



# SONM

Supercomputer organized by network mining  
(v0.1)

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# SONM

(Supercomputer organized by network mining)

Distributed computing power exchange

Decentralized operating system for fog computing

P2P BOINC grid computing technology

Whitepaper v.0.8

12.03.2017

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# 1. ABSTRACT

## 1.1. What is SONM

SONM is a decentralized worldwide fog computer for any general purpose computing – from site hosting to scientific calculations. The purpose of SONM is to replace hash-based traditional cryptocurrency mining, which now dominates the blockchain community.

Unlike widespread centralized cloud services, SONM project implements fog computing<sup>[1]</sup> structure – a decentralized pool of devices, all of which are connected to the internet (IoT / Internet of Everything).

*SONM is SOSNA – Superglobal Operating System with Network Architecture for fog computing.*

**Buyers of computing power get more cost-efficient solution than cloud services** (Amazon, Microsoft, Google Cloud, Digital Ocean etc.) can offer.

We use fog computing instead of cloud, so there is no more need to pay in advance for private and monopolized cloud computing. Since SONM is fully decentralized, there is no centralized authority that regulates computing resource distribution.

SONM has hybrid architecture, and thereby supports any kind of computational tasks without facing Ethereum's "out of gas" problem.

**From a technical point of view**, SONM has a top layer of underlying P2P technologies – BitTorrent for data transfer, modified P2P BOINC protocol as a scientific decentralized computing platform, Ethereum Smart Contracts as a PoE (Proof of Execution) and consensus system, BitMessage for communication etc.

There is no central control behind the system and no backdoors or escape hatches. Several existing technologies were combined and modified by our developers to make a new GRIB (GRID+Blockchain) technology.

**In terms of providing distributed value for investors**, SONM uses its own token SNM, based on Ethereum blockchain.

[\(click here to skip the project description and go to SONM token description\)](#)

Almost every online service needs computational power for their product, including Web-sites, online shops, MMORPG, companies using large databases, and app store applications. That means that everyone in the world using internet for business will have an option to use SONM tokens to solve their computing power issues. On the other hand, all internet users will be able to use SONM to receive passive income by providing their computational resources for rent.

This disruptive migration from centralized cloud computing to decentralized fog computing will not happen quickly: it will be a long and hard transition, but the result will be worth it. SONM token price calculations show decent ROI for the project's early adopters.

SONM token price is supported by stable market demand for computing power and possibility to provide more competitive prices than traditional cloud computing services. SONM token holders earn percentage from transactions and operations fees (buy-sell-develop). It's a direct analogue of holding shares and receiving dividends from operational profit.

**If you are a miner or computational power owner**, SONM is a great opportunity to use your equipment for some useful calculations and proceeding real tasks.

SONM fog computing platform is a fresh start for solo mining. There are lots of miners with GPU mining farms becoming useless due to the increased Proof-of-work mining difficulty (even for altcoins). In recent years, being a part of a mining pool has been the only way to guarantee profit from mining. But even in doing so, this profit is so small that sometimes it doesn't even cover the cost of electricity spent for PoW mining.

SONM platform gives all the miners profitable solution.

With SONM you will stop burning your kilowatts for PoW mining and start serving calculations for all distributed World Wide Web. For those who are confused by difficulty bomb or Ethereum (and many others) PoS-migration - each miner is suggested most profitable applications and tasks for his hardware. CPU, GPU, ASIC, even gaming consoles and smartphones can be used for SONM fog computing. All you need is to set up mining client application and run it.

**SONM is the Multi-agent system**, so each user will be able to use intelligent agents and smart-contracts to maximize the profit. You can set up automatization level from choosing of every project manually to one-click settings. The SONM system will then automatically pick the most profitable project for your equipment, work with it and receive payouts to your personal Ethereum address.

**SONM is easy to setup and use, both for miners and computing power buyers.**

There is no need to have advanced IT skills or to hire sysadmins if you use SONM – our self-learning system finds most profitable task for miner's equipment (and vice versa for buyers) and runs this task with no need to set up and support a dedicated server.

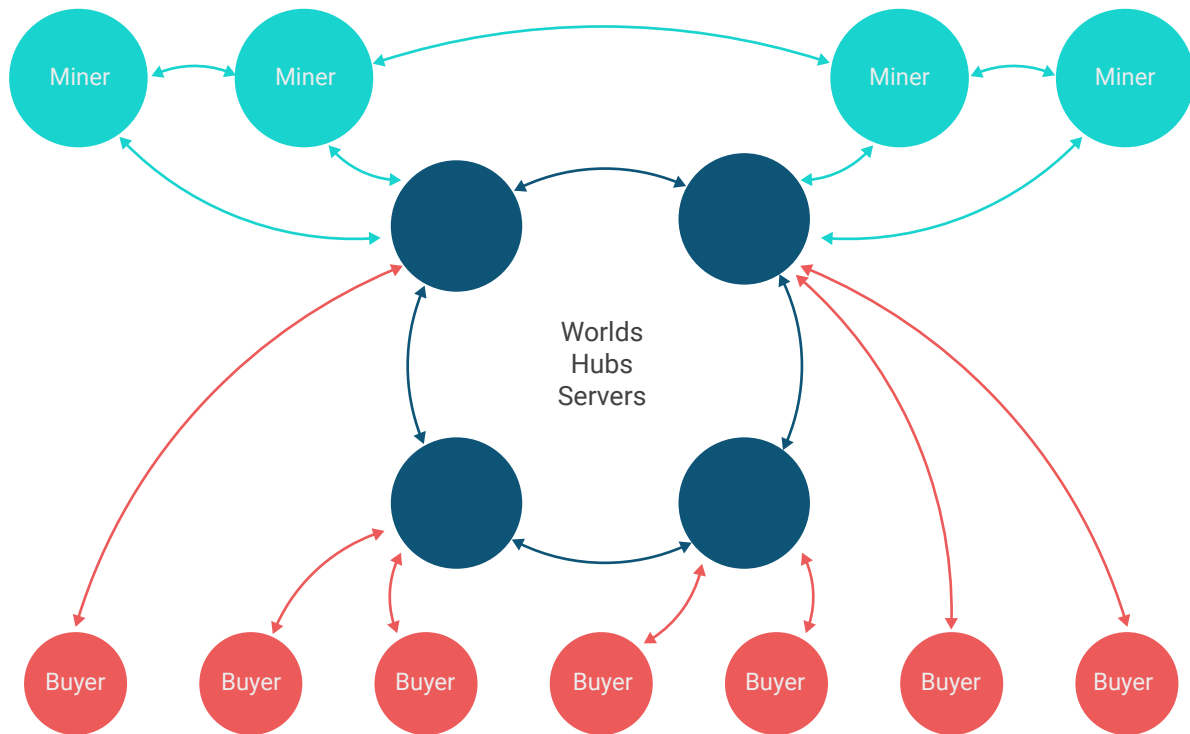
**SONM has been developed to be Self-learning and totally safe for its users.**

Our system supports anonymity tools like proxy, VPN or TOR, but it can't be used as a hacker dream tool-kit. Intelligent agents are able to self-educate using neural networks and keep malicious users out of the system, while at the same time providing most efficient task solution - both for miners and computational power buyers.

Also, SONM computing power exchange has the properties of the free market, so malicious hubs and users will shortly be ignored by buyers and miners due to their bad reputation.

So, we expect SONM to be the smartest, the cheapest and the largest decentralized computing system with strong rules regarding morality and loyalty, due to SONM's reputation system and self-learning neural network.

## SCHEME OF THE NETWORK



## 1.2. SONM Use Cases

### 1.2.1. Scientific projects

SONM network can be used to run essential scientific calculations requiring massive computing power, for example:

- social statistics
- bioinformatics
- drug development
- climate predictions
- aerodynamic calculations
- modeling
- meteors trajectory modelling

#### One of the case examples of Scientific research project – DrugDiscovery@home.

*It's the first project of the SONM developers and one of the first hubs, working as a use-case example for the SONM project. DrugDiscovery@home project started in 2009 and achieved proven efficiency and decent results. The experience gained during this project's development helped us build SONM to be more efficient, secure and viable.*

*You can find further information about this project in this Whitepaper.*

[Go to DrugDiscovery@home Whitepaper section](#)

### 1.2.2. Site hosting

SONM network can be used to deploy websites not depending on centralized cloud services (AWS/Azure/Google Cloud etc) or hosting providers. We use modified BOINC technology to implement virtual machines recognized as servers, with IPFS and other decentralized data storage solutions as an underlying layer.

Website owners can also use our code snippets on their websites to collect payments in SONM or Ether tokens and automatically pay for hosting.

### 1.2.3. Game servers use-cases

There are lots of MMO games using in-game currencies. Our technology offers solution for deploying game servers in the **SONM network**. Furthermore, game currencies can be easily exchanged for SONM tokens and back using our out-of-the-box solution.

On the other hand, gamers can support their favourite game servers by providing their computing resources in exchange for tokens or in-game currency.

### 1.2.4. Neural networks projects

Neural networks is a powerful technology becoming more and more widespread in recent years. Neuronet-work projects require massive computing power for their deployment, learning and tuning.

SONM provides cost-efficient and effective solution for neural networks implementation. In the future SONM computing resources can be used for the management of currently developing computer-neuronal interfaces by uniting them into one network.

### 1.2.5. Rendering video and computer graphics.

Rendering CGI video tasks can be distributed over the SONM network between large number of computing devices and can be processed very quickly (in a matter of minutes).

We suggest much faster processing for **Buyers' (Clients')** CGI computing projects due to SONM infra-structural flexibility. Compared to one K80 Nvidia rental from Amazon (for example, for 10 hours), a buyer can use SONM network to rent 600 K80 Nvidia with a total task processing time of 10 minutes for each of them. It allows for use of more efficiently distributed architecture and parallel computing.

Unlike cloud computing services, SONM can provide buyers any rental time, any computing architecture and any computing network structure.



## 1.4. SONM benefits summary:

### 1.4.1. Benefits for the investors

#### 1.4.1.1. Pre-ICO investors

Pre-ICO investors get 100% bonus tokens. Presale SNM tokens exchange rate: 1 ETH = 303 SNM

#### 1.4.1.2. ICO investors

##### 1. Functional product crowdfunding

Are you tired of ICO, which has nothing but an idea with good cover? Are you worried about fraud? **Invest in a real product!** We have not just a prototype — we already have one successful functional project running on our platform.

##### 2. Unique Technology

We are using unique technology, which was developed by a strong scientific team — we will dominate on the distributed calculations market.

##### 3. Wide scope of token adoption.

**Everyone** needs computing **power**: websites, shops, MMORPG, companies which use databases, applications from the app-store. It is a fact that everyone today needs computing **power** to run their products, and they can get this power from our tokens. That means that everyone in the world who is using the internet for business will adopt our token for payouts. Invest now, and be sure that tokens will be accepted **everywhere**, because **everyone needs computing power!**

##### 4. Stable price

The price of tokens is supported by stable demand for computing power inside the market.

##### 5. Large trade volume

Trade volume is guaranteed by lower costs for buyers and higher profits for miners (sellers). That's a deal breaker for AWS

##### 6. Dividends for SONM token holders

A percentage from transactions for operations (buy-sell-develop) is earned by the system founders/company. In the future, we will implement SONM DAO, which will get the amount from the profit of a company.

### 1.4.2. Benefits for the miners

#### 1. Guaranteed profit from useful calculations

Are you confused by a difficulty bomb? Are POS dangerous to your equipment? Are you in the dark about what to do when bitcoin reward for block will decrease again? With such cryptocurrencies as bitcoin or ethereum, miners could have reduce-in-time bounty for serving transactions, or even a threat that their equipment will be banned or algorithm will be changed to PoS. However, in our system, your power is being used for some «useful» calculations and processing real tasks — you will stop burning your kilowatts and start serving calculations for the distributed World Wide Web.

## 2. Plug any computing device into the blockchain

Optimized software-hardware relationships. Each miner is suggested most profitable applications and tasks for its own hardware. CPU, GPU, Playstation and even smartphone device computing are possible.

## 3. Profit maximization due to big data self-learning

Since SONM is based on a Multi-agent system, every user of the system will be able to use its **intelligent agents** and **smart-contracts** to maximize their profit. You can set up automatization level from the option of choosing every project manually, to the one-button setting where the system will automatically choose the most profitable project, and then work with it and direct payouts to your personal account in Ethereum.

### 1.4.3. Benefits for computing power buyers

**1. SONM computations are cheaper** than cloud services (Amazon, Microsoft, Google Cloud, Digital Ocean etc.). Since we use 'fog' instead of cloud, there is no more need to pay an elevated price for the private and monopolized cloud.

**2. SONM is decentralized.**

There is no centralized authority regulating computing resource distribution. We also support tools for anonymity like proxy or TOR.

**3. Tokens ecosystem.**

Have you always dreamt that your customer will serve your servers? Suggest them discounts for our tokens, or try to use token-based games and offers — and exchange them for the computing power of your business.

