decided to consider working blockchains and find out if they suit us. We found that these blockchains can't meet our needs for several reasons:

1) Each of them has some technical restrictions for providing ecosystems with high volume and needed functionality for business and individual consumers. You could look at research at Appendix 1.
2) Any public blockchain has no prospects to be adopted by governments and businesses because of legal reason.
3) Also a real problem of blockchain is «elitism» of technology (complexity of development and introduction) and misunderstanding of blockchain by business

In our opinion, public blockchains were focused on the interaction between individuals (p2p). They were not planned and implemented to work with legal entities. As a result they are not adapted for business needs. Their main idea is radical decentralization close to anarchism and underground economy.

So we decided to design our own blockchain protocol. It must combine all advantages of blockchain with few specific technical and architect solutions that would allow us to solve some technical problems inherent in the blockchain. So Timeus was started.

But we realized that our needs are not unique. Everyone who wanted to use blockchain in their business have a similar problem. We recognized that Timeus application could and should be wider just within our project. We could unite community developing public external environment where both businesses and individuals would be connected. Everyone can realize his protocol case and expand the environment, bringing additional demand. So Teus – environment idea appeared.

After our own reflections and negotiations with different business structures we find out that any business don't want to risk using any public blockchain. That's because it doesn`t have any legal permissions of money transferring to buy crypto and use any possibilities of blockchain like fast cross-border transactions, smart-contracts and other. It was really clear that at this moment legal entities can't really use marketplaces with crypto and blockchain structures until they are adopted by the states. So, unfortunately, now blockchain is on the way of many not admitted technologies. It has not been accepted by business and governments yet. It is not commercialized.

That is why we should create a «business-oriented» blockchain. And such blockchain must meet some requirements:

1) The idea and concept should have a chance for adoption. It means that some kind of step away from anarchy is necessary
2) It is necessary to apply new technical and technological solutions to expand the possibilities of the blockchain.
3) Blockchain should have sufficient functionality to meet the needs of corporate and individual segment
4) It is important to allow other projects to join ecosystem built on this blockchain and benefit from development of the environment and the community.

The second problem was solved using unique Teus - protocol architecture. The third – implementing unified wallet, barking access to extensive user functionality, the fourth – creating Teus - environment. However, adoption is undoubtedly the most important limitation. The only solution for adoption can only be user verification, with limited access to personal data for a certain circle of people. It’s the only way to mass adoption and a compromise step towards blockchain recognition in legal economic relations.

We don’t abandon Torgim implementation and now Torgim demo is at the final stage of development. We consider Torgim like first Timeus case and an engine of ecosystem growth. Torgim will bring initial transaction base for Timeus blockchain and make others believe in a possibility of implementing our approach.

Timeus main features

Blockchain industry has certain limitations that need to be solved at the level of technology, product or business model of the project. Speaking in details we should mention three main of them. Timeus blockchain has an ability to solve all of them.

Firstly we must mention legal restrictions due to lack of regulation by states. At the moment, a regulation of blockchain and crypto are being formed in almost all countries. States initiates law drafts, which will undoubtedly become laws in time. That's why definite regulation of distributed ledgers is a matter of time. The main reason of non-adoption is anxiety of states due to inability to identify a user.

Verification

Before using any type of wallets anybody has to undergo verification procedure. Without passing verification using of your wallet will be abandoned. You will be able to make it in your wallet without going anywhere.

The main reason of non-adoption is anxiety of states due to inability to identify a user. Timeus is a new concept of blockchain adapted for business and states. Anyone who wants to become a member of the system will have to undergo verification (legal entity to sign a contract). This is a mandatory requirement for each participant of Teus - environment. It means that each participant will be identified and it may be possible to make a one-to-one correspondence between its id and private key generated for him. This option allows the state to find out the identity of a key owner

Verification does not mean that everyone have access to your personal data and can identify you. Only narrow range of participants (states) will have an access in accordance with your residence. Outsiders won't be admitted to any verification data.

Timeus gives a tool allowing states to identify users if it necessary, but not a tool to control the environment itself. In our opinion, it is a reasonable compromise. Timeus works exclusively in accordance with anti-money-laundering and counteracting terrorism financing and criminal activities. To monitor compliance with the requirements of the law, Compliance department has been established. It develops AML and KYC procedures, which determine the policy of interaction with persons who sign a contract.

Compliance is designed to ensure that company's activities comply with international standards for combating money laundering and all documents provided by customers are relevant and comply with the requirements of legislation. Especially careful will be the verification of residents of countries identified by applicable law as being in high-risk countries.

To pass verification, everyone must provide:

For individuals:

- a color copy of the document that is proper for confirming the identity of the Client in accordance with the legislation of the country of which the Customer is a resident
- additional documents (by request) - a copy of the driver's license, receipts for payment of services (for confirmation of the Client's residence)
- confirmation by the customer telephone number

For legal entities:

- Registration certificate
- Statute of the association/ memorandum
- Certificate of Incumbency / Certificate of Good Standing
- Evidence of directors and shareholders (10% +). Usually this is a passport or a national identity card.
- Evidence of the address of directors and shareholders (10% +). As a rule, utility bills for the last three months.

Transfers of funds from the customer's account are allowed only after the customer passes the verification on the basis of the provided proper documents and completed questionnaire. Receipt of funds is carried out only to an account owned by a person already identified.

Secondly, there are some technical problems that limit scalability and efficiency of the blockchain network. According to research at Appendix 1 we can highlight several problems that could be solved technically.

