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TABLE OF CONTENTS

OVERVIEW

IAGON is an Open Source platform for harnessing the storage capacities and processing power of multiple computers over a decentralized Blockchain grid. IAGON enables to store big data files and repositories, as well as smaller scales of files, and to carry out complex computational processes, such as those needed for artificial intelligence and machine learning operations, within a fully secure and encrypted platform that integrates blockchain, cryptographic and AI technologies in a user-friendly way.

The size of the cloud services market providing both storage capacities and computational processing capabilities to companies and to corporates is estimated be 45 billion USD per annum and steadily growing year on year. The market is dominated by four major players: AWS, Google Cloud, Microsoft and IBM, all utilize central and less trusted storage and computation facilities. Due to their oligopolistic dominance, the four providers of cloud services set high pricing levels. These providers are also capable of hampering any competition and preventing new market entrants from competing with them, due to the broad scale of their operations and their substantial investments in data centers, servers and storage facilities.

Interestingly, however, the demand for computational processing capabilities and storage is expected to dramatically increase in the near future due to two major trends in the business and computing worlds: Big Data and Artificial Intelligence (AI). Big Data is the collection, management and storage of vast amounts of information obtained from any internal or external sources (such as the company's IT systems, social networks, sensors and so on). The data management of companies promotes collection and storage of any data related to its operations, clients and competitors, should a need to analyze any of these data ever present itself. The other major trend is the emergence of Artificial Intelligence methods that "learn" from data on past operations, find patterns and business rules and predict future behavior. AI-based processes consume require vast amounts of computations and consume significant processing power of CPU and GPU processes. The demand for storage and for processing power is expected to exponentially increase with broadening the introduction of AI applications in new areas and with the widespread adoption of data collection from multiple channels (such as sensors, social networks, data providers, etc.) and later processing them.

IAGON's major aim is to revolutionize the cloud and web services market by offering a decentralized grid of storage and processing. By joining the unused storage capacity in servers and personal computers and their processing power, we can create a super-computer and super data center that can compete with any of the current cloud computing moguls.

We aim at providing companies and individuals storage and processing services at a fraction of the market prices and at a better security level by connecting data centers, business computers and personal users and making use of their free storage capacities and their CPU and GPU processors during idle times. Doing so, IAGON overcomes the entry barriers imposed by the high level of investments required to compete in this market.

Our token-based economy is based on computer, server and data center owners who join the storage and processing power grids. In return for sharing the capabilities of their machine, they will be granted IAGON tokens that can be traded back to fiat money, while any party who wishes to utilize their capabilities will purchase IAGON tokens to distribute them to the parties that provide their services to the grid. The storage mechanism will be based on Blockchain encryption and delivery of encrypted file fragments to many storage facilities. Contributors to the grid can publish their skills and free capacity and offer their service on the basis of their experience, available resources and storage space and bidding on price. Advanced machine learning and AI algorithms will assist in recommending prices to parties involved in this venture and classifying them according to their price levels and assuring continuity of services and access to all files.

As more and more companies recognize the benefits of IAGON's platforms for storing files and processing them, the demand will increase and so will be the demand for the token – the way customers pay grid participants.

IAGON's token and platform are proven services with our Ethereum-based Blockchain beta version, proving the concept of blockchain-based distributed computing and storage grid. IAGON plans to support also the new and innovative Cardano technology that provides an alternative, rapid and lower cost solution for operating the Blockchain technology. Thus, IAGON will establish blockchain on Ethereum and implement Cardano technology – providing the complete flexibility and freedom of choice to our users and miners.

Further developing our platform and the client program that will be used by any party that would like to join our IAGON grid and benefit from its unused computer resources. IAGON will offer the lowest fees in the cloud industry to customers who purchase storage capacity and/or processing capabilities, as both are abundant and can be fully utilized and scaled, inter-connected by our platform.

IAGON developed and released its beta version (MVP) of its storage grid and the miner's application for installation on Windows, Linux and iOS. The storage grid supports the upload of files, their encryption via SHA256 and the Blockchain, the distribution of file shards between miners and the secure retrieval of files stored on multiple nodes by the user.

IAGON's team works hard to support the reputation of IAGON as the leading platform for storage and processing services, enhancing its adoption among users that allocate their computational resources and among potential customers.

INTRODUCTION

The recent development in Artificial Intelligence (AI) and Big Data technologies and the dramatic increase in adoption of these technologies signify an ongoing and exponentially growing demand to both storage capacity and for computational processing power vis-à-vis the broader adoption of these technologies.

Big Data technologies such as the Hadoop framework (notably its MongoDB, HDFS and Spark databases) require vast amounts of storage capacity, either in a centralized or a distributed manner, for processing and managing Big Data files. To a large extent, Big Data technologies support the exponential growth of data in any type of organization, within web based services and social networks and their implementation is essential to support the proper operation and processing of these immense of data *(see Fig. 1)*.

Machine learning and deep learning processes (notably Google's TensorFlow, Caffe and Theano; see also: Dean et al., 2012, Ray, 2017) carry out advanced computational pattern recognition, image recognition and predictive analytics that require high volume of computations. The scenario of an exponentially growing demand for both Big Data and AI capabilities is solid and highly tangible, given that both technological areas are the basis to support IoT and Industry 4.0 systems. Additionally, though Big Data and AI technologies are only at their infant stages of implementation, most of the corporates and public institutes have begun examining their application to improve many aspects of their operations.