**4. Rapid data transfer using BitTorrent protocol**

We use torrent technology to distribute data from clients and hubs — so you do not waste time uploading your files onto a server.

**5. Easy to set up and manage**

The SONM system always finds the best equipment for your computational tasks and it runs with no need for setup and dedicated server support.

### 1.4.4. Benefits for the developers

**1. Possibility to develop and distribute DAPPs**

Develop your own distributed applications, sell it to the hubs and receive profits.

**2. Decentralized AI is better than Swarm.**

Build and run your application without '**out of gas**' errors. Your application will return correct results with no need to run itself on every machine of the network (as it's implemented in Ethereum network).

**3. Widespread open source developers community**

We use lots of time-tested open source technologies and protocols with a huge developer community: BOINC, BitTorrent, Ethereum, BitMessage, etc.

## 2. SONM TECHNOLOGY

Nowadays the popular Internet of Things concept<sup>[2]</sup> (IoT) gives way to the new emerging concept called Internet of Everything (IoE).

Internet of Everything, also known as fog computing, is the unification of all computing resources of humanity. It has core differences with currently widespread centralized cloud computing technology.

In order to develop a system implementing this disruptive idea, SONM team used the most efficient and proven P2P, distributed computing and blockchain technologies.

SONM is not a monolith product, it's a top layer built on underlying protocols and technologies: Ethereum, Torrent, BOINC, neural networks, etc. In order to use all of them in one distributed global SONM computer we use Multi-agent system.

*(By the way, Bitcoin creator(s) also combined existing technologies (cryptography, P2P nodes network, Proof-of-work concept, etc) to bring brand new independent decentralized currency/payment system to the world.)*

### 2.1. IoE, IoT and fog computing.

Before describing the future "World Computer" architecture we need to mention some details regarding IoE, IoT and fog computing concepts.

Nowadays, the concept of an Internet of Things (IoT) is commonly known..

According to IoT concept, Thing is any natural or artificial object able to have an IP address and transfer data over the network.

Internet of Everything (IoE) represents further development of IoT concept:

Cisco defines the Internet of Everything (IoE) as the networked connection of people, process, data, and things. The benefit of IoE is derived from the compound impact of connecting people, process, data, and things, and the value this increased connectedness creates as "everything" comes online.

IoE is creating unprecedented opportunities for organizations, individuals, communities, and countries to realize dramatically greater value from networked connections among people, process, data, and things<sup>[3]</sup>.

This definition emphasizes a very important aspect of IoE, which distinguishes IoE from IoT: namely, the so called "network effect", formulated by James Macaulay from Cisco IBSG consulting department.

The term "network effect" refers to a decentralization of organizations included in IoE.

These kinds of decentralized systems are being developed by groups of so-called "crypto-anarchists" (people implementing decentralized P2P systems using cryptographic methods<sup>[4]</sup>).

Furthermore, here we are referring to decentralized organizations of computing machine resources, and not decentralized human organizations.

Most of the data in the current IoT state of development is being processed by private centralized clouds - i.e. using cloud technologies, like AWS, Microsoft Azure, etc.

Centralized cloud technologies have several weaknesses and can't be used in IoE.

*Some Things in IoE can create massive amounts of data. Cisco gives the example of jet engine, which creates about 10 Terabytes of its activity data in 30 minutes.*

*Transferring this data to the cloud, and receiving the results of data processing, requires adequate network bandwidth, takes significant amount of time and can have delays.*

Furthermore, private centralized cloud systems potentially can be compromised, influenced from the outside, attacked or have failures, and also have lower computing power than fog computing solutions.

| How can these problems be solved?

**Fog Computing** shifts the cloud computing paradigm and moves it to the lower level of the network. Instead of processing some task using the cloud, we can use all the devices surrounding us: personal computers, smartphones, even coffee makers and traffic lights.

Cisco's Ginny Nichols originally coined the term Fog Computing. The metaphor comes from the fact that fog is a cloud that is close to the ground,, and thus fog computing concentrates processing at the edge of the network. In Fog computing, data processing and applications are concentrated in devices at the network edge rather than existing almost entirely in the cloud. That concentration means that data can be processed locally in smart devices rather than being sent to the cloud for processing<sup>[5]</sup>.

Thus, instead of centralized cloud solutions, we can use fog computing systems, getting the computational power of every internet-connected device, with decentralization advantages like independence from any centralized service, full protection against possible failures, etc.

## 2.2. World computer

So-called "computing fog" is the layer of computational resources able to process some kind of task.

However, aside from computing fog, the system also involves its users setting computational tasks, and some middleware distributing these tasks among the fog resources, which then return the result of the calculations.

| This system is called "World Computer".

The first mention of the World Computer term was Vitalik Buterin's project Ethereum, which implemented used blockchain technology able to include executable code to transaction blocks, so every miner's machine automatically executes this code.

Thereby, Ethereum in fact is the World Computer working like a Turing Machine<sup>[6]</sup>, with blockchain used as a state register.

This also implies that due to the fact that every program must be run on every machine in the Ethereum network, it's very costly and only the limited range of tasks can be run using this platform.

We'll examine this project in more detail further in this Whitepaper.

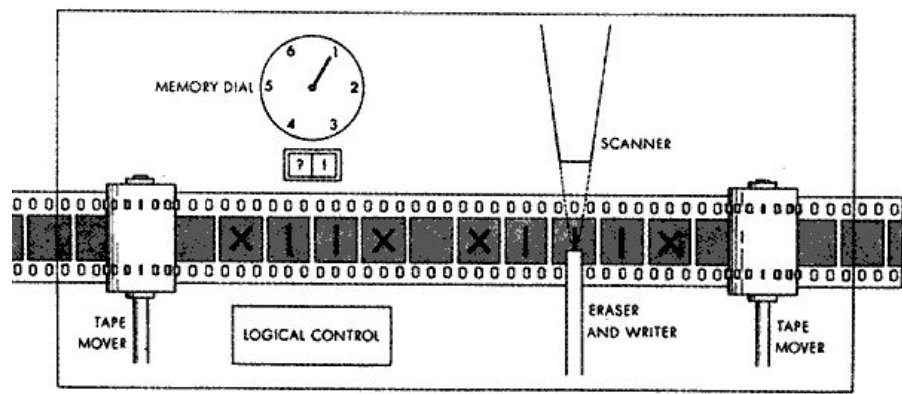
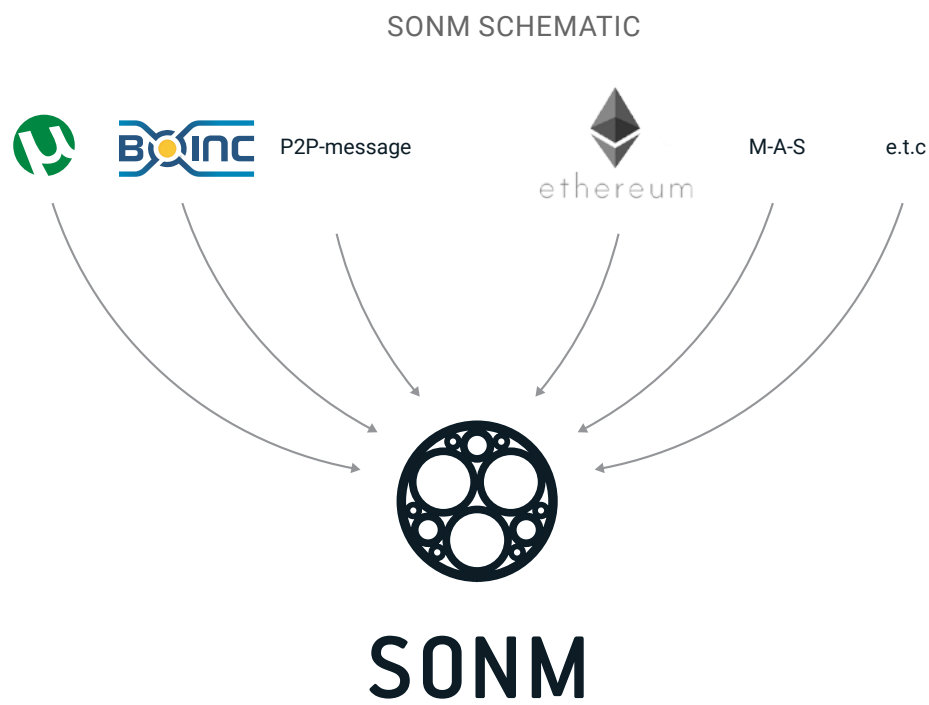


FIG.1 - TURING MACHINE

There are other projects developing a decentralized world computer (Golem, iEx.Ec and others), however all of them are built using the same principles as Ethereum and have the same problem: excessive parallelization leads to high costs of operations. This is caused by the absence of any control centers managing task processing in real time that can stop it after receiving the desired result, which leads to running parallel / asynchronous processes.

In fact, this projects can't provide the functionality which any usual personal computer has nowadays.

SONM team has already spent 3 years to developing a World Computer functional concept able to process any kind of tasks, up to the standard of a fully functional computer.



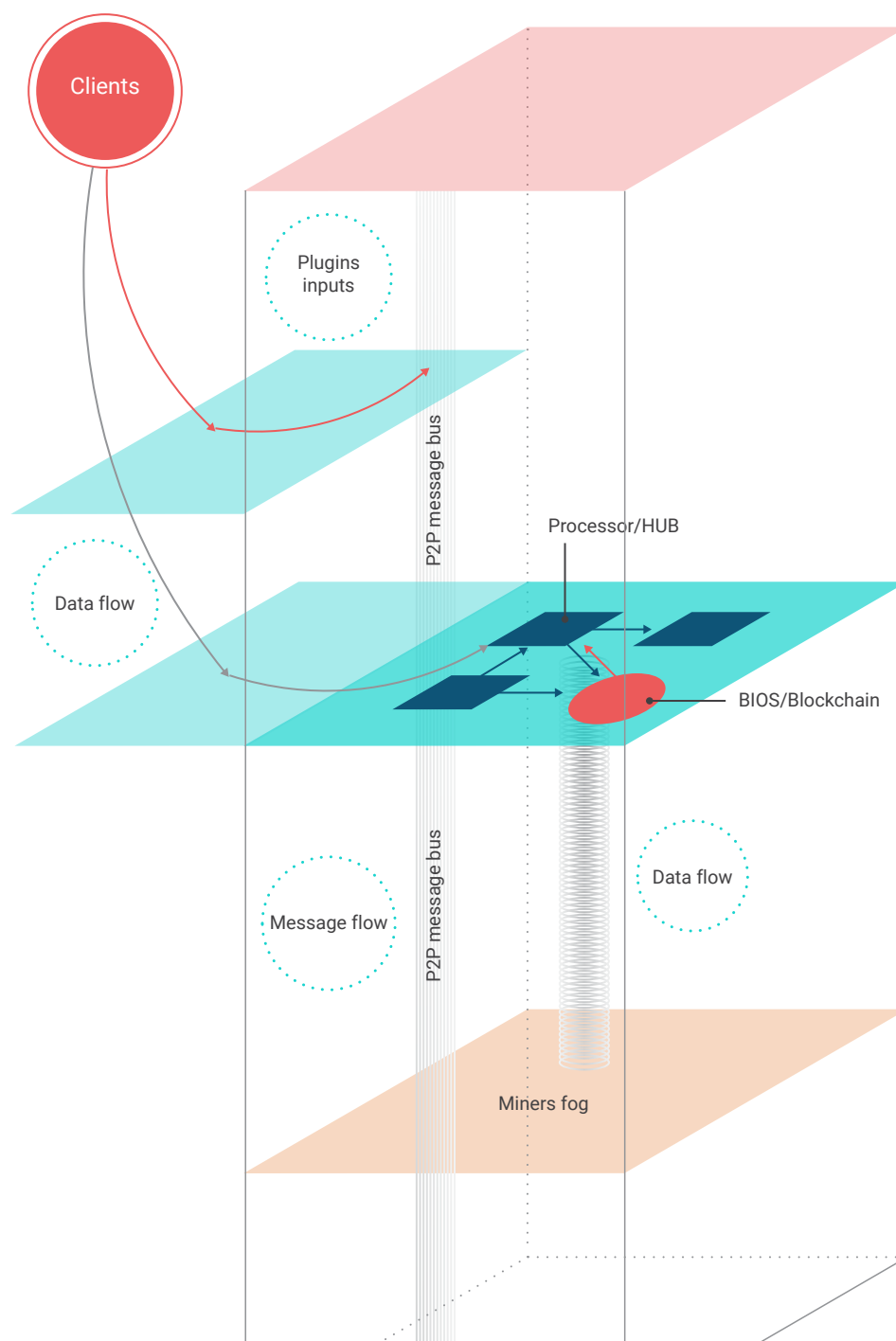
## 2.4. World computer low level architecture

What kind of architecture do we imagine when we talk about a PC? A processor, motherboard, battery, BIOS, bus, hard drive, GPU, RAM memory, etc.

For our computer world computer architecture, we decided to follow the modular way all the personal computers are built.