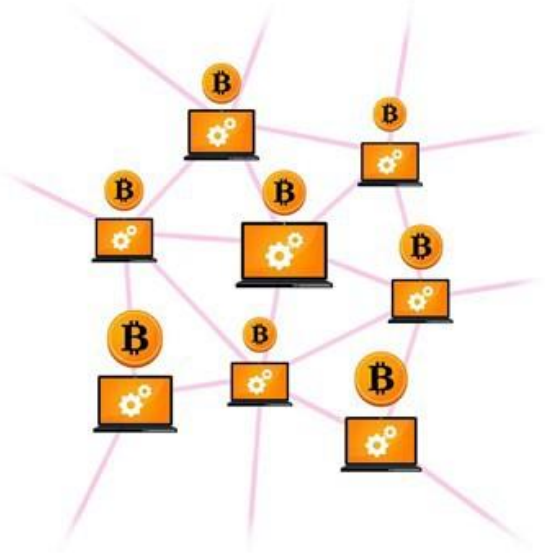
Technical features

Any blockchain consist of three main points:

1. Consensus algorithm
2. Distributed ledger (distributed nodes)
3. Linked list

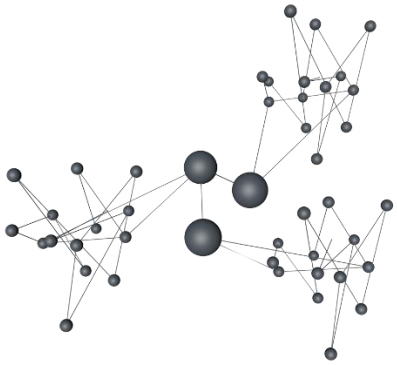
From architectural point of view an issue of the optimal nodes structure is extremely important. We implement a multi-level nodes structure that will allow us to increase network security and solve the problem of data storage. The main idea of multi-level architecture is a backup formation.

In standard structure each node is a single full node. That is every full node contains all data of blockchain like a replica.



Standard structure of nodes (BTC)

In comparison with the standard structure of nodes, the structure of Timeus nodes has been modified to a multilevel. It is a possibility to increase the security and stability of the network due to multiple backups.



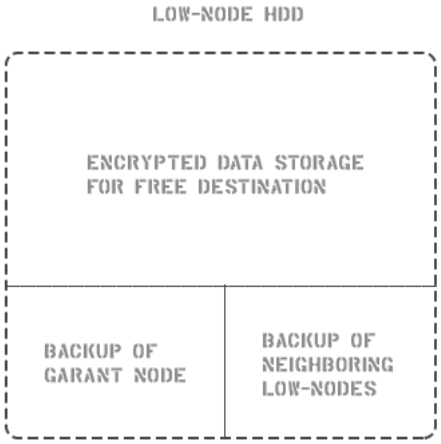
Timeus node structure

At the first level, the network consists of nodes according to a distributed principle: there is no single data center, information is contained on all full nodes. This is a classic peer-to-peer network. A key difference of Timeus node architecture is decentralized full node. It means that we are not talking about a full node as a single node but about full node like full node cluster.

Full node cluster is a structure of three or more (It depends on full node weight) garant nodes. In other words, initially every full node splitted by 3 general garant-nodes that store 1/3 of full nodes and completely form a full node. At the second level, each garant node is decentralized to a set of low-nodes. Every garant node supported by «n» number of low nodes and backup garant node in a certain proportion. This proportion is determined by 300% reservation rule. It means that a set of low nodes assigned to each garant node contains data reserved three times. As a general rule, each new low node assigned to the garant node with a

smaller number of low nodes in the network. Also every low-node contains data storage for free destination and backup of neighboring low-nodes.

Garant or low node is a manually allocated storage on a disk by a network member (dedicated storage). Garant-nodes are selected from the number of low-nodes according the size of dedicated storage (HDD), three largest become garant-nodes and others become low-nodes. Any user can allocate any amount of space and receive a reward for holding information. According to the basic rule - everyone who allocates a place for data storage (holds a garant or low-node) receives a reward for holding in proportion to the allocated place.



Low-node HDD structure

As a result, Timeus node architecture allows avoiding loss of node integrity and makes the network more resistant to external attacks. That is, any losses of a certain number of low-nodes (depending on the complexity of the low-node structure for each node) will not lead to the loss of the main node and is not critical for the network.

Each user who installs a software or application allocates space on the disk of a computer, mobile device or any other holder, receives a reward for the number of hours of uptime and data availability. Thus, Timeus has all the features of decentralization.

Timeus multilevel node structure gives an opportunity:

- To keep dedicated storage of each network participant within acceptable limits
- To receive a holding reward for network participants
- To increase full node size without storage problem

Consensus algorithms are used now such as Proof of work (POW) and Proof of stake (POS) have significant drawbacks. POW (historically the first algorithm) based on mathematical task where solution can be found by a simple selection of values. That task becomes more complicated with time. It leads to the fact that large computing power is wasted (the larger the network the higher the losses). Moreover, there are special computing devices (ASICs) that are applicable for this particular task and are otherwise useless. When we talk about POW, we immediately think that we need electricity, special computing devices. Over time, complexity increases, there are pools, increased investment in equipment and electricity costs. Moreover the risk of attack is 51%.

In the POS algorithm probability of forming a new block (and receiving an appropriate remuneration) depends on the amount of crypto (which he mines) owned by the miner (steak). It means that there is a serious entry barrier and network scaling can be limited.

Drawbacks of consensus algorithms leads to blockchain performance (the number of transactions per sec) and their cost (transaction commission) don't meet expectations of users and limit the network growth. So, when we talk about POS, we immediately see a vote, freeze tokens for the production of blocks. That in itself makes manufacturers of blocks at the entrance prepare for investments for maintaining the network.

But, what if an algorithm was aimed at preventing electricity from being wasted in vain, tokens would not have to be frozen, and the system could calculate and designate the block manufacturer?

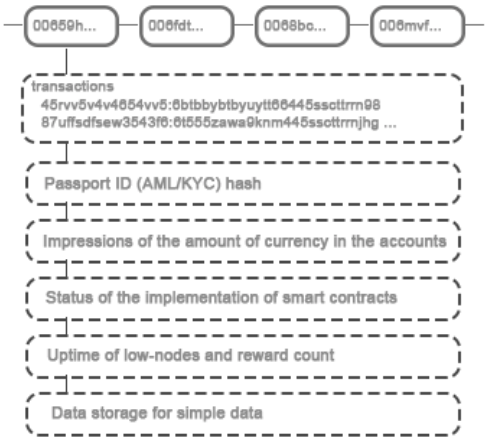
Proof-of-Fortuity is designed so that the network must be sequenced from the selected super-node. This allows you to make the network fast and handle an unlimited number of transactions in fractions of a second.