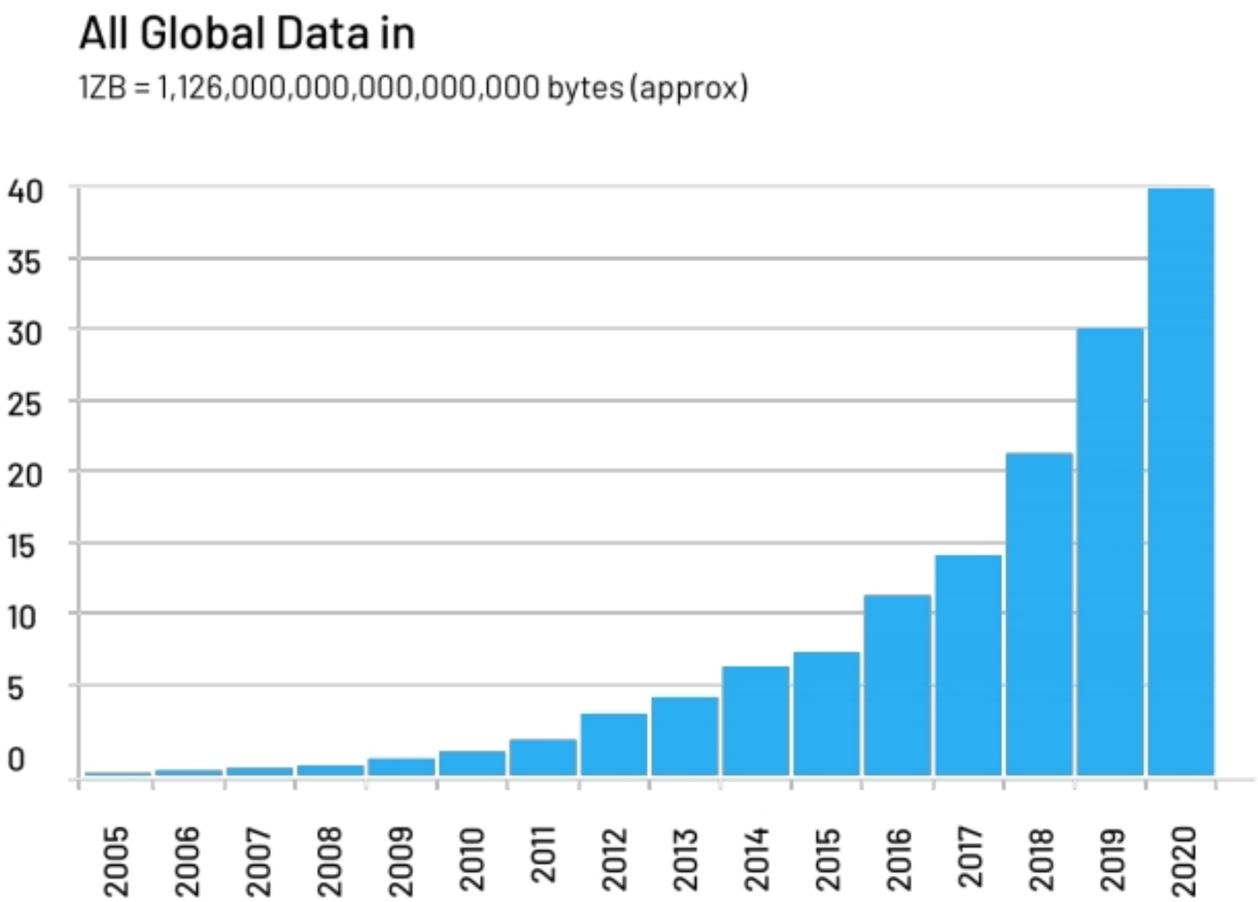

Figure 1: Historical and predicted volumes of data per annum worldwide

(Source: United Nations Economic Commission for Europe)

MARKET OUTLOOK OF CLOUD STORAGE SERVICES

Cloud data storage is based on the delivery of files from local computers and servers into the remote servers and storage facilities that are obscure to the user, but can be accessed and managed at any time. Thereby, the reliability of cloud storage services and the privacy of users (i.e. protecting the files from being accessed by any party other than their owner) are paramount to subscribing to and implementing any cloud services.

The market of cloud storage services is composed by a large number of companies that operate and offer data storage programs, from small data centers who cater to the needs of individuals and SMEs to large storage facilities of companies (such as Amazon, Google and Microsoft). Such companies aiming at managing their own gigantic volumes of data, but also offered to external customers. However, the reliability of centralized data centers, the liability of cloud storage companies in cases of lost or incorrectly stored files and the privacy of users are often expressed by experts (see for example Hu et al., 2010; Dai et al., 2017) since the first days of cloud storage services and until recently concerns over the protection of data.

Faults associated with technical performance of the cloud emerge from its servers, from retrieval systems (Content Distribution Networks, or CDNs) and from clients. Some faults are defined as crash faults while others are performance-degrading faults. Crash faults are the most common category, categorized by service "blackouts", whereas services that are temporarily disabled or exhibit lower degrees of performance are performance-degrading faults. For example, an incident in which files that were uploaded to the cloud are not accessible due to writing errors to a folder is a crash fault, while CPU leaks that cause lower performance of a server (and therefore slower retrieval of a file) are performance-degrading faults (Wang, 2017). When data and files are managed through a centralized data center (or through a series of them), a wide scale fault, and in particular a crash fault that terminates the access of users to their stored files, can cause the termination of operations of companies, organizations and individuals for as long as the outage persists. For example, AWS' recent outage in March 2017 continued for several hours, causing damages that are estimated to be more than 300 million USD (Sverdlik, 2017).

MARKET OUTLOOK OF CLOUD COMPUTING SERVICES

Artificial Intelligence is a set of advanced computational models and processes inspired by research of the human brain. These models and tools operate behind the scenes of many apps, websites and applications in a seamless way that does not interfere with the user's interaction through the UI. For example, web searches and similarity between terms, automated translation, face recognition and recommendation systems are some of the applications of AI.