FIGURE: SONM WORLD COMPUTER IMPLEMENTATION SCHEME.

Consider the details of this world computer architecture implementation figure.  
As you can see, this architecture includes lots of linked elements.



Like a standard home PC, world computer in the scheme has similar elements: CPU, BIOS, bus for data exchange, board of plugins (connectable devices), peripheral devices, graphics card, etc.

Hard disk drive analogue will be implemented using decentralized data storage solutions: IPFS (InterPlanetary File System), Storj, Sia, etc.

The first component of the system to consider is the **processor**.

SONM world computer's processor is represented by the set of independent hub nodes distributing tasks, assembling calculations results, keeping statistics and providing uninterrupted operation of the system.

Each hub node on the figure is equivalent to the processor's core (but is not equivalent to the processor). There can be an unlimited number of hubs, and they can be easily included and excluded from the system.

Hubs do not process calculations directly, but rather they represent a very important part of the system, providing management and support (just like a computer's processor regulates and controls the operation of GPU, and is able to process sophisticated high-loaded parallel computations).

Hubs are implemented using modified BOINC protocol servers.

The next element of the system is equivalent to a PC's **GPU**. It is comprised of fog computing miners' processing tasks computations in the SONM system.

**The communication bus** for transferring data and messages in the network is represented by P2P communications module. (Bitmessage)

SONM computing power buyers are equivalent to PC **peripheral devices**, usually used for information input.

**The plugins board** allows the system to constantly expand and gain power by connecting to external compatible networks, for example, any Grid network.

The integration of existing neural networks is planned for the future stages of SONM development.

**BIOS** is an important part of the SONM system, represented by Ethereum blockchain in our decentralized computer model. As we mentioned earlier, Ethereum systems offer high reliability, but perform only basic operations due to its architecture - that's why Ethereum is the most suitable candidate for the world computer BIOS.

Finally, as we know, PC itself isn't worth anything without an **operating system**.

Our global computer also requires an OS, and we have it ready.

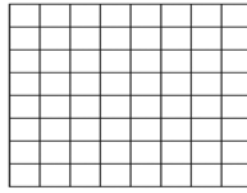
## 2.5. Superglobal OS on Network Architecture (SOSNA)

### 2.5.1. Grid systems

Grid computing is the collection of computer resources from multiple locations to reach a common goal<sup>[8]</sup>.

The distinctive feature of grid computing is the system architecture taking into account a possible inaccessibility of any node in the network due to connection interruption or node malfunction.

## GRID SYSTEMS NETWORK ARCHITECTURE:



Each point where the grid lines are crossing represents a network node. The combination of these nodes represents a loosely coupled heterogeneous computing network with redundant parallelism. In the case of inaccessibility of one of the network nodes, its work can be continued by any active node.

Thus, in terms of network architecture, grid is a unified, open and standardized environment with flexible, safe and coordinated sharing of computational and data storage resources. Grid is the basic network architecture for distributed computing systems.

### 2.5.2. OS middleware

There are a lot of ways to create a grid network using open source tools, for example, Globus ToolKit, which is the de facto standard in grid systems development.

Creating this kind of system from scratch is very complicated from a technical point of view, so most of the proprietary grid systems are governmental, scientific or military closed networks with development, scaling and software installation problems, due to the closed protocols limitations.

Therefore, most of the modern independent computational networks don't create proprietary grid networks, and instead use various frameworks as middleware. These middleware solutions provide all the standard grid services, while at the same time giving the ability to use an operational layer for interaction with applications and services. It significantly facilitates the setup and maintenance of the network and development of decentralized grid apps.

Thus, grid middleware is the core of the SOSNA operating system.

### 2.5.3. Modified P2P BOINC protocol as the middleware solution

Grid systems can be divided into 3 categories:

- science-specific: special tasks, perfectly parallelized (the ones Golem and Elastic projects are working on)
- volunteer (BOINC, Bitcoin, Ethereum);
- commercial (geographically dispersed cloud infrastructures).

We use BOINC as the grid middleware solution for the core of our SOSNA OS v.1.

SONM uses its **GRIB technology**. Our team developed GRIB as decentralized P2P version of BOINC (**Berkeley Open Infrastructure Network Computing**) protocol, an open-source middleware system used in lots of projects for volunteer and grid computing.

Originally developed to support the SETI@home project, BOINC became widespread as a platform for other distributed applications in areas as diverse as mathematics, linguistics, medicine, molecular biology, climatology, environmental science, and astrophysics<sup>[9]</sup>.



The SONM team used this platform as a basis to develop our own decentralized GRIB fog computing technology.

BOINC is open-source and has a big community around the world, with lots of use cases and achievements. Currently BOINC is used by majority of modern scientific distributed volunteer computing projects and we decided to use its technological principles for hubs implementation in our fog computing network.

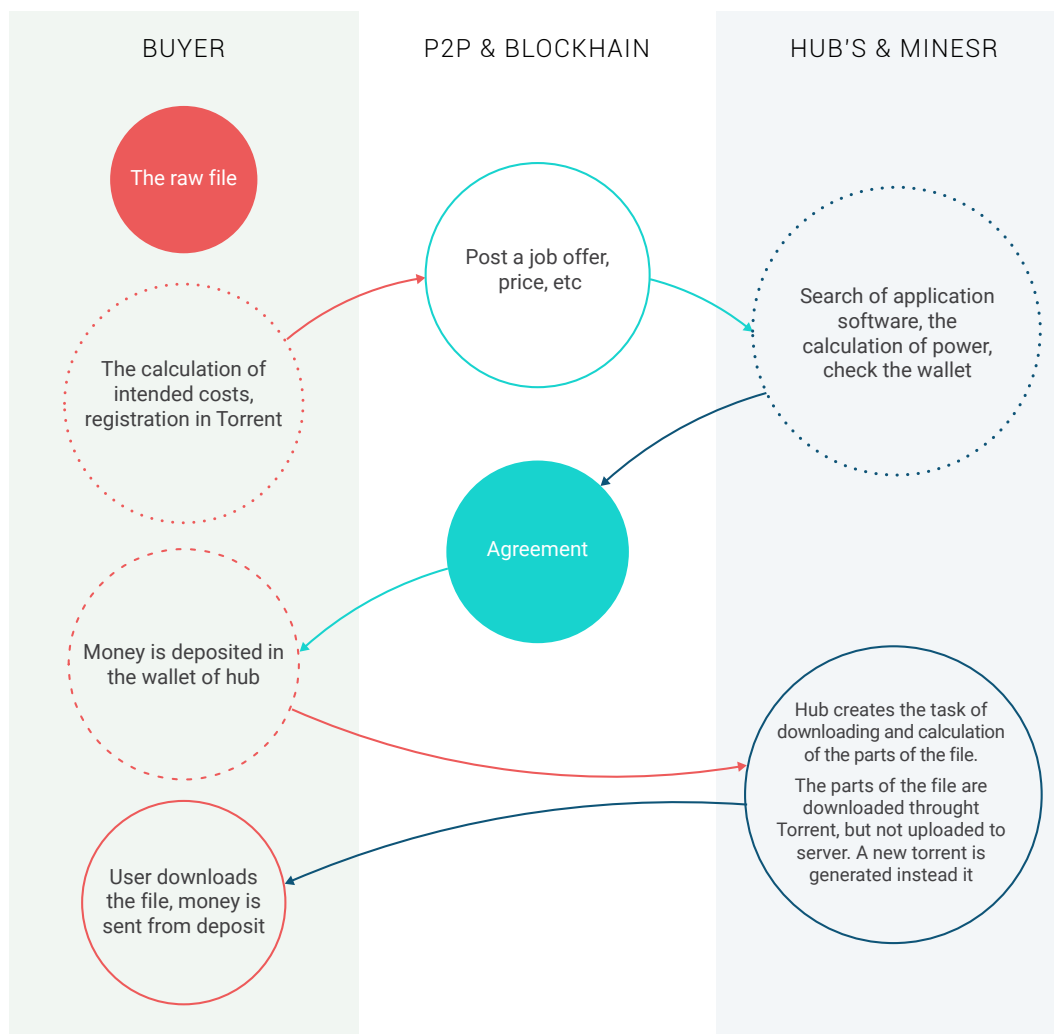
This enables SONM to use validation procedures for cross-checking the results correctness.

*Due to the fact that BOINC was initially developed for volunteer computing, most of the essential functions for interaction with miners are already implemented and work "out of the box", which has enabled us to launch our test commercial project (DrugDiscovery@home) very quickly.*

*You already can participate in DrugDiscovery calculations. You can also create your own hub and run your own decentralized applications (however, you won't be able to pay miners for their work, until SONM crowdfunding ends) [Go to DrugDiscovery@home Whitepaper section](#)*

### Benefits of using BOINC as the middleware solution:

1. BOINC was initially developed for volunteer grid computing, so there is no need to tune the equipment or miner's software. Moreover, hub software is also well-documented and works "out-of-the-box".
2. BOINC applications can be created using any object-oriented programming language.
3. BOINC is perfect for big data calculations management



**Our modified P2P BOINC protocol** is able to create servers and distribute computing tasks between the miners, which process their part of the task and return results to the server, where results are being validated and each miner's impact is being calculated. All statistics and input/output data is open and ready to be checked.

In addition, P2P BOINC technology supports resources clusterization, and therefore it is possible to create virtual private machines with any architecture. All of this means that SONM platform can implement services, currently provided by cloud computing platforms (Amazon Web Services, Microsoft Azure, GPU clouds, etc) and can be applied to any computing task, from site hosting to Big Data calculations, and even work as Amazon Delta service. As such, SONM can be used both as PaaS (Platform-as-a-Service) and IaaS (Infrastructure-as-service).

We use P2P BOINC protocol as a starting point to create decentralized network with supernodes managing computing distribution tasks. The original BOINC protocol is a centralized platform, and this its core disadvantage. The SONM team developed a decentralized version of BOINC protocol by combining heterogeneous and P2P homogeneous networks.

## 2.6. Single and Multi-agent AI systems

The basis of the classic AI model<sup>[10]</sup> is a task being solved by a single agent.

According to that model, an intelligent agent (for example, the AI system), has a global vision of the problem, and has all the necessary skills, knowledge and resources to solving the task.

In contrast, when building a multi-agent systems (MAS), we assume that a single agent can have only a partial understanding of the task and can solve only some subtasks. Therefore, the **interaction** of agents is required to solve any complex problem, and this is the key principle of MAS.

Tasks in MAS are distributed between multiple agents, each of them is considered as a member of the group or organization. Distribution of tasks in MAS includes assigning roles to each agent, defining the measure of an agent's responsibility and the requirements for an agent's experience.

Task distribution in SONM is carried out by considering maximal efficiency of equipment, so miners in the SONM network always get the job that is most suitable and profitable for their computing equipment.

On the other hand, buyers of computing power automatically get the most efficient equipment for rent due to SONM's multi-agent system.

The distribution of tasks and validation of the results is performed by standard means of BOINC.

## 2.7. Decentralization

### 2.7.1. SONM Miner-Hub interaction solution

Let's consider the process of SONM miners and hubs communication when they need to establish mutual cooperation (i.e., the first phase, when the miner hasn't decided yet whether to participate in computations and receive tasks from the hub or not).

First, SONM hub administrator sets up an Ethereum smart contract containing SONM tokens used to pay miners for computations.

Then, the ethereum address of this smart contract, address of pool administrator and hub IP are recorded to a special SONM smart contract "Hubs Pool List".

Hubs pool list includes unconfirmed (unverified) hubs and verified hubs (i.e., listed in the hubs whitelist). At first, the whitelist will be managed by SONM team, and further it will be formed only by the miners.

In any case, hub information in SONM smart contracts includes the address of the hub owner, the address of the hub wallet and the hub IP. In case of IP or wallet address change, the hub owner can change the hub record.

Therefore, SONM hub records the address of smart contracts containing the funds used to pay miners for computations (so miners can check the existence of these funds) and registers basic information about itself, including the address of the owner and IP.

Then, SONM hub agent starts broadcasting to the network using P2P messenger protocol, sending a broadcast message about itself in the format: «IP, hub owner address, wallet address, hub name».

The agent on the miner side listens to the channel, receives data messages from the hubs, and then makes a request to the Hubs Pool List smart contract to compare the data from the hub messages with data in hubs whitelist. The miner may customize agent settings to accept messages from all servers or only from proven ones listed in Hubs Pool List.

After that, miner's blockchain agent requests information about the contract-wallet of the hub, amount of funds in hub's wallet and recent transactions of the wallet.

An intelligent agent checks the received data to compare it with conditions set by the miner: are there sufficient funds in the hub wallet, are hub payments to miners regular, what is average amount of tokens paid to miners by this hub, etc?