A naive description of block adding process is following. From the number of garant-nodes in a random way (equiprobable for all) one is selected, which is considered a supernode and gets the right to add a block to the chain. Network selects only one node and adds this block to the entire network, in other words, a super node confirms only true block. Generation of blocks occurs every second that allows not overweighting block and keeping it acceptable size. Data is taken from the memory pool, and each transaction is assigned a unique hash of the entire main block.

One account can make one transaction or a single set of transactions per second. Thus, every second snapshot of the network and account balances will not allow attacking with double spending. Such a consensus algorithm will ensure high network performance at low commissions.

A multilevel node structure gives an opportunity to design a two-level structure of blockchain implemented in Timeus. There are mainchain and 6 tree branches. Each of trees is an independent linked list for different types of data. These 6 sidechains determine the basic functionality of Timeus: transactions, smart contracts and free storage. In process of network development and adding of new decentralized applications a number of branches will increase. Each new case (application) deploys new sidechain. It helps to increase the functionality of Timeus for users due to new applications development. Such approach allows us to expand functionality of Timeus.

Mainchain contains hash of sidechains. It ensure a necessary speed of adding a new block (every second) and so required transactions processing speed (100 000+ tps) is achieved.



Timeus basic ledgers

Verification data

Information obtained during the verification procedure. This information makes it possible to identify account holders if needed. Roughly speaking, there store all data related to AML and KYC procedures.

Transactions data

This chain stores information about all the transactions that have ever been made within network (for example, transfers of funds between participants)

Smart contracts data

Contains information about statuses of smart contracts. Timeus will support smart contracts via Ethereum virtual machine (EVM). EVM is the most widely used execution engine for smart contracts. Most of the existing dApps built on top of EVM can be directly deployed on Timeus platform. In addition, to utilize high-scalability feature of Timeus, we will provide additional scalability-aware interface such as which node cloud the contract is being executed, sending smart contract specific data and more opportunities.

Network status metrics

Storage of the state and availability of funds on the wallets in 1 second after the creation of the previous block.

Low-node uptime metrics

Time of fixing accessibility of low nodes (online) for payment of appropriate fee.

Free data storage

A branch for registering files in a storage and accounting of such data. Here will be held text data, tabular data, charts, lists and other non-media data.

Timeus demand

Speaking about product demand we keep in mind its user values. Timeus offers users such kind of values:

Simple and unified interface

We provide market with adapted software clients for business and individuals. These wallets allow them to conduct and manage different types of operations from one place. We offer two types of wallets with different functionality. One is for individuals and their private needs with transactions support and for business with support for advanced functionality. Both of them provide with user's account management.

Wallet for individuals

- Gives an opportunity to conduct p2p transactions
- Gives access to Dapps products
- Has a functionality of standard smart contract creation
- Allows using of free storage

Corporate wallet

Corporate wallet has a higher protection, functions for transaction conducting, passing verification standard, and creating standard and also unique smart contracts in addition. Moreover, there are set of documents for reporting and functionality for integration with services. In a business wallet will be developed standard smart contracts with an ability of its ready-made design. That is, required smart contracts can be created by any employee with a minimum level of computing knowledge.

Timeus has free, decentralized data storage. Any company will be able to create its own data format and they will be signed by the identifier of this company. All data is encrypted. By creating product labels and providing a key to your application, a company will be able to allow counterparties and customers to verify the goods through their own application.

Each wallet (address) has public and private keys. A public key generation based on the data that is entered to verify a user. User's address is short (@ceo_timeus, for example) and does not change. A public key is stored in the Verification data branch, together with the data for verification. A private key is analogous to a digital signature and can be stored on a portable storage or on a local disk.

A possibility to receive an income from participating

Being Timeus participant each user has an opportunity to receive holding reward. Holding reward represents an income received by network members for the allocated storage space. Holding reward is fixed per unit of usable capacity of HDD and is paid to everyone in accordance with usable capacity of HDD (total bit unit amount). Also, as a general rule, a holding reward of a garant-node is equal a reward of low-node. However, according to the structure of the Timeus nodes, a garant-node is significantly larger by size than a low -node.

Holding reward is paid with a certain frequency, the income is paid only to those participants who have provided activity of the repository.

An access to wide range of products

Teus protocol provide with basic functionality for users:

- Transactions
- Smart contracts
- Data storage

With decentralization and security which gives blockchain. But we consider Teus-protocol like some kind of ground where anyone can develop its own case (an application). It allows us to significantly expand Teus functionality for users. As we mentioned earlier Torgim is one such cases.

Teus - environment

Teus – environment realize the main case of Teus-protocol. It is Teus like cryptocurrency. Timeus blockchain is a technological basis of the system, a tool that combines all elements and allows interaction within the framework of the network. Any company that has signed a contract and has been verified can be integrated there. A company's industry and market on which it operates are not of primary importance. The network will include both start-ups and companies that have an operating history.

Our strategic task is rapid ecosystem growth. It's important because:

1. Entering projects give new values for consumers due to additions of new products and services
2. Increasing turnover balances product and Teus supply

We want any client of the network can get the full range of services he needs within our ecosystem without turning to other markets and systems. Each company could find a contractor, supplier, buyer and any other partner legally.

Just imagine!

Many projects integrated into one ecosystem: ecommerce, fintech, IT etc. For example, an IT project immediately gets interested in its development companies. Ecommerce gets the opportunity to order an IT project for the development of certain technologies, and through integration with fintech can expand the demand for its services or enable customers to receive passive income for temporarily free funds.
Teus environment participants:

- Timeus foundation
- Public authorities (custom, tax, financial and other regulatory and law enforcement agencies)
- Legal entities (corporate)

- Individuals (and commodities)
- Daps developers and projects
- Funding and business development providers (VC, CC, angels, accelerators, incubators)
- Stock and exchange institutes
- Government and state companies
- Industry associations, formations and unions

We can explain some benefits of participating in Teus ecosystem. Such benefits are associated with obtaining competitive advantages.