AI is often used to generate better user experience. A simple case of this would be Google. Google uses advanced machine learning algorithms to narrow down its search results to provide its users with results closely matching what the users are looking for. As the algorithm learns and refines its search definition, users can sometimes notice that search results may vary from day to day or user by user. Targeted ads often use machine learning algorithms to propose possible products and advertisements on sale based on the user's search results.

The market for AI applications is expected to grow substantially in the coming years. Figure 2 presents some of the expected common uses and the revenues from their commercialization in the near future. Nonetheless, the widespread implementation of AI processes requires increasingly powerful computational facilities, due to the complexity of these operations. Therefore, companies invest immense in purchasing GPU and CPU units that are dedicated to carry out this scope of computations, or purchase at a great expense processing power from one of the cloud processing providers (i.e. Amazon Web Services, Google Cloud, Microsoft Azure and IBM).

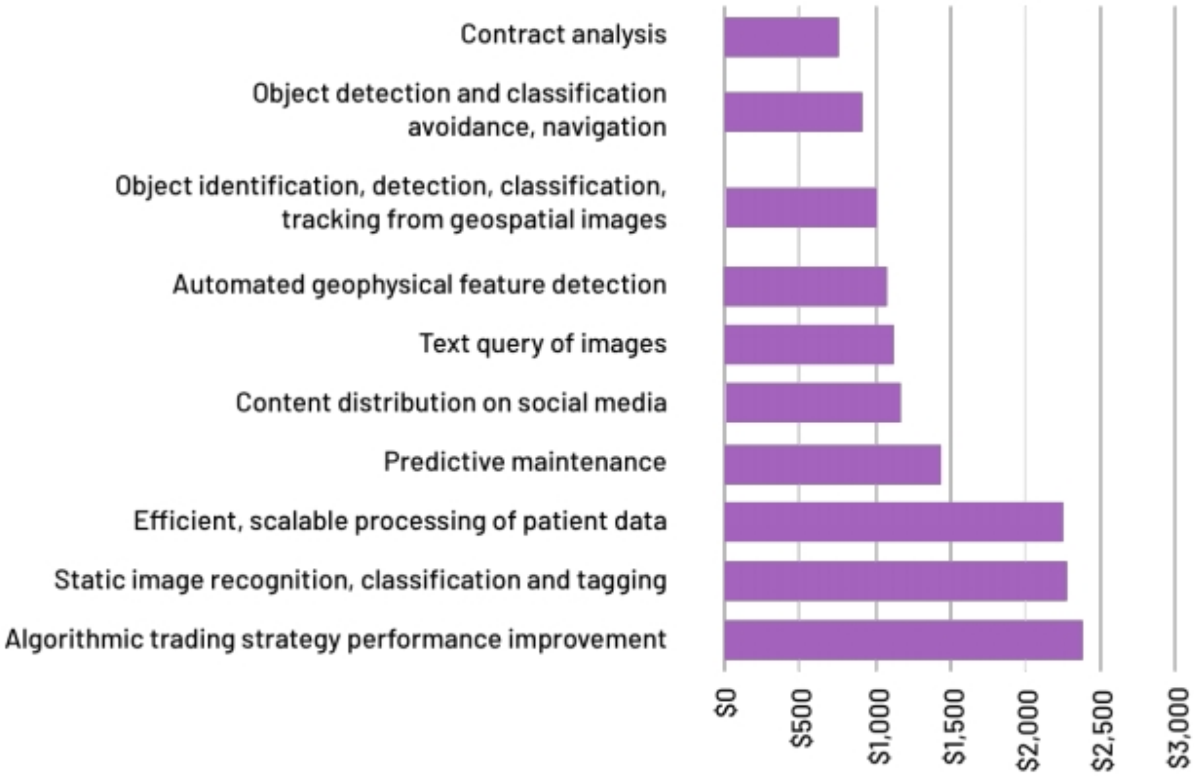

Figure 2: Estimated revenues for typical AI use cases in 2025 *(Source: Tractica)*

IAGON’S AI-BASED COMPUTATIONAL PROCESSES

Just like a human brain, AI and machine learning algorithms require inputs of data to deduce an inference. Data mining is the computing process of discovering patterns in large data sets and helps reduce large sets of data structures to allow machine learning algorithms to make decisions and inferences. Consequently, as organizations and companies accumulate large datasets as a part of their day-to-day operations virtually on every aspect of their performance, suppliers and clients, they seek new ways to apply AI and machine learning methods to derive new managerial insights from the data on a continuous basis.

Nonetheless, AI and machine learning tools for analyzing overused of data require large volumes of computational power that organizations often lack, hence requiring them to subscribe to a commercial cloud service and uploading their sensitive data files into another company’s servers. Due to the confidential nature of data and its commercial value, many companies avoid doing so, hence not benefitting from the potential value of analyzing their databases with advanced AI methods.

The Blockchain technology provides a unique and fully secure solution towards processing, storing and distributing data and maintaining their consistency and integrity that can be used for use-cases like decentralized processing. The Blockchain is simply blocks of data hashed together and chained using previous hashes and its current block to maintain consistency across the chain (Vijayan, 2017). Blockchains use the SHA-256 algorithm to create a hash. The unique nature of the hash makes its resource intensive to crack as the SHA-256 hash can only be broken today through brute force with computational power that is not avail- able yet in the commercial hardware market (Vijayan, 2017).

Distributed data mining of large datasets was introduced by the SETI Institute through its BOINC program (Estrada et al., 2009). The introduction of‘Bitcoin’ and the proof of work mechanism allowed a framework for providing incentives to data miners for work and energy to accomplish a large series of computations expanded to process data over a decentralized network (Nakamoto, 2008).