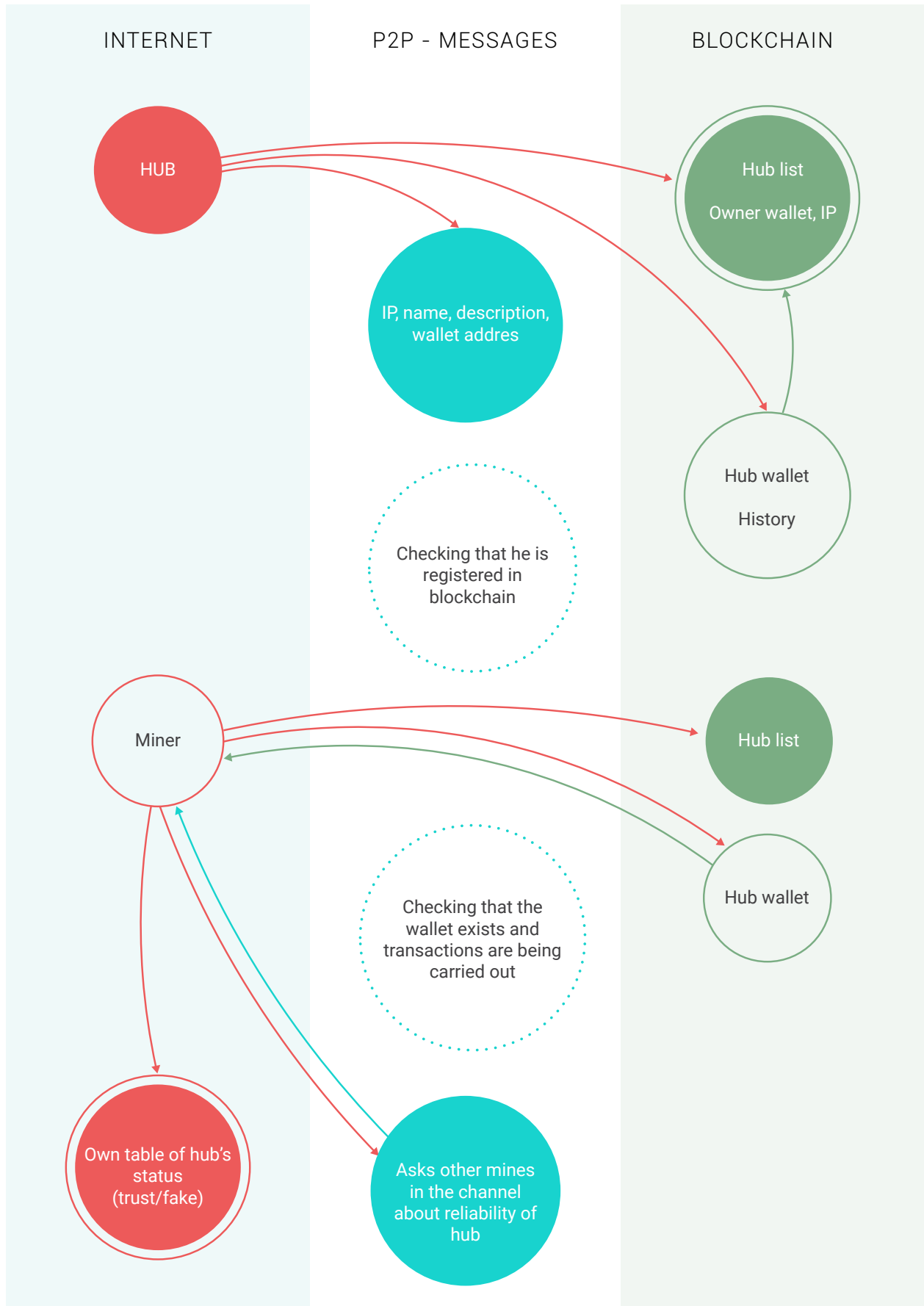
Then, P2P messenger agent sends a direct message to the hub to request additional meta-data, and records full information about the hub in its hubs list with a "not confirmed" mark.

At the same time, P2P messenger agent constantly broadcasts question messages to the common miners data channel for information about the hub, the average amount of reward paid to them, and so on. Other miners' agents broadcast positive answer messages to the channel if hub information in the question message is correlated with their information, or negative answers, if they believe this hub is malicious or not reliable.

If a miner's agent receives a sufficient amount of confirmations from the network, the hub receives "checked" status in the miner's hubs list. If the transaction received by the miner from this hub corresponds to the original agreement, the status of this hub changes to "safe".

After that, depending on the settings of miner's software, a miner can either manually select a hub to connect and perform computing tasks, or a miner's agent can automatically select a hub offering maximum profit and connect to it.

# FLOWCHART OF "MINER-HUB" MESSAGES EXCHANGE:

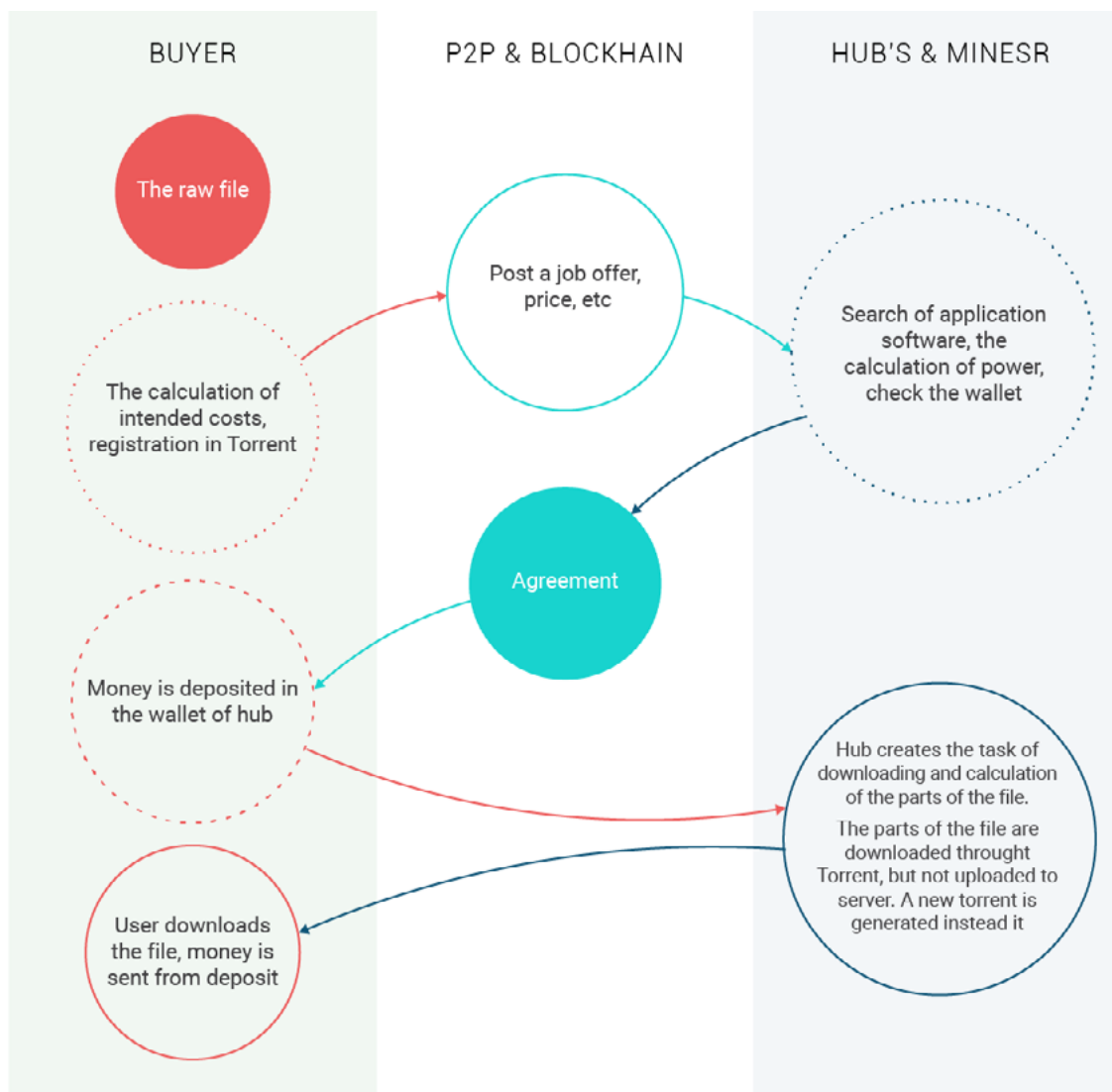


### 2.7.2. SONM Client-Hub interaction solution

Clients (buyers) interaction with SONM hubs is similar to the miner-hub agent's interaction, with a difference in intellectual agent results parsing, which for buyers prefers the hubs with the lowest computations price (and vice versa for miners). Buyers more probably will use "Application Pool" ["2.9.3. Reputation system and Application Pool whitelists"](#) than "Hub Pool" smart contract.

Buyer creates a task and deposits funds to the hub's smart contract wallet to pay for the job. When the buyer receives the calculations result, he confirms the transfer of money using smart contract function (similar to Multisignature Wallet).

FLOWCHART OF CLIENT-HUB INTERACTION PROCESS:  
(Some intermediate messages in the flowchart are omitted)



### 2.7.3. SONM Client-Hub content delivery method

Content delivery method is the only significant difference between client-hub and miner-hub interactions.

As you might expect, there is no difference between rendering a 6-hour video using the local computer and *uploading* this video to the server while waiting for video rendering on the remote server, because most of the time will be spent on uploading.

We developed the solution for this issue:

*When a client wants to upload a large file of raw data to the server, SONM automatically creates a torrent and sends a message to the selected hub. This hub receives the message and creates a task sequence for torrent downloading, computation work with downloaded file(s) and creation of a new torrent for calculation results file.*

*After processing the calculations and creating a torrent for the resulting data, the hub sends a message to the buyer, who only has to download the received file from the miners.*

We expect it to be the most rapid solution of all those that exist at the moment.

## 2.8. Results verification

The problem of validating computations executed by a third party is a thoroughly researched topic <sup>[10][11]</sup>, but still lacks production-ready solutions, since most of them are very expensive in practice (at least in an HPC setting).

More practical solutions are based on repeating computations – verification by replication. This approach requires designated nodes (hubs) to distribute workunits, aggregate results and verify them. BOINC uses this approach and has a highly tested implementation.

For some kinds of computational problems it may be practical to offload the task of aggregation and verification to a smart contract. The process goes as follows: miner computes some workunit and posts merkle-tree root hash to the smart contract. Some other miner computes the same workunit and notices that results differ. In this case, it is possible to calculate a compact proof of cheat. The proof can be checked by the smart contract, and the cheater punished.

Economic motivation is used to promote this double-checking behavior: miners deposit some fixed amount of tokens, and this deposit will be returned after some timeout if no proof of cheat was posted. On the other hand it is possible to earn tokens by checking computations and revealing cheaters.

**Verification by smart contracts is actively researched <sup>[12][13]</sup> and has some benefits:**

- does not require trusted third party to aggregate and verify results;
- does not impose any overhead in case of honest miners;
- has limited and bearable overhead in case of dishonest miners.

## 2.9. Safety and Security

### 2.9.1. Security for Buyers (data protection)

SONM implements encryption using SSL certificates and end-to-end data encryption to keep clients' data confidential and secure.

Virtual machines are used to separate on-demand computing from other processes on miners' devices. We also consider using high level homomorphic encryption to get the highest security level and data confidentiality on every level of data transfers in computation process.

SONM will use the following data protection mechanisms:

1. Privileged accounts
2. SandBoxes
3. Fully homomorphic encryption

### 2.9.2. Safety of miners and server owners

The safety of miners' computers will be protected by using virtual machines and setting minimal user permissions for running the applications.

However, no technical solution can fully protect miners from running unsafe and malicious software. Therefore, in order to prevent this, we introduce several levels of reputation system for the **Application pool** ([section 2.9.3.](#))

SONM infrastructure allows buyers to become miners and miners to become supernode owners, using the reputation system that is based on their purchase history.

Applications will have several levels of trust. SONM has the reputation system, based on total amount of FLOPS computed (tokens spent) and feedback, which will be applied for all parts of the system.

On the 1st stage after SONM, launch buyers and miners will manually set the prices for the computing tasks / equipment rental.

On the further stages of development, SONM intelligent multi-agent system will gather information, self-learn and start making optimal price suggestions.

Each server administrator validates software. Each user (miner or buyer) can suggest software for the black list.

### 2.9.3. Reputation system and Application Pool whitelists

System applies to	Measurement	Reputation system
Applications, Miners, Buyers, servers owners	Yes/No	Whitelist from SONM administrators
	Yes/No	Whitelist from each supernode owners
	Amount of tokens spent	Applications with most of computing power allocated
	Number of purchases	Most purchased applications

## 2.10. Artificial Intelligence implementation

SONM system architecture represents the network of multiple intelligent agents (multiple network nodes). So, each user of the system will be able to use **intelligent agents** and **smart-contracts** for profit and efficiency maximization.

The automatic choice of most efficient software/hardware combination for buyers' tasks, the automatic and smooth mining **resyncing** from one task to another in case of mining price change, super-fast data exchange based on BitTorrent protocol, natural language for task definitions and other complementary technologies make SONM a weak class AI.