- Access to a growing customer base that allows it to scale the business and make profits
- Obtaining of many technical and technological solutions and automation of business processes (the system of mutual settlements, the system of smart contracts, the formation of the history of the company's work, tracking the reputation of counterparties, countering falsification, etc.)
- An ability to build partnerships with other actors in the environment
- Increase business reputation and status as the environment develops.
- Access to financing and attention of venture funds and other sources of financing
- Entering the international market when joining the network

Teus is a single cryptocurrency of Timeus ecosystem. The core issue of any ecosystem is optimal internal liquidity amount. That's why we thought over concept of filling the network by Teus and you can see it principles below. In order to coordinate inflation and deflation mechanisms within Timeus network we analyze Ethereum network development (Appendix 3).

The main conclusion is too much ETH initial genesis. As a result till the moment when network obtain a critical transaction number ETH exchange rate was very low. The reason is unbalanced ETH cryptocurrency demand and supply. We receive this problem by accurate liquidity extension conception. Its description you can find below.

Also a number of transactions per one wallet have been reducing. We think that the main reason is mining restriction. Only miners have on opportunity to receive a stable income. We received this problem by holding payment.

Timeus economy principles

It's obvious that supply and demand form the price of the goods and services. Exactly a supply and demand for the currency form the exchange rate. In our case, the demand is made by internal and newly coming users. The supply of currency is formed by all those network members who allocate storage space. They receive payments for the space allocated and claimed by the network and accumulate Teus tokens.

We must consider Teus ecosystem from two sides. On the one hand, as an independent economy isolated from external environment in a certain sense and in conjunction with an external economy, on the other. The key issue of any cryptocurrency is the question of the stability of its course towards fiat and cryptocurrency money. In order for a course to be stable, it is necessary to ensure sufficient external demand (an increase in a client base and average funds for the wallet) and sufficient supply that is formed within the ecosystem.

Therefore, the basic principles of an ecosystem should be aimed at:

1. Formation of the optimal (non-redundant) supply of Teus. Moreover a small deficit of Teus supply is permissible.
2. Formation of demand for Teus with an emphasis on attracting new users
3. Providing some internal mechanism, according to which large volumes will not be held. That is, large amounts of currency should not be deposited in wallets (in the form of savings) with the expectation of future investment income, and offered in an exchange market. Otherwise, a one-time sale of large stacks may collapse the Teus course.

Teus demand was considered above. The initial demand for Teus will be provided by its basic functionality and projects of the Timeus team:

- Internal settlements (transactions)
- Smart Contracts and Designed Smart Contracts
- Torgim (ecommerce)
- TeusCloud (cloud storage)

In the future, the demand will be expanded by Dapps and Apps, providing a different range of products for the community. Moreover, we are confident that demand will only grow due to mandatory verification that allows avoiding many problems with legal.

Teus supply

Speaking about Teus supply we bear in mind two important points:

1) Filling the Teus environment by liquidity
2) Economical need for Teus holders to enter an exchange market

The liquidity of TEUS (TEUS supply) ecosystem will be promoted in two stages

- Initial supply of Teus
- Teus liquidity extension

Initial supply is funds in Teus that will be allocated to the team and for sale. Initial supply represents amount of TEUS, with which a network begins its operations, providing the necessary liquidity for the development of ecosystem for the first time.

With a start of network operations (launch of the mainnet) a process of liquidity extension will be launched. An increase in liquidity in Timeus ecosystem will occur due to the receipt by the network participants of income for storage (holding reward).

Total Teus emission will be 10 000 000 000 Teus

- 325 000 000 is a Team bonus/Marketing (100% Team tokens locked 2 years)
- 675 000 000 is for a sale
- 9 000 000 000 will be introduced into the ecosystem during its development. It is liquidity extension fund.

Some team tokens can be allocated to promotion campaigns. But its share cannot exceed 50% of the team's fund. Token's holding do not guarantee, provide, or imply any income to purchasers. Payments to holders in a form of dividends or any other form won't be made.

Tokensale will consist of three stages. On pre-seed stage project was financed by founders. At the seed stage, we provide bonus conditions for the early believers. Since their contribution that can be decisive and fostering for Timeus.

We reserve the right to decide whether or not stages A and B to be. In the event that some of them are not held, these tokens will increase liquidity extension fund.

A more detailed explanation of the funding process can be found in "Funding paper". In the same place we describe our road map.

Holding reward and payment

Holding reward is an income received by network members for the allocated storage space. Holding reward is fixed per unit of usable capacity of HDD and is paid to everyone in accordance with usable capacity of HDD (total bit unit amount). Also, as a general rule, a holding reward of a garant-node is equal a reward of low-node. However, according to the structure of the Timeus nodes, a garant-node is significantly larger by size than a low -node. Holding reward is paid with a certain frequency, the income is paid only to those participants who have provided activity of the repository.

All HDD capacity in the network is divided into two parts:

- allocated (capacity that the user is willing to provide)
- filled (Actually occupied capacity on user's HDD)

Holding reward payment procedure

Total holding reward (M) is accumulated on a special purse and distributed equally among all Timeus holders when sufficient funds are reached, equal to M. Next, the reward is divided between Guarantor B and the low-end i, depending on the allocated storage location (P coefficient) and uptime E.

$$\text{Individual reward} = M / (B * 3 + ni * (P * E))$$

Total holding reward is constant and does not change. So that individual holding reward will reduce during ecosystem development (with growth of full-node size). Holding reward reducing urge network participants to enter the exchange market for their cost recovery.

Transaction fee and cashback in the network

There is a transaction fee for transaction conducting. All transaction fees (a set added transactions) fill special reward fund. Transaction fees are set by the user, but there are maximum and minimum value. Average transaction fee amount increase with growth of network scale.

In order to reduce fees for users at the beginning of the network work and to stimulate its scaling a special cashback is entered. For the user, it acquires a discount form. It means that a user will receive back some of coins spent as a fee. The percentage of return (and return amount) will decrease with time (according to the remain of coins in the Teus supply increasing fund). The size of cashback return will be limited for each address.

Payment procedure

All transactions fees are accumulated on a special purse and distributed equally among all Timeus holders (so as holding reward payments). Payment amount depends on number of transactions and its fee during accumulate period. So it is not stable.

Thus, there may be several types of participants in the network. Firstly, simple users who use hot wallets. They do not allocate space and do not receive income. Secondly, «miners» who

receive income but don’t conduct transactions (don’t spend accumulated funds). But if you combine spending and mining you has a chance to earn funds for your transactions conducting.