There are many projects ongoing in terms of providing secure storage over a decentralized network. A decentralized storage network is defined as a cloud platform where nodes either store a part of the data or file or the entire chain of data in a blockchain. Some of the more well-known names in this space are FileCoin, IPFS, SiaCoin, Storj, NextCloud, and NEM’s Mijin project (see e.g. Protocol Labs, 2017). Reliability and privacy on a decentralized network can be a major issue. Most decentralized networks are not equipped to recover lost data in the event the hosting node experiences hardware crashes or nodes with malicious intent configure files in order to hack the file recipient (a common problem that plagues torrent).

IAGON was built not only to serve the decentralized network but also work with current data storage facilities like SQL and NoSQL databases. The approach taken with IAGON is unique to the point that IAGON utilizes is machine learning algorithm to distribute load across a decentralized network for processing and then encrypts/decrypts data which flows through its system.

There are many use cases that IAGON can serve. IAGON can provide secure storage over centralized, clustered or decentralized networks, distribute data processing load across its network of data miners for data analytics, provide a secure solution for creating smart contracts over the Blockchain, or serve to identify honest and attacking nodes within a system.

IAGON'S MULTIPLE BLOCKCHAIN SUPPORT

IAGON aim at providing its users and miners complete flexibility and freedom of choice in providing and consuming decentralized cloud services. Hence, IAGON will provide a multiple Blockchain solution. running its cloud storage and processing operations both on the Ethereum Blockchain and on Cardano.

Users and miners can choose either Ethereum or Cardano to fully securely store their files, to process computational tasks, to pay and to receive IAGON tokens for cloud services, and primarily to benefit from huge advantages in gaining access to the market's prominent and state-of-the-art technologies.

IAGON'S SECURE LAKE TECHNOLOGY

The Big Data market is characterized by the recent adoption of Data Lake architectures, such as information systems that are based on the Hadoop framework, by large companies. The Data Lake architecture is based on implementation of a NoSQL central database (such as MongoDB, HBase or Cassandra) in which files of any sort can be stored and be retrieved from. Companies can virtually define a central depository for their information and data files that does not depend on the contents or on the file types and provides a user-friendly and accessible source for all the files managed either in SMEs, middle sized companies or large corporations.

Nonetheless, the data lake architecture suggests that once it is hacked, an intruder can "swim" in the database system, explore the files and gain access to valuable data describing every aspect of the operations of an organization that is hacked. One of the major uses of IAGON's Secure Lake technology in encrypting, slicing and distributing the data lake files is "freezing" the lake, that is prohibiting by means of encryption and decentralization of files any party from navigating within the data lake after gaining access to it (see Figure 3).

Data lake architecture ***IAGON's Secure Lake solution.***

Figure 3: The data lake architecture vs. IAGON's Secure Lake solution

Hacking a Data Lake of any organization exposes it to unlimited number of security, privacy and financial risks, from online publication of private information of clients, through use and sale of suppliers and commercially sensitive data to trading trade secrets, internal correspondence and digital goods (such as source code and designs of new products).

The vulnerabilities as well as the hacking possibilities of databases of Big Data and Data Lake infrastructure are publicly posted online, mainly warning organizations against security breaches that may rise due to use of these platforms.

Few examples from the recent years illustrate the broad scope of threats and risks to organizations (as well as to their customers and suppliers) that result from hacking their IT systems and databases:

- In January 2017, Camarda (2017) reported that "Hadoop attacks followed ongoing attacks on MongoDB, ElasticSearch, and Apache CouchDB. In some cases, criminals have been know to clone and wipe databases, claiming to hold the originals for ransom. In other attacks, they have simply deleted databases without demanding payment".

- At the same period, Constantin (2017) reported that "It was only a matter of time until ransomware groups that wiped data from thousands of MongoDB databases and Elasticsearch clusters started targeting other data storage technologies... 126 Hadoop instances have been wiped so far. The number of victims is likely to increase because there are thousands of Hadoop deployments accessible from the internet although it's hard to say how many are vulnerable. The attacks against MongoDB and Elasticsearch followed a similar pattern. The number of MongoDB victims jumped from hundreds to thousands in a matter of hours and to tens of thousands within a week. The latest count puts the number of wiped MongoDB databases at more than 34,000 and that of deleted Elasticsearch clusters at more than 4,600".

- Claburn (2017) indicates that the actions of the attackers on Hadoop based systems "may include destroying data nodes, data volumes, or snapshots with terabytes of data in seconds".

- Earlier reports explain how to hack into Hadoop systems and to exploit their vulnerabilities to destroy of copy large volumes of data (see for example Gothard, 2015). Given the nature of the vulnerabilities exposed, and those that have not yet been exploited by attackers, but may exist in the systems , as well as the lack of policies of ongoing cyber security auditing in many organizations, databases at large are exposed to other parties, should they decide to apply these intrusion techniques. The results for any organization can be catastrophic and have a large magnitude of impact on its operations. To illustrate, the Equifax hack, reported in September 2017, exposed the personal data of 143 million customers, causing a daily fall of 19% in Equifax's market value.

IAGON's Secure Lake is based on the Blockchain unbreakable encryption technology, on file slicing and storage of small, anonymous and strongly encrypted slices of the original files ensuring the complete protection of data files, other types of files (such as scans, photos and videos) and databases of any size and ensures the rapid retrieval and update of any stored file. Except from the user who securely uploads a file and has the password (key) to retrieve and encrypt it, no one can read the contents of the small file slices, encrypt, delete, change, retrieve them, identify their source or even associate them with other file slices, that are generated from the original uploaded file. IAGON's technology ensures that even when information systems are breached in any way, the data and files that they use cannot be accessed, deleted or modified in any way.