Our system solves the 'resource distribution' task, which is NP-incomplete, so it's standard resource distribution solution based on a standard weak-AI class.

On the further stages of SONM development, we'll implement general-purpose AI using machine and deep learning methods applied to big data, gathered on specific tasks.

## 2.11. DrugDiscovery@home: functional fog computing project by SONM team

We already have a functional prototype developed for the huge market of drug development with unmet demand.

DrugDiscovery@home ([www.drugdiscoveryathome.com](http://www.drugdiscoveryathome.com)) is a fog computing project using SONM technology to carry out scientific calculations for the development of new pharmaceuticals.

**DrugDiscovery@home** is the first hub in the SONM system that provides infrastructure for the development of life science computing and new medical therapies by integrating the open source software solutions used in this field. Each disease therapy development uses different software for numerous computational tasks, which will have their own price in SONM tokens.

### Genesis of DrugDiscovery@home

By February 2016, a group of miners was looking for a way to use their idle mining hardware for useful purposes, while simultaneously staying part of the cryptocurrency movement. This desire led to modern DrugDiscovery@home.

DrugDiscovery@home created an asset with a "Proof of Cure" concept to verify contributed computational power, where computing power results in models of high value medical treatments. This reduces the number of experiments required to get therapies into clinical trials.

Since smart contracts share the Ethereum blockchain, the legacy mining equipment from Altcoin mining can be redirected towards medical research. The Ethereum miners are already covering the security and hashing rate of the Ethereum blockchain.

### DrugDiscovery@home Mission Statement

Cheap computing power along with cutting edge modeling algorithms will allow DrugDiscovery@home to produce and sell new biomedical technologies at lower costs than any other research company, and these products will be affordable and available to everyone.

The research will start by developing treatments to different forms of cancer and anti-aging drugs, but its scope will then enlarge according to the available resources.

### DrugDiscovery@home workflow (chemistry or biology background is recommended to read this)

Currently suggested DrugDiscovery@home workflow integrates together the classic in silico drug development methods, which were widely adopted by biomedical and pharmaceutical industries along with getting the most recent newly developed in silico drug design approaches.

For example, we suggest a workflow for preclinical drug development as a series of programs, acting as filters on each stage. This project funnel is going to start from largest chemical compounds databases (such as virtual spaces) and fastest programs (for example Lipinsky, ADME/Tox, physico-chemical parameters filtering) thus producing initial databases for targeted drug design. The next stage will include datasets enrichment using various docking (including consensus, biotarget-tuned, and multiple-conformations), docking software, pharmacophore-based screening and QSAR models.



On the last stages, we plan to use the most computationally demanding applications (like molecular dynamics, MM-PBSA, quantum mechanics) on the remaining datasets, such as molecular dynamics (in screening mode – for ligand-protein complex stability evaluation), molecular dynamics with thermodynamics integration, dynamic pharmacophore models.

Biological targets are selected according to the in silico models of the diseases and pathologies profiles. Metabolic and signaling networks analysis, adjusted to the gene expression level, biostatistics omics data processing can show us the most promising therapy targets and their combinations, including drug-drug synergy and polypharmacology possibilities.

In this regard, we expect to collaborate with enterprises, working in this field, as well as to develop our own approaches. Our primary goal in this effort will be to make as much as possible data open to the public and all software resources to be open source as well.

### **DrugDiscovery@home Summary**

- DrugDiscovery@home aims to redirect computational power from cryptocurrencies PoW mining and idle computing devices (PC, laptops, tablets, smartphones, GPUs, GPGPUs, gadgets and even clusters etc.) to valuable scientific research.
- DrugDiscovery@home pays for SONM computing facilities by its own token, which is converted to SONM token according to their market values and the corresponding smart contract.
- DrugDiscovery@home takes upon itself an obligation to convert to our token all its incomes from therapies development process, from contract research, from patents selling and licensing.

### **Links:**

[DrugDiscovery@home token white paper](#)

[DrugDiscovery@home presentation](#)

## **2.12. UI and API**

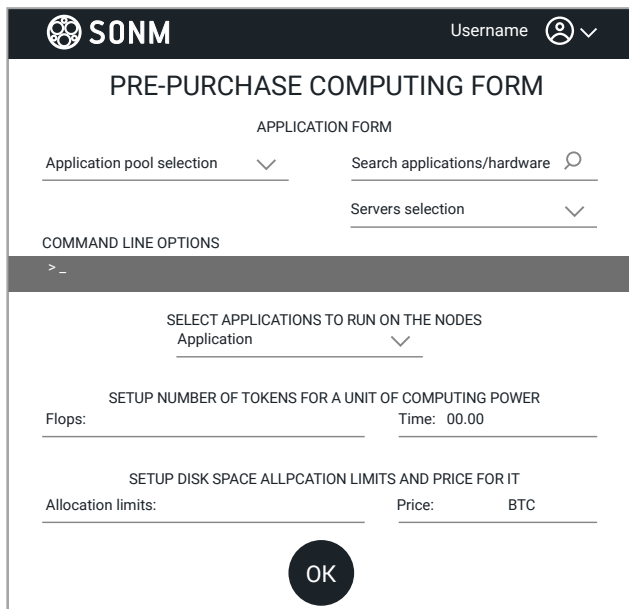
### **2.12.1. SONM buyers interface prototype:**

#### **Pre-purchase computing power**

- Hardware selection
- Application from Application Pool selection
- Search for applications/hardware
- Servers selection
- Command line (Terminal interface) for running own application, setup running application on the server, before it is sent to miners nodes

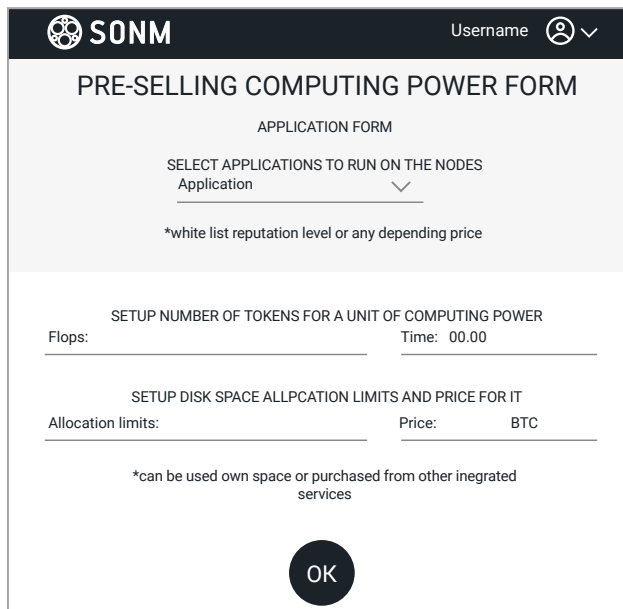
### 2.12.2. SONM miners interface prototype:

- Select applications to run on the nodes (white list, reputation level , or any depending on price)
- Setup number of tokens for unit of computing power (FLOPS, time)
- Setup disk space allocation limits and price for it (can be used own space, or purchased from other integrated services, like [Oraclize](#), [Factom](#), [Storj](#), [Sia](#), [Filecoin](#) etc.)



The image shows a web interface for SONM buyers. At the top is a dark header with the SONM logo, a 'Username' field, and a user icon. Below the header is a section titled 'PRE-PURCHASE COMPUTING FORM'. Under this, there's an 'APPLICATION FORM' with a dropdown for 'Application pool selection', a search bar for 'Search applications/hardware', and a dropdown for 'Servers selection'. Below that is a 'COMMAND LINE OPTIONS' section with a terminal-style prompt '> \_'. The main part of the form is titled 'SELECT APPLICATIONS TO RUN ON THE NODES' with a dropdown for 'Application'. Below this is a section for 'SETUP NUMBER OF TOKENS FOR A UNIT OF COMPUTING POWER' with input fields for 'Flops:' and 'Time: 00.00'. The next section is 'SETUP DISK SPACE ALLPCATION LIMITS AND PRICE FOR IT' with input fields for 'Allocation limits:' and 'Price: BTC'. At the bottom center is a large circular 'OK' button.

SONM BUYERS INTERFACE PROTOTYPE



The image shows a web interface for SONM miners. It has a similar dark header with the SONM logo, a 'Username' field, and a user icon. The main section is titled 'PRE-SELLING COMPUTING POWER FORM'. Under this, there's an 'APPLICATION FORM' with a dropdown for 'Application' and a note '\*white list reputation level or any depending price'. Below this is a section for 'SETUP NUMBER OF TOKENS FOR A UNIT OF COMPUTING POWER' with input fields for 'Flops:' and 'Time: 00.00'. The next section is 'SETUP DISK SPACE ALLPCATION LIMITS AND PRICE FOR IT' with input fields for 'Allocation limits:' and 'Price: BTC'. Below this is a note '\*can be used own space or purchased from other inegrated services'. At the bottom center is a large circular 'OK' button.

SONM MINERS INTERFACE PROTOTYPE

### 2.12.3. API for software developers

On the first stages developers' API will be implemented using widespread and well-tested BOINC and Ethereum API.

On the further stages of platform development, after the system core upgrade to v.2.0, we'll create propri-etary SONM API.

### 2.12.4. Plug-n-Play implementation of additional modules

SONM has easy "Plug-n-Play" implementation of downloading, installation and usage of the developers' apps.

Also, SONM network can be easily expanded through the connection of external compatible networks, for example, any Grid network. On the later stages of the SONM development, we will integrate with neural networks.

## 2.13. GitHub

SONM project GitHub repository:

<https://github.com/sonm-io>

[\\*\\* Link on crowdfunding smart-contract code: \\*\\*](#)

# 3. GOVERNANCE

## 3.1. SONM token

**SONM platform** uses a token of the same name – **SONM (ticker SNM)**.

Token account is a core component of **SONM**, and it is designed to ensure flexibility and control for the future evolution of the project. Tokens will be created during the crowdfunding period. Total supply of **SNM** will be limited to the amount of tokens created during crowdfunding period. **SNM** tokens will be used by the computing power buyers to pay for the calculations using the smart-contracts based system.

**SNM** is a token issued on Ethereum blockchain. Its design follows widely adopted token implementation standards. This allows token holders to easily store and manage their SNM tokens using existing solutions including Ethereum Wallet.

**SONM project** crowdfunding (ICO) and SNM token creation will take place using Ethereum smart contracts. Participants willing to support **SONM** project development will send ether to specified ICO ethereum address, creating **SNM** tokens by this transaction at the specified SNM/ETH exchange rate.

ICO participants will be able to send ether to SONM crowdfunding ethereum address only after the start of the crowdfunding period (specified as the Ethereum block number).

Crowdfunding will finish when the specified end block is created or when the maximal ICO cap is reached.

## 3.2 SNM tokens presale (Pre-ICO)

### 3.2.1 Pre-ICO benefits

1. Pre-ICO investors get tokens with 100% added bonus. Presale token exchange rate: 303 SNM per 1 ETH.
2. Pre-ICO tokens will be transferred into main token contract through special safe migration function.

### 3.2.2 Presale smart-contract

Presale smart-contract will be available at this URL after pre-ICO start:

[\\*\\*<<address>>\\*\\*](#)

Approximate date of presale start (to be announced):

25.03.2017

You will be able to get your presale SNM tokens after the end of SONM crowdsale using “Migrate” function from main ICO smart-contract.

## 3.3. SONM Crowdfunding (ICO)

ETH		
Minimal ICO funding		20000
Maximal ICO funding		586740
Approximate date of ICO start	1/05/2017	
Approximate date of ICO end	15/06/2017	
Maximal number of SNM tokens to be issued	222000000	732600
Nountu campaign	2000000	6600
SNM tokens issued on ICO & pre-ICO	177800000	586740
SONM team SNM tokens number	22200000	73260
SONM Ecosystem fund SNM tokens number	20000000	66000

### Crowdfunding terms

- ICO will proceed through the native SONM application using Ethereum smart contract.
- No token creation, minting or mining will be available after the crowdfunding period. At the end of ICO, SNM token creation will be closed permanently.
- SNM tokens transfer will be restricted for security reason for one month after the end of crowdfunding. All unredeemed tokens will be burned
- In case if maximal ICO funding cap is not reached, tokens distribution ( bounty, SONM team, SONM ecosystem is proportional to the number of SNM generated during ICO)

### SNM / ETH exchange rate

for 1 ETH	
ICO	303
Pre-ICO	606

Further crowdfunding process details will be announced before the start of the ICO through the following channels:

- [Reddit](#)
- [Slack](#)
- [Facebook](#)
- [Telegram](#)
- [BitcoinTalk](#)
- [Twitter](#)
- [Google Groups](#)
- [Medium](#)

ICO page will be available at this URL when crowdfunding starts: <http://sonm.io/ico/>

## 3.4. Dividends and fees

During the SONM crowdsale, 222,000,000 SNM tokens will be distributed to ICO participants.

SNM tokens can be used in DAO for managing decisions about fees. There is no other ownership of the project, rather than % from all transactions and operations.