Once the total number of TEUS reaches 10 000 000 000, any operations with TEUS will be a redistribution of funds among the participants in the network. MaximumTEUS supply is fixed at $ 10,000,000,000. However, this volume will be introduced over several decades, so do not worry about inflation.

Input flows are flows leading to an increase in the number of TEUS in an ecosystem. They lead to liquidity extension.

- Holding fees
- Cashback payments
- Payments to the team

Redistribution flows are flows that do not lead to an increase in a total number of TEUS in the system. They don’t lead to liquidity extension.

- Transaction fees
- Fee for the amount of cloud storage used
- Smart contract payments
- General purpose payments (other transactions)
- Internal exchange operations (coins - Teus conversions)
- External exchange operations (fiat-Teus and crypto – Teus conversions)

Core team

Roman Saydulin Tech lead

Aix-Marseille (Computer Science), France
RANEPA(State and municipal government)
University of Nicosia(Digital currency)
roman@timeus.org

Started education of web development in 2001.

In 2001, I finished school and entered the French university in Aix-Marseille to Computer Science, Masters.
In 2016 finished RANEPA university in Saint-Petersburg, bachelor course State and municipal government.
In 2018 finished MSc course in University of Nicosia Digital currency by Andreas Antonopoulos and Antonis Polemitis.

Back in the Russian Federation, started marketing and IT development agency "Creative Agency AF" in 2008.

As a tech lead, designed and developed more than 80 e-commerce and business websites and closed systems for companies for control, inventory management software, etc. with use of big data management and analytics systems.

Agency “AF” built hundreds of marketing and grow hack strategies for clients for last 10 years.
Now it`s one of the oldest agency in the market.

The first integrated DLT system was in 2013 for the international manufacture of stretch ceiling 'Saros" presented in Germany, Russia, France, United Kindom, OAE, Estonia. The system of control was built for partners and clients and help to prevent falsification.

From 2014 worked in IT-Security and white hat community. One of accomplishment is deanon Blackhole malware.

From 2017 start work with blockchain technology. Built the first POW blockchain by itself and in January 2018 create the first view on solutions of the blockchain, who was named Timeus.

Dmitry Bogdanov CBO

Saint-Petersburg State University (economics)
Higher School of Economics - National Research University (financial management).
dbogdanov@timeus.org

Graduated from two leading financial and economics universities in Russia:
Saint-Petersburg State University (economics)
Higher School of Economics - National Research University (financial management).

He had an internship in the largest Russian commercial bank – Sberbank.

Then worked in Tinkoff Bank.

In 2014 he joined the micro-finance company Denga like analyst. During his time in Denga, he went from analyst to lead business analyst.

For this time Denga has become one of the biggest companies in the country (PDL segment), federal corporation with real plans to expanse international market.

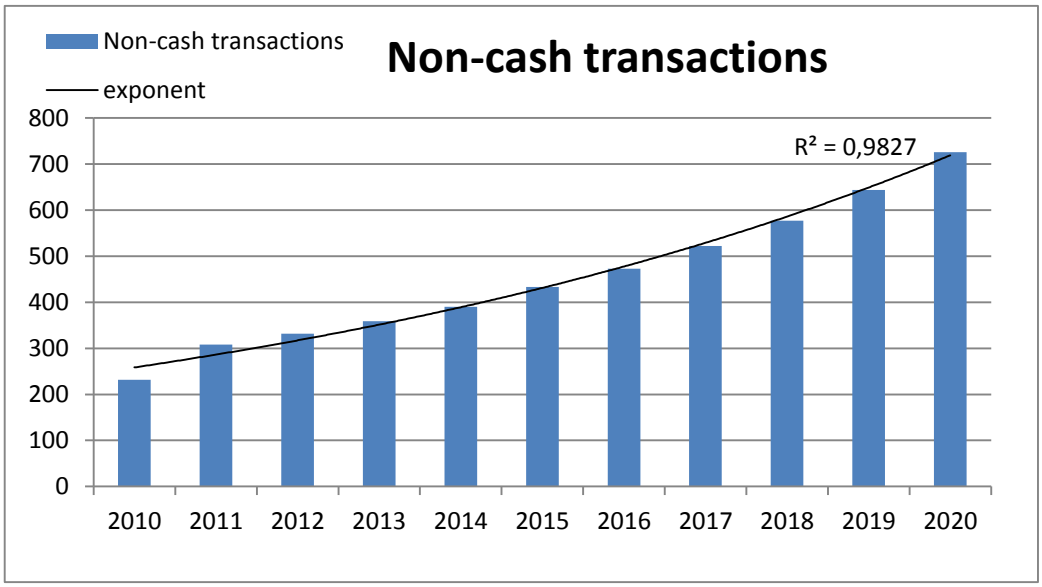
In 2018 joined Timeus like CAO (Chief Analytical Officer).
Professional competences:
• Risk Management
• Business processes and business models optimization
• Financial and economic modelling
• Financial and economic analysis
• Business valuation
• Corporate finance
• Marketing analysis
• Competitive analysis

Appendix 1 Restrictions of public blockchains (BTC research)

Thinking about Timeus environment we clearly understand that we should use blockchain like technical decision and support for its economy. But very soon we find out that any public blockchain can't be an effective instrument for us. Full nodes of public blockchains occupy tens and hundreds of gigabytes on the hard disk. Moreover, the node also must receive and return the same tens and hundreds of gigabytes of data per month (acting as a client and server). The reason lies in the fact that the networks of public blockchains are cluttered with information (useless smart contracts and transfers of small amounts between people from all over the world, for example).

All this can be called an overload of network participants, many of which are economically useless. So that supporting real ecosystem any public blockchain would have a problem of overweight data storage during ecosystem scaling. And we decided to conduct a research of economy based on public blockchain. We took hackernoon.com study as a basis.

We can illustrate it in a simple modeling. Let us imagine Bitcoin become the one true currency used for peer-to-peer payments around the world. It means that all non-cash payments are conducted with Bitcoin. Instead of credit cards, people whip out their favorite Bitcoin hardware or mobile wallets in coffee shops and hair salons across the world. Let's look at number of non-cash transactions per year according to worldpaymentsreport.com .