IAGON'S SMART COMPUTING GRID PLATFORM AND AI-TRACKER TECHNOLOGY

The increasing demand for processing power is evident, for example, by the growing sales of NVIDIA systems for Machine Learning and Deep Learning operations, as well as other advanced operations of Artificial Intelligence that require vast volumes of computing and processing capabilities. The technology domain of AI based innovations that require large capacities of processing power (mostly supplied by batteries of servers with large amount of CPUs and GPUs) include face recognition, video processing, voice analysis, text analysis, pattern recognition in Big Data databases and digital document repositories, autonomous cars, IoT based decision support systems and many more. AI technologies and applications are expected to exponentially grow over the next years, thereby increasing the demand for processing power to support both research and their day-to-day operations.

IAGON's Smart Computing Grid is equivalent to any other power grid (such as solar production of electricity):

- It connects multiple producers to customers
- Smart Computing Grid fulfils the demand for the necessary resource
- It transfers unused resources to customers in need (CPU and GPU processing power and storage space), and
- It benefits the miners providing processing power and storage space to the grid without requiring efforts when their servers and computers are not used by them.

The Smart Computing Grid is based on advanced Artificial Intelligence components that include more than 100 Machine Learning algorithms, methods and techniques that integrate to form our AI-Tracker system. AI-Tracker is the "brain" behind IAGON's Smart Computing Grid. It optimally allocates encrypted file slices to the miners' free storage spaces and computational tasks to the miners' free (idle) CPUs and GPUs that compose the Smart Computing Grid.

AI-Tracker is a dynamically learning system that continuously analyzes past and current data streams that reflect the availability of storage space and processing capacities of miners. AI- Tracker carries out the tasks of optimally allocating and transmitting encrypted file slices to designated storage spaces, allocation for processing tasks for rapid, optimal performance of the grid and identification of rogue nodes that should be blocked and removed from the grid and continuously fine tuning the grid's attributes to optimize its performance at any time (see Figure 4).

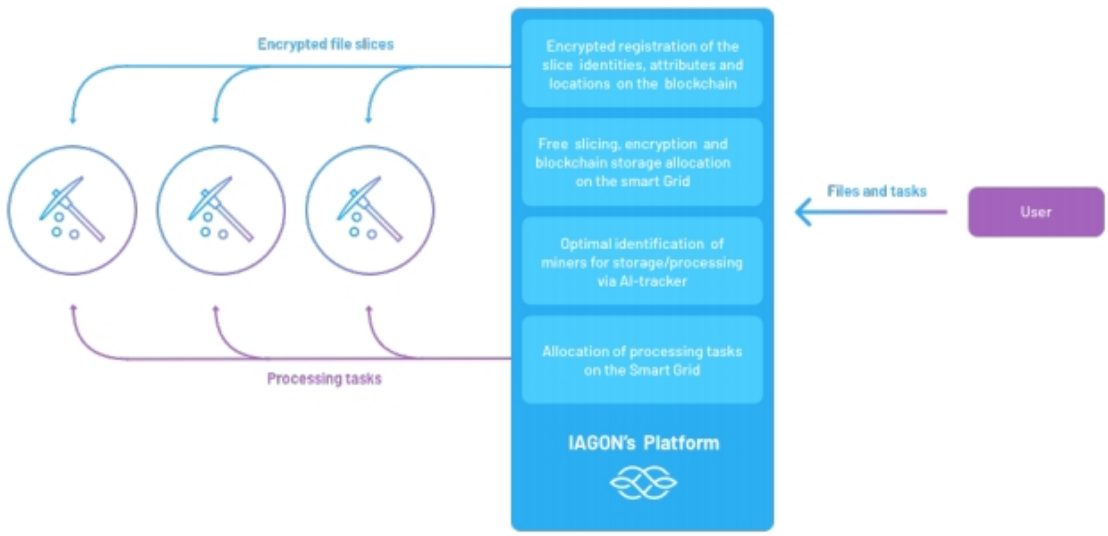

Figure 4: IAGON's platform architecture

CASE STUDY

IAGON intends to bring decentralization into mainstream businesses and consumer markets. In order to achieve this, IAGON was designed and built to integrate seamlessly into existing IT infrastructure without the need for expensive resources to deploy.

Figure 5: IAGON in a typical server-database architecture and frontend-backend architecture

Figure 5 is a graphical representation of IAGON serving as a middleware between server-database and frontend-backend in existing IT infrastructure. IAGON can work with both SQL and NoSQL database structures that are commonly used today without the need for expensive migration processes or specialized resources to implement and deploy. IAGON provides a security layer because it identifies specific digital fingerprints associated with the request going through the server to identify if a request is an honest node.