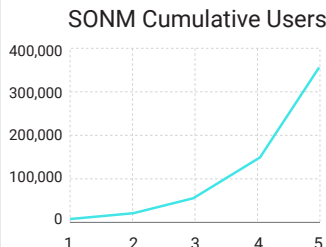
We can model the potential returns for SNM tokens holder by considering a metric called dollar turn-over – the amount of dollars transacted on the SONM platform through the mechanism generating fees for buyers (and returns for investors).

World Parameters	
USD/BTC	1259
USD/SMN	0.0627360
ETH/SONM	0.0033000
Available risk-free APY (magnr.com)	2.35%

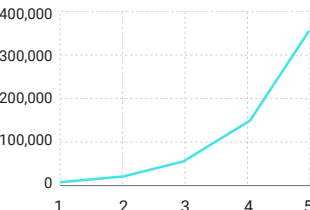
SONM Platform Parameters	
\$ TFLOPH	0.03864
Monthly \$ input/buyer	1159.20

**Fee = 0.5%**

Growth Model	Year	SONM Byers	Turnover (\$)	Implied Fees (\$)	Implied Dividend (\$)	Discounted Dividend Today (\$)
	1	10,000	278,208,000	1,391,040	0.0063	0.0061
	2	24,596	684,281,262	3,421,406	0.0154	0.0147
	3	60,496	1,683,060,322	8,415,302	0.0379	0.0354
	4	148,797	4,139,660,404	20,698,302	0.0932	0.0850
	5	365,982	10,181,921,608	50,909,608	0.2293	0.2042
	<b>Avg</b>	<b>121,974</b>	<b>3,393,426,319</b>	<b>16,967,132</b>	<b>0.0764285</b>	
	Implied 5-Year Price (\$) Gordon Growth Model					<b>0.3453</b>
	Implied 5-Year Price (BTC)					<b>0.000275</b>

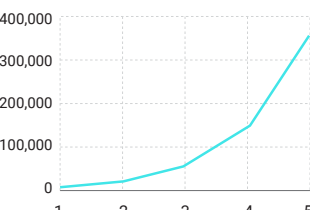
For instance, if the turnover of SONM is \$278 millions in one year, and we assume the average SONM market fee to be 0.5%, then SNM holders will collectively receive a dividend of \$278 millions  $\times$  0.5 = \$1.39 million. The holder of 1 SNM would accordingly receive \$1.39 million  $\div$  222,000,000 = \$0.0063. Thus, if I give you a 1000 SNM tokens (ICO price \$59.29) today than a year from now you can expect to get paid \$6.26 under these assumptions and in a fifth year about \$229.3.

## Fee = 2%

Growth Model	Year	SONM Byers	Turnover (\$)	Implied Fees (\$)	Implied Dividend (\$)	Discounted Dividend Today (\$)
<div>SONM Cumulative Users</div> 	1	10,000	278,208,000	556,416,000	2.5064	2.4488
	2	24,596	684,281,262	1,368,562,525	6.1647	5.8849
	3	60,496	1,683,060,322	3,366,120,644	15.1627	14.1421
	4	148,797	4,139,660,404	8,279,320,807	37.2942	33.9852
	5	365,982	10,181,921,608	20,363,843,216	91.7290	81.6709
	Avg	121,974	3,393,426,319	6,786,852,638	30.5714083	
	Implied 5-Year Price (\$) Gordon Growth Model					1,3813
	Implied 5-Year Price (BTC)					0.001105

If DAO decide to make fee to be 2%, then holder of 1000 SNM (ICO price \$59.29) would accordingly receive \$25.06 dividends in first year and \$917.29 in fifth year.

## Fee = 5%

Growth Model	Year	SONM Byers	Turnover (\$)	Implied Fees (\$)	Implied Dividend (\$)	Discounted Dividend Today (\$)
<div>SONM Cumulative Users</div> 	1	10,000	278,208,000	13,910,400	0.0627	0.0612
	2	24,596	684,281,262	34,214,063	0.1541	0.1471
	3	60,496	1,683,060,322	84,153,016	0.3791	0.3536
	4	148,797	4,139,660,404	206,983,020	0.9324	0.8496
	5	365,982	10,181,921,608	509,096,080	2.2932	2.0418
	<b>Avg</b>	<b>121,974</b>	<b>3,393,426,319</b>	<b>169,671,316</b>	<b>0.7642852</b>	
	Implied 5-Year Price (\$) Gordon Growth Model					<b>3.4533</b>
Implied 5-Year Price (BTC)					<b>0.002754</b>	

Furthermore, if DAO decide to set a fee of 5%, then holder of 1000 SNM (ICO price \$59.29) would accordingly receive \$95.09 dividends in first year and \$2293.22 in fifth year, etc.

*\* Note that models are only attempts at approximating reality and in cryptoasset markets where speculation abounds, no one can truly predict the outcome.*

## 3.5. Trade volume

SNM token trade volume will be supported by lower costs for computing power buyers and higher profits for miners (sellers). We reduce margin of the current market, give entrance to the market for the new players, maximize profits for buyers and sellers by removing intermediate players (current cloud services providers).

The wider the usage of SNM token for computational power purchase, the higher will be the market demand for the token on exchanges, and the higher the price in comparison with initial ICO price.

[\(Go to Markets section of whitepaper\)](#)

## 3.6. Payment (exchange) mechanism description

Computing power buyers will be able to pay for the SONM resources they rent using cryptocurrencies, fiat currencies and traditional centralized electronic payment systems (PayPal, Skrill, etc).

We'll implement payment methods similar to those used by cryptocurrencies exchanges, with Shape-shift-like services for instant cryptocurrencies exchange and payment gateways for fiat deposits.

Buyers' deposits will be instantly converted to SNM tokens at the current market rate, and after that buyers will be able to use the tokens to pay hubs/miners for performing computing tasks.

## 3.7. Token allocation and financial plan

### PRE-ICO allocation structure

19%	SONM original team
34%	R&D (including team expanding, advisers, etc.)
10%	Indirect (legal, office etc)
32%	Marketing (promotion, market growth, community & expansion)
2%	Complementary technologies
3%	Technology infrastructure

### ICO allocation structure

20%	SONM original team
30%	R&D (including team expanding, advisers, etc.)
4%	Indirect (legal, office etc)
33%	Marketing (promotion, market growth, community & expansion)
7%	Complementary technologies
6%	Technology infrastructure

### Founder's fee

At the end of the **main** crowdfunding, the founding team will receive **10%** of allocation of **SNM**, subject to a twelve-month holding period. These tokens will serve as long-term incentive for founding team. **90%** will be distributed according to the **table above** and spent on direct costs according to Roadmap.

### 3.7.1. Financing and RoadMap

Levels of crowdfunding raised will allow us to progress according to the RoadMap presented above. The main spending of funding will go to sustaining a team of developers, with a smaller part also going to community and marketing managers. Minimal funding will go to Desktop Grid Computing specialists.

#### Team Salary

The main part of funding is needed for full-time financing of team work and for involving new team members, when needed. In addition, external contractors and complementary services are expected.

The team listed in the team section is expected to be the core, but the project expects more hiring in the process of project development. As far as we expect to come to the market as fast as possible (probably

the first from the similar projects), part of funding is going to come from the profits of the network (0.1% transaction fee for any transaction in the network.). We already have experience fusing Desktop Grid computing for Drug Discovery@home project and coupling it with smart contracts.

**In the 'minimal financing' scenario**, the ultimate deliverable is a working SONM. It is a creation of the decentralized computing power market along with tools for developers to implement their applications on SONM infrastructure. In particular, the minimal financing will be sufficient to introduce a basic version of SONM Ecosystem.

**In the 'maximum financing' scenario**, we are making a commitment to deliver software we describe much faster due to a parallel development program. In addition, this could allow us to focus on the 'singularity' and AI section. Machine Learning and optimization algorithms in general are expected to provide very efficient software/hardware pairs, which makes computing faster, easier, more scalable, effective and lowering cost the more you use it. The more computing calculations performed, the faster a system learns how to be efficient. It is possible to make this software system to be very specific and dedicated just for your needs, and to predict your costs easily and cut time delivery to a minimum.

**SONM** team spending costs consist solely of employment costs. With minimal scenario, we expect to hire teams of developers for Grid Desktop Computing as well as for the blockchain smart-contracts. With maximum scenario, this will also involve hiring professionals in the fields of cryptography (cipher text reading, running computing for encrypted data) and artificial intelligence.

#### **Offices and indirect costs**

Office and indirect costs include costs of offices rental (minimal offices space – Moscow and Warsaw, maximum – also offices in Zug, San Francisco and London), as well as other indirect, employment-related costs. This is expected to make us more available to the community and clients, actively selling their computing resources on the market.

#### **Third-party contractors and complementary services**

By contractors we mean all third parties we are willing to work with. The number here is high because of security audits. Legal and accounting services are also included in this category.

#### **Community management and expansion**

We expect expansion of SONM community in multilingual and multicultural environment. This will include community management, communication, marketing and promotion.

The goal is to bring Clients (Buyers-Requestors) toward network and will include direct sales activity and making self-sustaining decentralized sales network, which may get direct benefits and % from the buyers. This will also include creation of SONM foundation. We plan that at part of this money will go on market to re-buy our tokens and financing our servers, hubs and worlds by them.

By **complementary technologies** we mean technologies, which are needed by SONM and can be integrated into it. Mostly we will rely on open-source and distributed applications. It will mostly be spent on funding integration work for these technologies with SONM system.

#### **Contingency**

Contingency fund is calculated as 10% of the total budget (5% for minimal financing).



## 3.8. SONM Team



**Andrey Voronkov**

Founder, CEO  
of DrugDiscovery@home project.

[BTT profile](#)



**Zhu Lianbing**

Chinese community manager.  
Blockchain enthusiast.



**Sergey Ponomarev**

Founder, creator of SONM multi-agent and blockchain technologies.



**Maxim Taldykin**

Pre-sale contract, DAO



**Krzysztof Piszczek**

Founder, creator of BOINC P2P technology.

[BTT profile](#)



**Oxana Lorie**

Graphic designer



**Krzysztof Faryna**, developer.

Krzysztof is experienced BOINC administrator, who manages BOINC Poland foundation.



**Alexey Antonov**

Marketing & financial adviser



**Barnaba Pawełczak**

Marketing and business development.



**Vasiliy Ivanov**

ICO and crypto community advise

[BTT profile](#)

## 3.9. SONM HR Policy

To reach our goals and stick to development roadmap and timeline we'll hire the most professional, hard-working and creative team members from all over the world.

### We need:

- grid systems programmers
- P2P BOINC experts
- multi-agent systems experts
- intellectual agents interaction experts
- backend programmers
- community managers

**Employee can choose one of the following wage plans:**

- Salary
- % of SNM tokens
- Both

We are a completely responsibility-based company and do not bind anyone to our offices, and this is one of the key advantages for our potential employees. All the work is being done online and remotely, so any of our team members can freely choose the location and working conditions, working hours and style.

We need talented people showing big results, not the ones just wasting their time and energy in the office routine.