We can see exponential growth in number of transactions every year from 2010

Some initial assumptions in modeling:

- BTC is able to accommodate such number of transactions
- BTC block is added into blockchain every 10 minutes
- Average transaction size is 250 bytes
- BTC is an only currency for all non-cash payments from 2017 till 2020

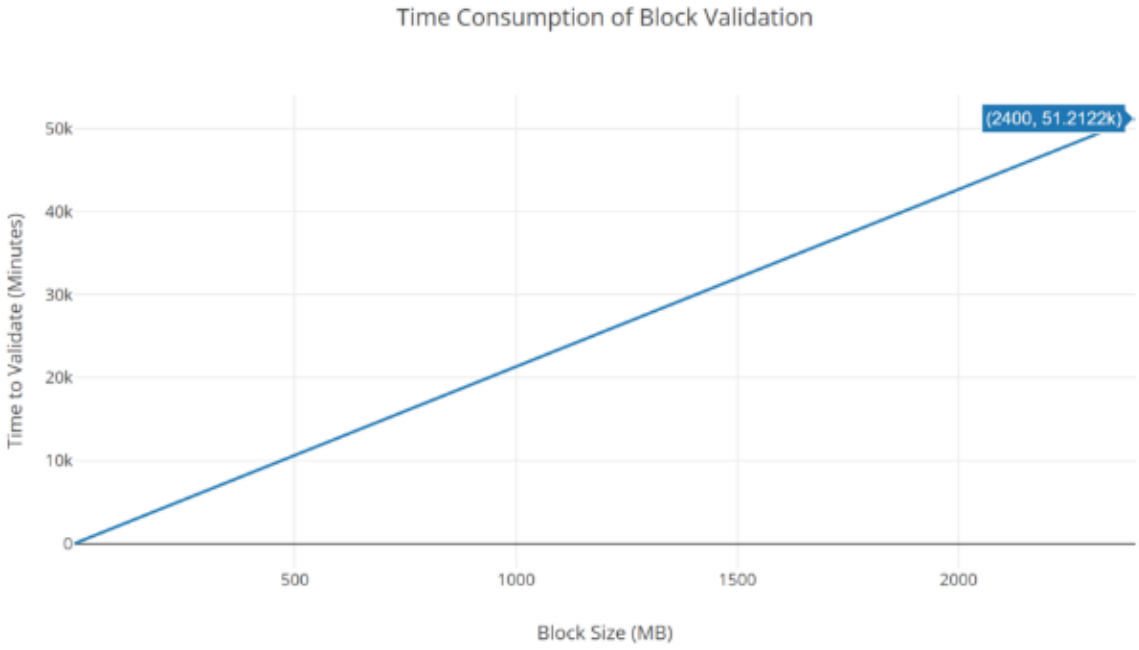
Now we can calculate some metrics of our BTC economy (look at the table below).

	2017	2018	2019	2020
year trns number	522 bln	577 bln	644 bln	726 bln
day trns number	1 430 136 986	1 580 821 918	1 764 383 562	1 989 041 096
1 minute trns number	993 151	1 097 793	1 225 266	1 381 279
10 minutes trns number	9 931 507	10 977 930	12 252 664	13 812 785
block size (gb)	2,3	2,6	2,9	3,2
day storage weight (gb)	333	368	411	463
annual storage weight (gb)	121 538	134 343	149 943	169 035
total storage weigth (gb)	121 538	255 881	405 824	574 859

It means that total storage weight (full node size) at the end of 2020 will be 561 terabytes. The blockchain ledger is upheld and propagated by nodes, which are user machines that hold a copy of the current valid Bitcoin blockchain ledger. These nodes all work together to uphold the decentralized blockchain. Nodes receive new transactions from users' wallets, have miners validate them, and then receive mined blocks from miners to add to its ledger. The nodes then also immediately propagate these validated blocks out to other nodes across the Bitcoin network.

Today, nodes validate and propagate approximately 1 megabyte blocks to other nodes across the world. According to this analysis about the effects of block validation on memory usage, the process of validating a single block on a node (i.e. serializing and hashing it) consumes about **1.25 gigabytes of memory** and takes approximately **thirty seconds**. The analysis also claims that block validation times scale quadratically, and an eight megabyte block would take approximately *150 minutes* to validate.

Let's assume validation time and memory consumption scale only linearly.



This is how the scale of block validation might look like if Bitcoin took over the world today, with 2.4GB blocks.

Extrapolating to fit our newfound monster blocks, we're looking at a validation time of over **51,000 minutes** per block, or approximately **35.4 days!** It would take *over a month* for a node running current-day consumer-grade hardware to validate any block that it receives. On top of that, memory consumption per block validation runs in the range of **3 terabytes**. The only machine that seems to come even close to that level of memory (outside of server racks) is the unreleased HP Z8 that will cost well over $10,000 at launch.

Also we should mention that each machine (with full node) must store from 60 (average during the year) in 2017 to 479 terabytes of data. With the cost of storage hovering at 1.9 cents per gigabyte, this machine's operator would need to spend approximately from 1155 to 9316 USD per year on storage costs.

But that's not all! Our nodes also need the ability to both download these blocks from nodes, and then transmit them to other nodes. Let's assume our node has to download a block every 10
minutes, and uploads the minimum 144 blocks per day recommended by Bitcoin Node guidelines. This comes out to over 691 GB of bandwidth every day, or 20,73 terabytes per month.

Now we can get a summary of main problems and restrictions of BTC in real economy processing adoption:

1) Tremendous node size (hundreds of terabytes)
2) Tremendous bandwidth requirements (memory) for node holders due to block size
3) A huge storage costs for node holders

The main idea of blockchain is decentralization. It means that all blockchain data are stored at huge number of devices of individuals. Instead of this, most nodes will be replaced by monopolized and centralized entities with enough financial power to maintain server racks that can handle hundreds of billions of consumer transactions per year. And we are close to centralized banking system.