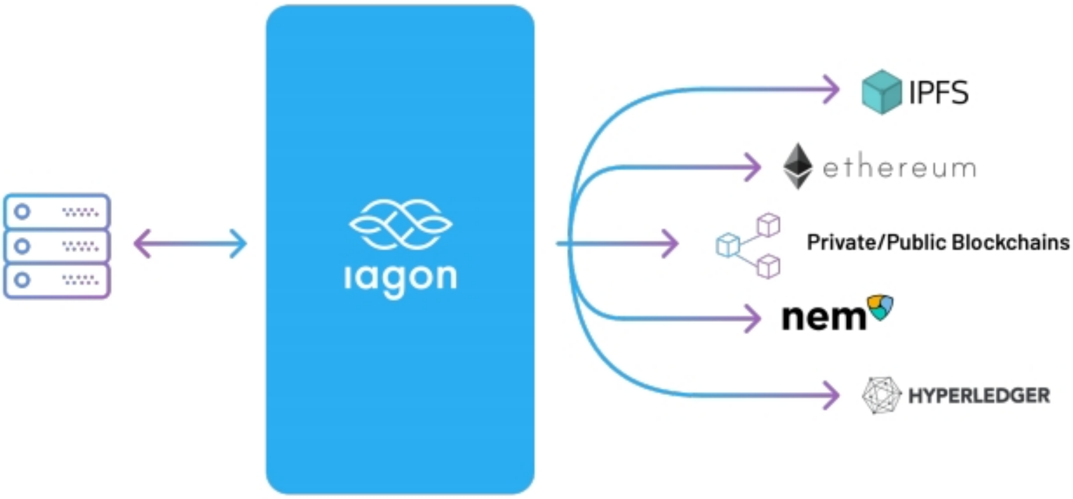

Figure 6: IAGON in public/private Blockchain architecture

Figure 6 provides an overview of IAGON in a private and public Blockchain network. It serves as a layer to allow data to be securely stored within both private and public blockchains. Using machine learning algorithms and encryption/decryption protocols, IAGON is able to provide a secure method in storing data across platforms.

IAGON can be configured to serve not only as a secure platform to integrate with existing blockchains but also utilize its data mining feature to process data. IAGON scales by distributing processing load across a decentralized network and securely stores data the across different decentralized platforms. This is done through IAGON machine learning algorithm that works to distribute the data based on the task it is required to undertake. IAGON uses both supervised and unsupervised machine learning method known as semi-supervised learning to both process and distribute data across decentralized networks.

REGULATIONS

The introduction of Regulation EU 2016 /679 to replace Directive 95/46/EC, introduced more stringent regulations in regards to data processing and mining of data of personal records. The regulation introduces certain restriction on the collection and processing of personal data including limitations on the free movement and sharing of such data (EU, 2016).

In order to remain compliant with local regulatory restrictions on data mining and processing, IAGON will limit and restrict the type of processing being done on its platform. It will perform this by using geolocation algorithms to identify the source of the user and the destination the data is being sent to. In general IAGON encrypts all data within its platform hence, the process of piecing together personal data or identifying individuals based on the data it processes is technically impossible. In most use cases IAGON is a pass-through entity as such it holds no data within its facility and only serves as a security layer between the data flowing through its systems.

REINFORCEMENT LEARNING

IAGON is an AI that learns over time. To achieve this, IAGON learns through a method known as reinforcement learning. Reinforcement learning is the science of decision making to handle a dynamic environment. This means IAGON undergoes an active learning process to optimize its decision making process to determine its course of action. This creates and unparalleled paradigm towards how IAGON handles its input. Using a method known as Markov Decision Process that is based on probability theory, IAGON tries to determine an optimized form of reward system that improvises its actions to maximize its reward system over time.

Reinforcement learning is the intersection of various paradigms in science as describe in Figure 8:

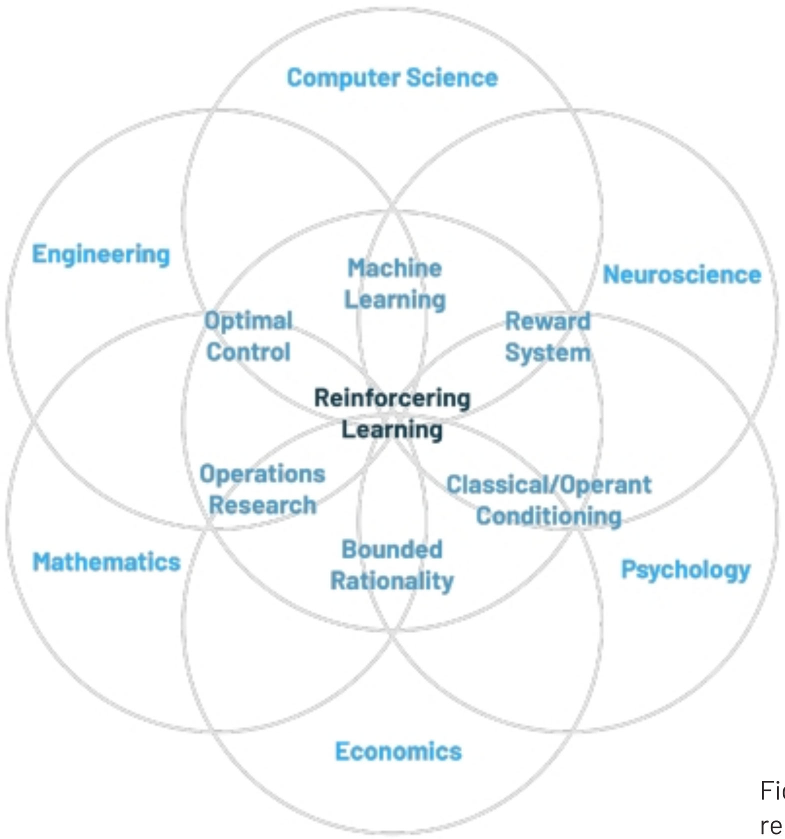

Figure 8: Venn diagram of reinforcement learning.

The Markov Decision Process can be describe using the following algorithm:

- S, a set of states of the world
- A, a set of actions
- R, the expected reward from a state and action
- , expected reward for transition from where some action is taken
- Rules to describe the observation the agent makes

The end goal is pick actions that maximizes future rewards

Markov state is unique in its approach because it bases decision making of the future independent of the past given the present (David Silver). This is represented by the information state (a.k.a Markov state) if and only if:

$$P[s_{t+1} | s_t] = P[s_{t+1} | s_1 \ldots\ldots\ldots, s_t]$$

The information state proves that if the present state of a system is known, then the historical actions need not be considered as the results of the future will be independent to the historical state.