## 4. DEVELOPMENT ROADMAP

### 4.1. Funding stages

SONM DEVELOPMENT ROADMAP		
<b>1. First stage: Server Optimizing the Network Mining.</b>		
<b>Funding: 20 000 ETH, ~200 BTC</b>		
1. Test server stage (first hub in the SONM network)	FEATURES	
2. Test server will be used to enable computing power sale/purchase for processing the tasks with the various complexity		
3. Solving GPU and distributed GPU virtualization data security issues		
4. Purchase/sale mechanism for miners and buyers		
5. Market for software developers		
6. Matching applications with computing and/or storage resources		
Ecosystem for computing power selling and buying, with robust reputation system using BOINC platform. Centralized (classic). Ethereum smart-contracts are used for payments automation	VALUE	
Anyone can download our client and start mining on its computing device. Anyone can pose the task for the software from white list and pay for it.	KEY DELIVERABLES	

<p><b>v.0.1 (done):</b></p> <p>BOINC is used as the system core, BOINC manager as the mining software. There is no client interface for computing power order yet. DrugDiscovery@home token is the only available contract.</p> <p><b>v.0.2:</b></p> <p>Presale smart contract.</p> <p>Modules: approximate equipment computing power calculator, functional auto-transactions framework for hub-miners payments.</p> <p><b>v.0.3:</b></p> <p>Intermediate solution after the end of presale.</p> <p>BitMessage core implementation, installation of plugins for hubs interaction with block-chain (C++ or go-lang library to process hubs payments to miners).</p> <p>Implementation of the miners plugin to check tokens balance in BOINC task-manager window.</p>	VERSIONS
<p><b>2. Second stage: Servers Organized in Network Market.</b></p> <p><b>Funding: 200 000 ETH, ~2000 BTC.</b></p> <p><b>Estimated implementation time: 1 year</b></p>	
<p>1. Multiple hubs in the SONM network</p> <p>2. Creation of the network-based computing power market</p> <p>3. Heterogenic decentralization of the computations</p> <p>4. Multi-agent P2P system development</p> <p>5. Hubs deployment standardisation using smart-contracts</p> <p>6. Homomorphic encryption or technologies similar to <a href="#">Enigma project</a> for the data security.</p>	FEATURES
<p>Ecosystem for decentralized data storage market. Secure data transfer during computations processing. SOSNA platform. Own SONM mining pools for better cooperation and higher valued contracts on the market.</p>	
<p>Multiple servers in the SONM network. Functional prototype with multiple servers involved in the computational tasks. Servers can interact with each other. Several hubs are created. Tasks validation system for P2P servers. Rating system is tested.</p>	KEY DELIVERABLES

<p><b>v.1.0, ICO:</b></p> <p>Post-ICO stage before SNM token listing on crypto exchanges.</p> <p>The main emphasis is marketing. (So, further stages will be focused on system debugging)</p> <p>Clients module launch, with client-hub interaction functionality and ability to run tasks instances. No payment functionality yet, probably no GUI - just to lay the foundation of this part of the SONM system.</p> <p><b>v.1.1:</b></p> <p>The most important part of the development.</p> <p>Implementation of buyer-side blockchain plugin used to pay for computations.</p> <p>Messages core debugging, start of API development.</p> <p>Development of hubs Deployment module to deploy hub-wallets contracts and interact with them.</p> <p>Torrent core implementation: hubs are able to transfer data via torrent network, miners are able to receive data via torrent.</p> <p>SONM DAO development and deployment.</p> <p><b>This is the key stage of the SONM development.</b> We don't have the unified miners and hubs network, but all the system logic and core functions are already implemented.</p>	VERSIONS
<p><b>3. Third Stage: Self-Organized Network Mining</b></p> <p><b>Funding: 500 000 ETH – 5 000 BTC</b></p> <p><b>Estimated implementation time: 2 years</b></p>	
<p>1. Complete decentralization of the market</p> <p>2. End-user solutions</p> <p>3. Developers API for hubs creation, tokens creation</p> <p>4. Interfaces for integration with other grid computing networks (Golem, iEx.Ec, Elastic, etc.).</p>	FEATURES
<p>Further development of SOSNA and GRIB technologies. Compatibility with other networks and projects. Hubs rewards/penalties model development.</p>	VALUE
<p>Anyone can deploy a server/hub in the SONM network. The number of hubs is not limited. Possibility to use any software and servers (not only from the whitelist). Decentralized computing power market, managed by DAO.</p>	KEY DELIVERABLES

<p><b>v.1.2:</b></p> <p>Key objective of this development stage is hubs and miners integration into the unified network. By this moment we will have implemented Message API, all the key modules, so we can start adding high-level architecture:</p> <ul style="list-style-type: none"> <li>- hubs whitelist and broadcasting modules (for sending hubs' info and links to whitelist to the channel);</li> <li>- channel listener module for miners to receive messages from hubs;</li> <li>- D'hall module for miners to compare hubs' information received from the channel with blockchain contracts info;</li> <li>- Messages plugin for buyers.</li> </ul> <p>At this stage SONM system works as multi-agent system <a href="#">described in 2.6</a>, except packing\unpacking torrent files.</p> <p>Buyers can broadcast a task to the network channel, miners can process these tasks, hubs can manage miners computations - so, all the core SONM functions are implemented.</p> <p><b>v.1.3:</b></p> <p>Development of new version of SONM core for the further stages of development.</p> <p>Releases of the system patches with various improvements and bug-fixes.</p> <p><b>v.2.0:</b></p> <p>Release of the new SONM core.</p> <p>Total renovation of the system core, moving away from the BOINC architecture.</p>	<p>VERSIONS</p>				
<p><b>4. Fourth stage: Supercomputer Organized by Network Mining</b></p> <p><b>Funding: 1 000 000 ETH ~ 10 000 BTC</b></p> <p><b>Estimated implementation time: 3-4 years</b></p> <table> <tr> <td data-bbox="130 1624 1197 1892"> <ol style="list-style-type: none"> <li>1. Heterogeneous fog computing (supercomputing)</li> <li>2. Integration with supercomputing and neural networks systems</li> <li>3. Mining and energy efficiency management. SONM system suggests the most suitable prices and tasks for the miners/buyers.</li> <li>4. Providing computing power to other blockchain projects</li> <li>5. Decentralized task distribution system.</li> </ol> </td><td data-bbox="1197 1624 1466 1892"> <p>FEATURES</p> </td></tr> <tr> <td data-bbox="130 1892 1197 2087"> <p>Reducing the costs and the time for processing the tasks due to machine learning algorithms based on the gathered big data. Decentralized supercomputing fog, integrated with other computing resources. Integration with relevant blockchain technologies and platforms (iEx.Ec, Golem, Factom, IPFS, Storj, factom), integration with other relevant and complementary services, cryptocurrencies and technologies.</p> </td><td data-bbox="1197 1892 1466 2087"> <p>VALUE:</p> </td></tr> </table>		<ol style="list-style-type: none"> <li>1. Heterogeneous fog computing (supercomputing)</li> <li>2. Integration with supercomputing and neural networks systems</li> <li>3. Mining and energy efficiency management. SONM system suggests the most suitable prices and tasks for the miners/buyers.</li> <li>4. Providing computing power to other blockchain projects</li> <li>5. Decentralized task distribution system.</li> </ol>	<p>FEATURES</p>	<p>Reducing the costs and the time for processing the tasks due to machine learning algorithms based on the gathered big data. Decentralized supercomputing fog, integrated with other computing resources. Integration with relevant blockchain technologies and platforms (iEx.Ec, Golem, Factom, IPFS, Storj, factom), integration with other relevant and complementary services, cryptocurrencies and technologies.</p>	<p>VALUE:</p>
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SONM system uses various machine learning approaches (neural networks learning, deep learning, generative adversarial networks). The system learns how to suggest the most suitable applications, hardware and price better than the miners and buyers.	KEY DELIVERABLES
<b>v.2.1:</b>  Development of plugins for neural networks integration and machine learning algorithms based on the data, collected by this moment. Optimization of the prices and software/hardware matching.	VERSIONS
<b>5. Fifth Stage: Superintelligent Omnipresent Network Mind</b>  <b>Funding: 2 000 000 ETH ~ 20 000 BTC</b>  <b>Estimated implementation time: 5-6 years (depending on complementary technologies)</b>	
1. Learn, which tasks are imposed on network by buyers. Computing tasks clusterization and classification.	FEATURES
2. The system teaches itself on which computing tasks are the most profitable and <b>maximizes the profits of miners.</b>	
3. Learn which algorithms and applications are the most efficient to execute standardized tasks. <b>Maximization of profits for buyers.</b>	
4. Natural language processing in order to understand tasks in natural language and formalize them in the form of application combinations for solving these tasks.	
5. Learns from hubs and servers profits data the algorithms and applications for super-nodes management.	
6. Starts posing the most profitable tasks upon itself, replacing buyers	
Optimized by every feature computing power to deliver as fast as cheap and as accurate results as it is available with global network resources	VALUE:
Proof of stake to generate temporary license token for gate activation to ML & A.I. optimization software (2 BTC equivalent or more for reputation penalties or growth).	OPTION:
Optimized towards SONM software blockchain and/or sidechain.	
System teaches itself which tasks are most profitable, which software/hardware pairs are most profitable and starts replacing buyers and miners by imposing tasks on it automatically and by purchasing, delivering and attaching hardware to itself.	KEY DELIVERABLES
<b>v.3.0:</b>  General purpose artificial intelligence. System learns to combine specific AI. Performance (profit-based) outperforms miners and buyers. System learns how to self-impose tasks and overtakes miners and buyers roles.	VERSIONS

## 4.2. Modules implementation roadmap:

Blockchain	Miners	Hubs	Messages	Buyers	Ver
DrugDiscovery token	Core: BOINC-manager	Core:BOINC  Software:  DD@home, any Grid и BOINC compatible apps	-	-	0.1
Pre-Sale.	+	Components:  Calculator, Auto-pay framework	-	-	0.2
	Blockchain plugin	Blockchain plugin	BitMessage core		0.3
ICO, Migrations	Debug	Debug	Debug	App-management API	1.0
Hub-wallet, Hub-factory, DAO	Torrent module	Components:  Deployer module, Torrent plugin	Debug	Blockchain plugin,	1.1
Escrow, White-list	Listener module,  D'Hall module, Switcher module	Broadcaster module	Message API	Message plugin	1.2
Debug	Rate plugin	Price API  Rate plugin	Torrent API	Price API	1.3
Debug	Debug, rate plugin	Debug, Rate plugin			1.4
Upd	Upd	Core-update	Upd	Upd	2.0
	Neuro-n plugin, Adviser.	Neuro-n plugin			2.1
	Integration of deep learning, general AI.	General AI. System, self-imposing tasks.			3.0

### Notes:

We will have fully functional system, able to be used for any general-purpose computations, starting from the v.2.0. Most likely, by this stage SONM platform will have full-scale computational projects deployed with high turnover volume.

Moreover, by the v.2.0 we expect SONM to attract lots of the open-source community members, which means:

- The community will be independently creating lots of decentralized grid-compatible apps.
- Lots of brand new markets and teams are potentially going to appear, as well as lots of community-crafted tools for interaction with the SONM platform, most likely better than the original apps, developed by the SONM team. For example, the official geth Ethereum client made by Ethereum Foundation comparing to Parity by EthCore, or Windows Media Player compared to WinAmp or Internet Explorer comparing to Mozilla Firefox. We understand and welcome it.

**That means that starting from this point we'll need to reduce our efforts for tools development and give way to the free market and community.**

We'll focus on creating new formations for interaction with this market:

- dedicated team developing decentralized computational power exchange;
- teams providing server hosting services based on the SONM platform;
- software for niche markets, like DrugDiscovery@home;
- various integration projects;
- external formations for tools development (like Metamask.io by ConsenSys)

I.e., by this point we will have a distinct division of SONM development areas. For example:

- original SONM core developers are creating basic protocols of the system;
- another team is creating apps within smart-solutions;
- SONM ExChange team is building UI-friendly tools for the interaction with buyers and managing the decentralized exchange;

## 4.3. Dissemination of the development process information

- The project team is responsible for making results open to the public and to use all available resources to disseminate information about the project.
- At least once in a week we'll publish a report about current development results and issues.
- Report will contain current project needs and issues.
- All major breakthroughs will be communicated with all interested mass media and spread in major community forums like BitcoinTalk and CryptoCoin Talk.

## 4.4. Timeline

Assuming that SONM crowdfunding attracts maximal ICO cap, we will release SONM v.2. in 1-1.5 years.

Estimated project time frames for all stages: 44 months (taking into account complementary technologies development).



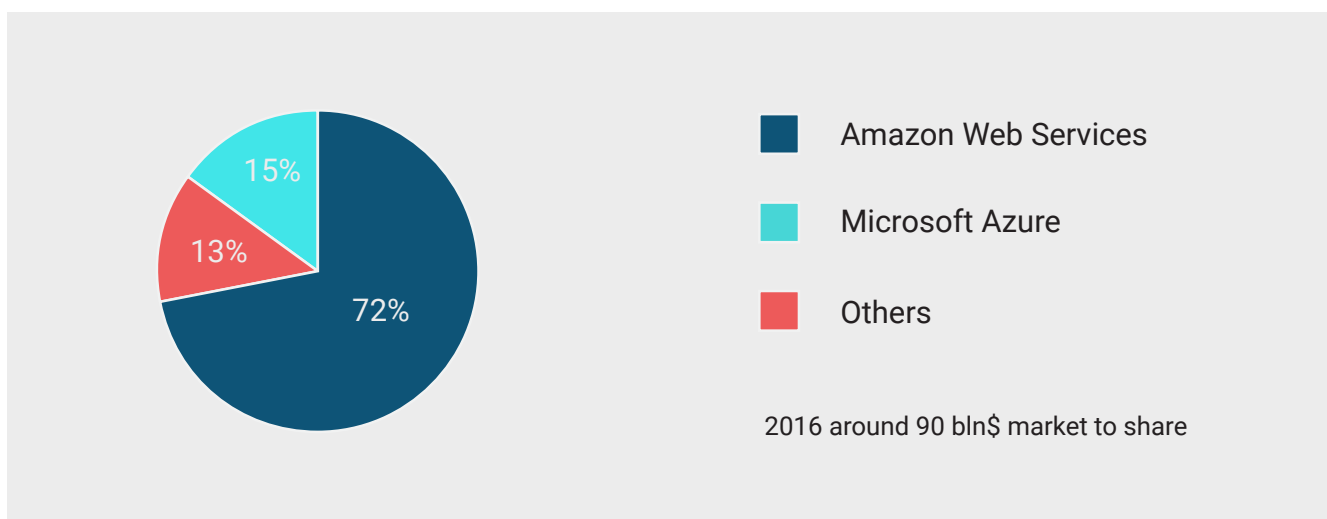
# 5. COMPUTING POWER MARKET ANALYSIS

## 5.1. Market

Today the computing power market is centralized with biggest players such as Amazon, Google, Microsoft and IBM having main market shares. This reduces pricing efficiency for computing services and makes computing market non-stable and easy to control.