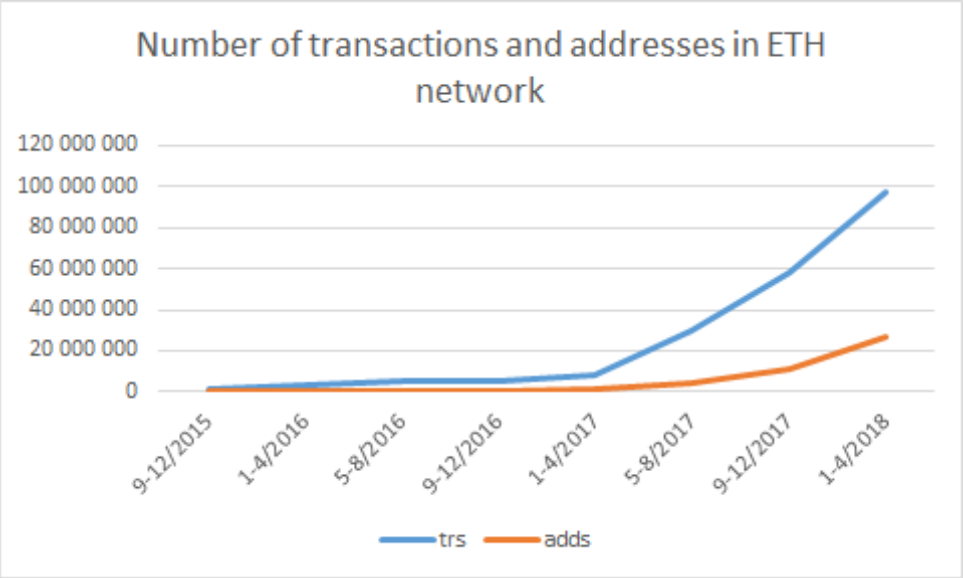
Appendix 2 ETH network dynamics research

Each ecosystem works on universal economic laws. As to cryptocurrency ecosystem a key issue is cryptocurrency course. Prices within any economic system depend on two key factors (with other things equal):

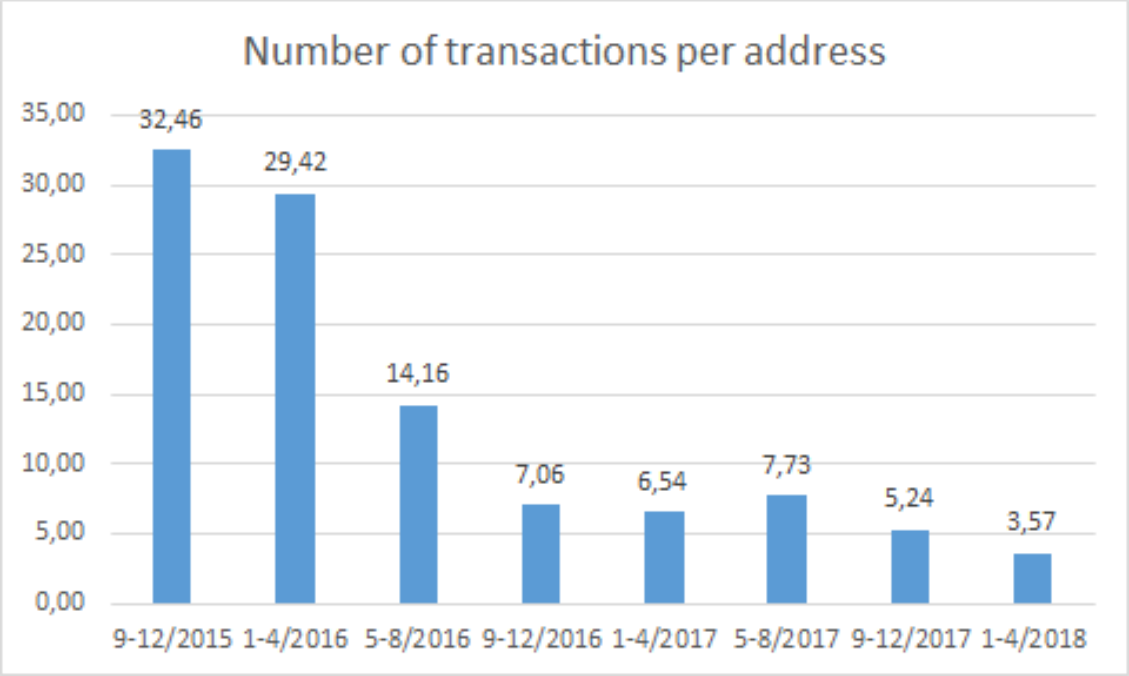
1. Effective supply of currency (money supply). As applied to cryptocurrencies, we mean the current supply of cryptocurrency (number of coins)
2. Turnover. As applied to cryptocurrencies, we mean number of transaction within network (p2p transactions and transactions by smart contracts)

In order to coordinate inflation and deflation mechanisms within Timeus network we analyze Ethereum network development.

Firstly, let's look at transaction dynamic (look at the graph below)



As you can see there is a tremendous increase in transaction dynamic in May - August 2017. And also we can see a stable decrease in trs/adds ratio.



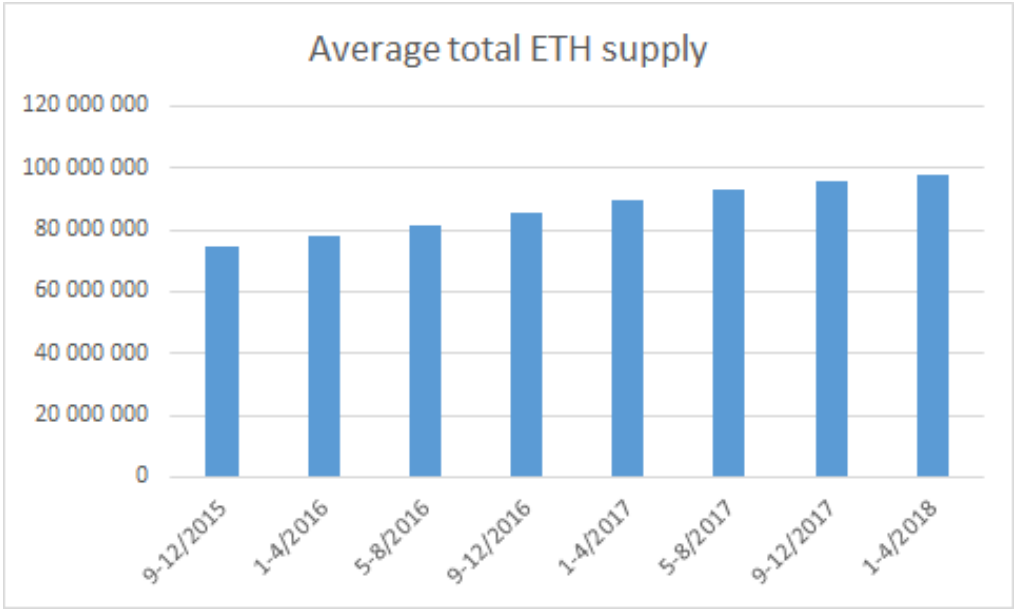
It means that most of new addresses are "empty", they were registered and are not involved in the turnover.