DATA MINING

IAGON takes a very different approach towards data mining. IAGON does this by utilizing a private Blockchain with public network protocols over API networks. A miner does not need to store any of the data in order to mine, the miner's sole duty is to honestly process the data and send the output back to IAGON's machine learning algorithm for analysis.

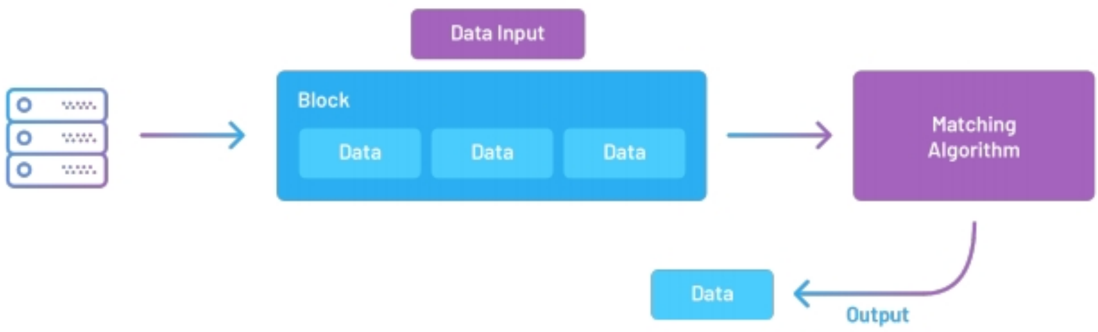

Figure 9: Mining data flow on IAGON's platform.

Data mining on IAGON's platform does not have the need to perform complex algorithm to solve an equation. Instead, IAGON uses the decentralized computing network to distribute load and increase speed for mundane data processing tasks. Block tasks are distributed to miners using the proof of variance method. Miners will need to match the data signature from the data input and find its corresponding data object in the block and return the data output. The miners do not need to store any of the data it processes, and once the data has been validated to belong to the specific block, the miner is considered to have mined the block. The miner receives rewards based on the number of data points it mines, and if no data is found within the block the miner does not receive any reward. This will incentivize miners to complete mining the entire block and to increase the number of blocks they mine. The incentive mechanism discourages miners from just mining a block until the first data output is achieved because of the speed limitations associated with network connections will prove to be uneconomical, as such miners will be encouraged for their own benefit to completely mine the entire block to find all possible data points that matches the data input.

Blocks are generated at a bounded rate and there are no communication between miner's clients. The server connecting the miners to IAGON's platform uses a multithreaded server to distribute and receive results. Blocks are sent over HTTP-based protocols so that clients inside firewalls can connect to it. There are two methods currently to approach block storage and removal from miner's unit. The option would be to process purely in memory provided by the random -access memory unit in a computer or introducing a garbage collector program that effectively removes the block from disk. The mining client architecture should allow it to run as a background process or a GUI application. To support different architectures, the best approach would be to create multiple threads, where one thread does communication and data processing while the other thread handle GUI interactions (Anderson, 2002). Proof of variance allows IAGON to identify the typical speed at which miners take to process a block. In the event a miner is disconnect, goes offline or does not complete computation on its block, the block is resent to other nodes in the network.

BLOCKCHAIN

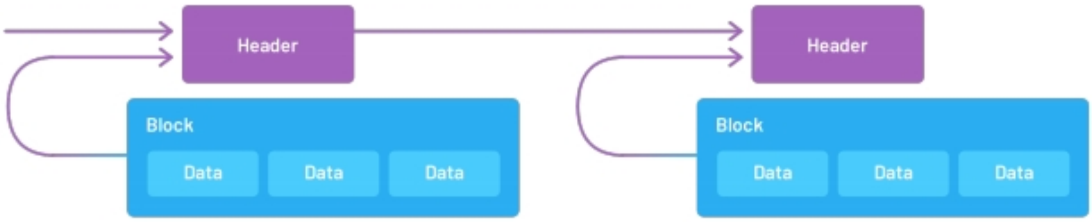

Figure 10: IAGON's Blockchain Protocol

IAGON leverages the Blockchain technology to maintain honesty of nodes across IAGON distributed data mining algorithm. The Blockchain uses SHA256 algorithm of previous blocks to maintain a chain link to its historical state (in this case data).This allows IAGON to incentivize miners on its platform to process data honestly and to guard against deliberate manipulation of the data output. Using the Blockchain, IAGON's machine learning algorithm can quickly identify if a data output mined from a block is actually a valid part of the block. This can be achieve within the framework of a simple Blockchain similar to that used by «Bitcoin» by hashing the inputs with the hash of the previous block. Genesis block are created internally within the private blockchain.

The Blockchain presents a unique approach towards sharing data across a decentralized network. The data can be stored, processed and validated by a network of nodes or it can be stored and validated within an internal facility where the processing is outsourced to a decentralized network of nodes. The Blockchain allows consistency to be maintained throughout the entire data structure.

One of the major reason the Blockchain is maintained privately is to compete with big data databases in the market in terms of volume, variety and velocity. A private Blockchain allows for the research, development and facility cost to be borne by IAGON's team with input from various stakeholders as oppose to getting multiple parties to reach a large enough consensus before making big development changes to improve the system. In order to keep up with massive read and write operations within its private Blockchain, IAGON might in the future scale to introduced multiple private Blockchains to reduce the potential of a single point of failure which can bring the down whole system by using a masterless architecture.