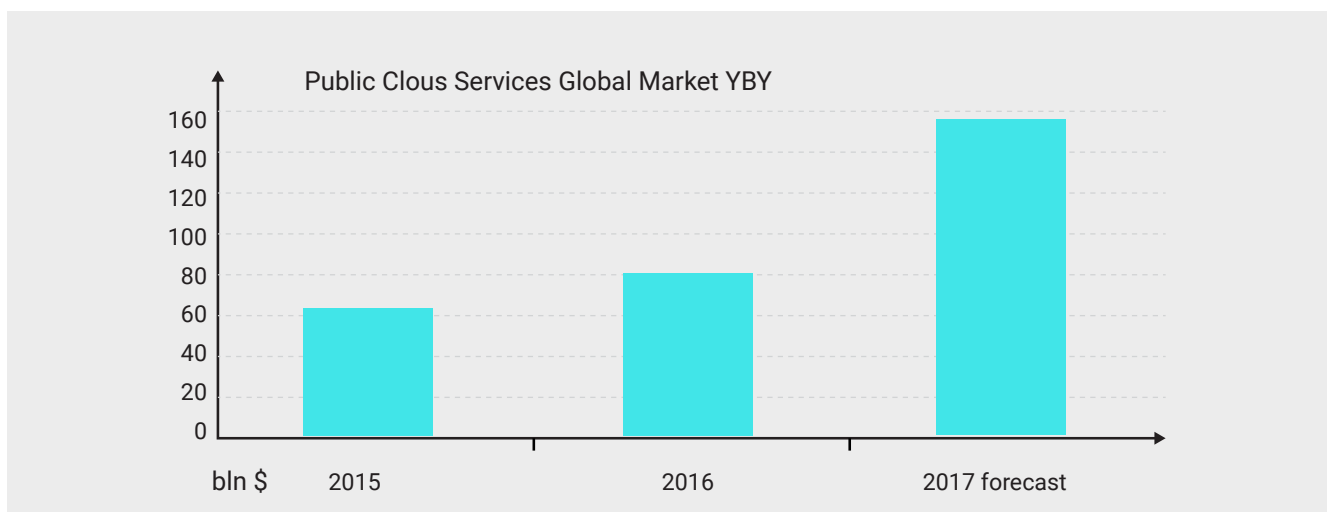
We are going to change this situation with contribution of millions of **Miners** worldwide. With SONM the supply of computing resources is based on contributions of individual and professional **Miners**, combined with an array of dedicated software solutions via SONM Application Pool.

CURRENT COMPUTING POWER MARKET SHARES



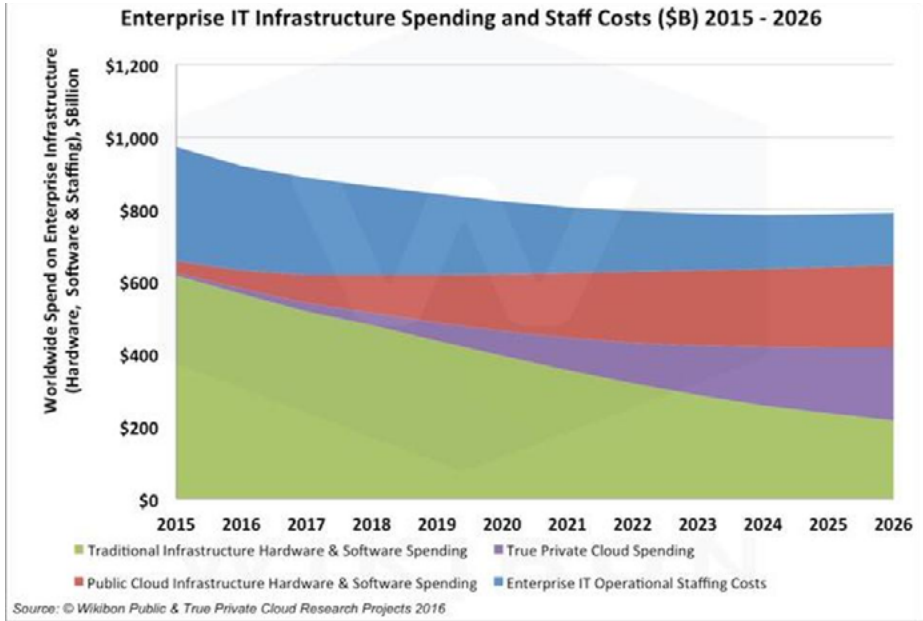
We propose market-based price regulation for the distributed computing market. Cloud computing market volume is rapidly growing and going to reach \$250B in a few years [\[14\]](#). This dynamic is beneficial for the development of distributed and fog computing due to the new players and competition on the market.

COMPUTING MARKET GROWTH AND FORECAST



SONM will disrupt the cloud computing market significantly by decreasing the calculation cost. Our system’s unique selling point is that it gives the opportunity to profit to anyone who has computing resources. This is a new era both for mining and for distributed computing.

ENTERPRISE IT INFRASTRUCTURE SPENDING AND STAFF COSTS

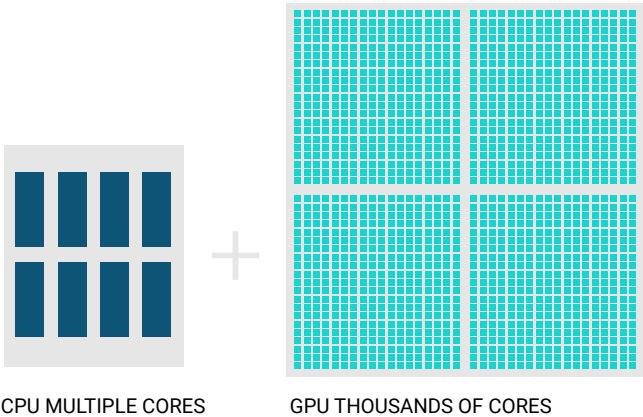


Our calculations indicate that the total computing power of bitcoin and altcoins miners’ resources is as high as ~4 EFlops. It’s important to note that this is the approximate computing power of cryptocurrencies mining equipment, and this number doesn’t take into account all the computing devices in the world able to process calculations.

Last years due to a significant mining difficulty increase, GPU mining is becoming less and less profitable. Large players crowd out solo-miners with GPU mining farms. Also, a lot of cryptocurrencies and blockchain platforms are going to migrate from Proof-of-Work to Proof-of-Stake algorithm, making mining equipment useless.

GPU mining farms represent general-purpose computing systems “Current GPUs are particularly well-suited to cross-GPU parallelization, as they are able to read from and write to one another’s memory directly, without going through host machine memory. The parallelization scheme that we employ essentially puts half of the kernels (or neurons) on each GPU, with one additional trick: the GPUs communicate only in certain layers. This means that, for example, the kernels of layer 3 take input from all kernel maps in layer 2. However, kernels in layer 4 take input only from those kernel maps in layer 3 which reside on the same GPU” [15] and have standard CPUs with full instruction set, sufficient amount of RAM memory and a hard drive.

GPUs have thousands of cores to process parallel workloads efficiently



This available computing power allows for a significant market share, which could to potentially prevail in the calculations market in the nearest future.

For example, here are the Top-5 most powerful supercomputers in the world [\[15\]](#):

0.093015 EFlops	Sunway TaihuLight	1
0.033863 EFlops	Tianhe-2	2
0.017590 EFlops	Titan	3
0.017173 EFlops	Sequoia	4
0.010510 EFlops	K computer	5

(IBM is currently working on creating 0.2 EFlops supercomputer)

*"Cycle Computing had already built a few clusters on Amazon's Elastic Compute Cloud that scaled up to several thousand cores. The customer that opted for the 10,000-core cloud cluster was biotech company Genentech where scientist needed computing power to examine how proteins bind to each other. Using Genentech's existing resources to perform the simulations would take weeks or months instead of the eight hours it took on Amazon. Cycle Computing boasted that the cluster was roughly equivalent to the 114th fastest supercomputer in the world, which hit about 66 teraflops. [\[16\]](#)"*

According to the public information, Amazon EC2 C3 Instance Cluster computing power stands at 484 TFlops = 0.0004842 EFlops. This is about 0,012% of the total mining equipment computing power, not taking into account idle computing power not used in mining, such as PCs, game consoles, etc.

## 5.2. SONM in comparison to the other grid computing projects

The best matching analogues of our project are Golem, Elastic network, iEx.ec. Our key benefit compared to these projects is our GRIB technology based on widespread middleware with huge worldwide community – BOINC. Initially BOINC was created as server-centralized volunteer distributed computing project. SONM developers modified BOINC technology to use it in decentralized fog computing network.

### 5.2.1. SONM in comparison to Golem Network

SONM advantages comparing to Golem:

**Golem network hasn't demonstrated concept proof yet.** Golem network currently isn't able to process general purpose computing. Their network is available in the test mode only for CGI rendering.

Furthermore, SONM uses more common and standardized BOINC platform, also used in lots of existing distributed projects, therefore SONM is compatible with many of them.

In addition, as we are developing SONM using a lot of open source technologies, we already have the core, network platform and most of the other important features of the project, and, in fact, we are ahead of the Golem project at least by two years of development.

**Golem's range of applications is still limited.** At the moment, efficiently tested tasks in Golem are limited only to rendering CGI in Blender.

**Golem has less functions.** Golem represents "peer-to-peer market" for computational resources. SONM is the cryptographically secure protocol providing tasks distribution, validation of results and proportional correct payment for the used computational power.

**Validation of the computing results.** Results validation system is one of the Golem project's weak spots. Not all of the computations' results are being validated, so Golem is depending on their reputation system to prevent users from paying malicious miners for wrong results of calculations. This system is potentially vulnerable and can be exploited.

SONM uses BOINC verification system allowing to check all the received results for correctness.

### 5.2.2 SONM in comparison to iEx.Ec project

**iEx.Ec uses its own XtremWeb-HEP protocol.** It is middleware similar to BOINC, however it is less tested and has smaller community and support behind it.

**Both in comparison with Golem and iex.ec we expect to get to the market faster** due to usage of open source technologies and protocols. We use widespread time-tested technologies, so we've already implemented the core of the SONM system, most of its important functionality and we have the functional prototype available for community alpha testing.

### 5.2.3 SONM in comparison to Elastic Project

**Elastic team is anonymous.** The project is being developed by the Elastic community, and there are no team members showing their real identity. So, in the case of project failure, there is nobody to take responsibility.

**Elastic is an experimental non-commercial project.** In fact, Elastic developers are good engineers, but they lack marketing and PR, and don't think about the commercial side of the platform and monetisation. They don't have any financial model or clear marketing plan, so the future price of Elastic tokens and project market capitalisation is very unclear. Also, Elastic had finished ICO crowdfunding more than a year ago, but their tokens still aren't listed on any crypto exchange, and ICO investors still don't have access to the tokens.

**Elastic uses a transactions pool for tasks, a mechanism similar to that used by traditional blockchain systems, such as cryptocurrencies.** This leads to a serious problem: a transactions block must be confirmed in a certain amount of time, so a task must be processed in this certain time frame. In the case of general-purpose calculations (for example, protein folding), we can't know with certainty how much time will it take to process the task.

Elastic uses its own programming language to solve this issue with a mechanism, similar to Ethereum, that leads to excessive parallelism and the necessity to run the code on the all machines in the network.

SONM uses modified BOINC protocol, which was initially developed for volunteer grid computing and is much more efficient for tasks distribution and processing.

### 5.2.4 Differences from GridCoin, FoldingCoin and CureCoin.

There are cryptocurrency projects such as CureCoin, FoldingCoin and GridCoin already involved in scientific distributed computing.

However, these projects use the white list selection for the scientific computing projects. They don't have and don't create a computing power market.

In our project any **buyer** can purchase computing power for a task of any size and any **seller** can rent computing power. Therefore, our main benefit compared to these projects is that SONM is not limited by a specific project's list. SONM will be the open decentralized secure computing power market available for everyone. However, SONM is fully compatible with these platforms, so once these projects start using SONM infrastructure, one may be able to earn SNM and corresponding tokens (FoldingCoin, GridCoin, CureCoin etc. also). Also, SONM is compatible with Grid apps, so any these apps can be run in our system.

## 5.2.5 Compatibility and integration with other decentralized on-demand-computing services.

Although we have mentioned differences with Golem, Elastic Project and iEx.Ec networks and some advantages of our project, we consider compatibility and possibility of these systems integration as a big advantage of SONM network and as a promising means of computing power usage optimization. Therefore, the goal is to create global integrated computing platform, where SONM, Golem, iEx.Ec and similar systems can be integrated together and computing power will flow toward the most profitable and efficient system.

One of our project's key goals is the development of intelligent, deep-learning based system, managing the efficiency of computing power usage for solving specific tasks.

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