Total ETH supply

Now we can research total ETH supply. All ETH supply consists of two parts: genesis part and mining part (block and uncle rewards). There are three ways of obtaining ETH:

- it could be used inside the network
- it could be traded (outside the network)
- it could be holded (be on balance, but not used)

We will call the first a turnover, and the second - a volume.



We can say that ETH supply is stable because of its huge amount of genesis.

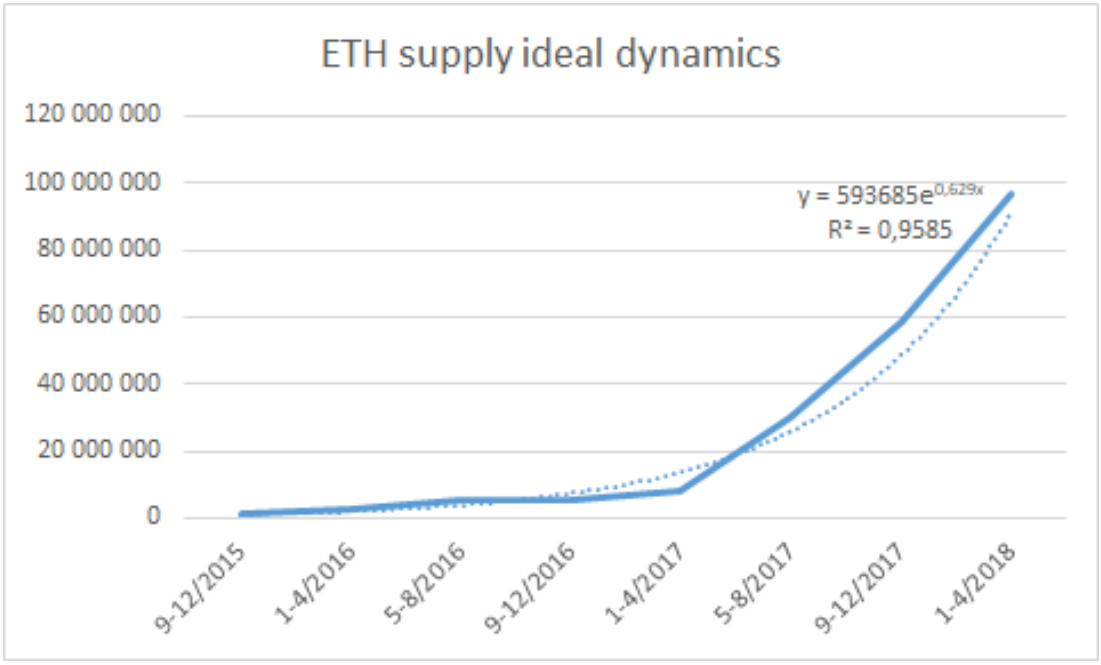
Period	ETH supply/trs	ETH/USD (average)
9-12/2015	77,6	0,9
1-4/2016	27,2	6,5
5-8/2016	14,9	12,1
9-12/2016	16,0	11,6
1-4/2017	11,5	27,0
5-8/2017	3,1	236,8
9-12/2017	1,6	317,3
1-4/2018	1,0	776,0

As we can see above ETH - USD rate depends on ETH supply/ number of transactions ratio. We can say that Ethereum genesis was rather big for early stage developing system. But with increasing of transactions the price is increasing too. Of course, there could have been some subjective factors (the growth of the bitcoin rate and community optimistic “moods”), but a definite trend have taken a place.

Period	**trs**	**Turnover (ETH)**	**Volume (ETH)**	**ETH/USD (average)**	**Average total ETH supply**
9-12/2015	960 675	150 295 076	80 162 132	0,9	74 535 580
1-4/2016	2 865 121	141 457 326	1 864 747 169	6,5	77 876 396
5-8/2016	5 460 980	184 769 148	3 404 036 400	12,1	81 574 130
9-12/2016	5 334 976	519 667 387	1 311 002 930	11,6	85 512 295
1-4/2017	7 786 149	781 714 065	8 468 045 240	27,0	89 346 577

5-8/2017	29 849 226	3 944 615 071	113 322 689 800	236,8	92 792 887
9-12/2017	58 315 510	1 431 808 162	149 504 726 000	317,3	95 503 400
1-4/2018	96 874 752	564 526 435	361 389 759 000	776,0	97 870 628

But we can simulate an ideal from our point of view situation of a balanced ETH supply. It is assumed that ETH supply / transactions ratio is stable "1".



So an ideal amount of ETH supply for the first period is 960 675 (about 10% of last period). If we approximate this graph the best function graph is exponent.

So now can make a summary:

1. A number of active addresses decreases with time. Thus, there is a relatively stable user base (core of users) , that is mostly formed at the first stages of network functionality
2. Excess cryptocurrency in a network lead to deflation. Moreover excess of cryptocurrency may be traded (external way) or holded (no-usage way);
3. Holding is a way of cryptocurrency control. It help "freeze" excess of crypto inside network. There different types of holding conscious or technical, for example. In the first case, the user holds the currencies based on his own profit. In the second case, it means transaction processing time;
4. Commission (fees) for transaction can be ignored in modeling (not always), because we can consider them like redistribution of cryptocurrency;
5. Crypto exchange rate depends on the balance of the cryptocurrency supply and the number of real transactions in the network. However, this is only one of the factors (but an objective factor)