MINING ALGORITHM

IAGON does not use the Blockchain like other cryptocurrencies. Even its use case approaches data processing in a more conventional method hence using a Proof of Work (PoW) or Proof of Stake (PoS) mechanism to reward a particular miner for discovering a particular block is not a viable solution. Hence, IAGON uses its own mechanism for determining miners' contribution and processing speed using a method know as Proof of Variance (PoV). PoV classifies each miner based on their contribution into a pool. Miners within the same pool then compete which each other. Miners from lower pools get upgraded or downgraded based on several factors but the two main factors are speed and amount of data miners are able to find. Proof of variance uses a combination of algebraic theory and probability functions to compute a miner's contribution and which pool the miner can be classified under. The probability theory utilizes both discrete and continuous functions and results of mining change over time.

Block Imaging: Block imaging is the method in which certain subset of the Blockchain is imaged or copied to be randomly distributed across the node. An image of the block sent to nodes will mean the Blockchain does not undergo any sort of permutation and remains immutable. Theoretically, randomly selected blocks are branched and distributed to nodes for processing. The imaging algorithm is a suitable method that is scalable to solve arbitrarily large problems by using distributed nodes. To create the algorithm for block imaging, we assume that blocks are separable:

$$f(y) = \sum_{i=1}^{M} f_i\left(y_i\right), \quad g(x) = \sum_{j=1}^{N} g_j\left(x_j\right),$$

where, $y = (y_1, \ldots, y_M)$ and $x = (x_1, \ldots, x_N)$.

We let A_{ij} be an $M \times N$ matrix $\in R^{m_i \times n_j}$, that is:

$$A = \begin{bmatrix} A_{11} & A_{12} & \dots & A_{1N} \\ A_{21} & A_{22} & \dots & A_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ A_{M1} & A_{M2} & \dots & A_{MN} \end{bmatrix},$$

where i is treated as the block row index and j as the block column. We may then express the function as:

$$y_i = \sum_{j=1}^{N} A_{ij} x_j, \quad i = 1, \ldots, M.$$

When, hence and once, all subvectors are size 0, and are fully separable. Fully separable blocks have no restrictions on partitioning with the end goal is to allow for each block to be handled by separate process and does not involve the transfer of block matrices among processes (Parikh and Boyd, 2012).

Binomial Distribution: To ascertain distribution of blocks within a set (blocks are assumed to include 0 as the genesis block), for natural numbers n and k, where $n \geq k \geq 0$, the binomial coefficients are arranged into rows for successive values of n, and in which k ranges from 0 to n. Since blocks are defined in natural numbers and can be defined as the coefficient of the monomial in the expansion of. The coefficient allows for the use of binomial theorem to scale data block distribution using:

$$(x+y)^n = \sum_{k=0}^{n} \binom{n}{k} x^{n-k} y^k,$$

where $\binom{n}{k} = \frac{n!}{k!(n-k)!}$ is the binomial coefficient. Solving for where is a non-negative integer provides the number of k-combinations (Molenaar, 1970; Fog, 2008).

This method allows for scalability as block numbers grow and dependent algorithms no longer require data to be parsed from the entire Blockchain once sufficient volume has been obtained.

Continuous Time: IAGON uses a particular mathematical dynamic knows as continuous time as a framework to perform its calculations given that the time dimension grows linearly. Continuous time would account for the potential limitations that exist with using discrete time models when dealing with continuous simulations.

Proof of Variance: IAGON uses probability density function in determining data distribution and miner classification. It utilizes a function of continuous random variables whose value at any given point in a sample space is defined as the relative likelihood of a miner finding a data output within an n number of blocks. Blocks are distributed in this manner to miners throughout its system where the general likelihood of miners with higher probability levels can process data at higher speeds. Since the function utilizes continuous variables over time, it allows the classification of miners based on performance rather than a lottery system or having a stake within the particular system.

Given that:

$$f(t) = \frac{1}{2}\left(\delta\left(t+1\right) + \delta\left(t-1\right)\right),$$

where the Gaussian distribution is denoted as

$$f(x) = \frac{1}{\sqrt{2\pi}} e^{\frac{-x^2}{2}}$$

And joint continuously in a domain, D in the n-dimensional space of variables between $X_1, \dots, X_n$:

$$Pr(X_1, \dots, X_n \in D) = \int_D f_{X1, \dots, X_n}(x_1, \dots, x_n) dx_1 \dots dx_n$$

Finally, variance is used to identify a particulars miner grouping within a performance vs time metric:

$$\sigma^2 = \frac{\sum(X - \mu)^2}{N}$$

The proof of variance algorithm is unique to the use case in regards to different domains used in its calculations. Since blocks are generated in continuous time and processing happens asynchronously, the usage of probability functions allows for a fairer system of rewarding miners based on the group the miner is competing in. Proof of variance allows for new miners to improve their computational power over time and existing miners with greater computational power and connection speed to earn rewards proportional to their contributions.

RESOLUTION PROTOCOL

Like all autonomous systems, there is always a need for some form of manual intervention when dealing with anomalies. The resolution protocol has a set of rules when dealing with anomalies to either resolve it automatically or perform further processing by sandboxing the request and allow manual intervention to resolve the conflict.

ENCRYPTION/DECRYPTION

The encryption/decryption protocol is used for internally stored data. All data stored within IAGON's platform is encrypted to some degree to protect the data in the event of a breach. IAGON has a variety of options to store data on its platform including SQL, NoSQL, private Blockchains and other 3rd party storage providers which are compliant with regulatory requirements. IAGON at its core use AES-256 to encrypt and decrypt data. AES-256 is the encryption standard recommended by the NIST (National Institute of Standards and Technology) and uses a symmetric key algorithm.

SYSTEM ARCHITECTURE & IMPLEMENTATION DETAILS

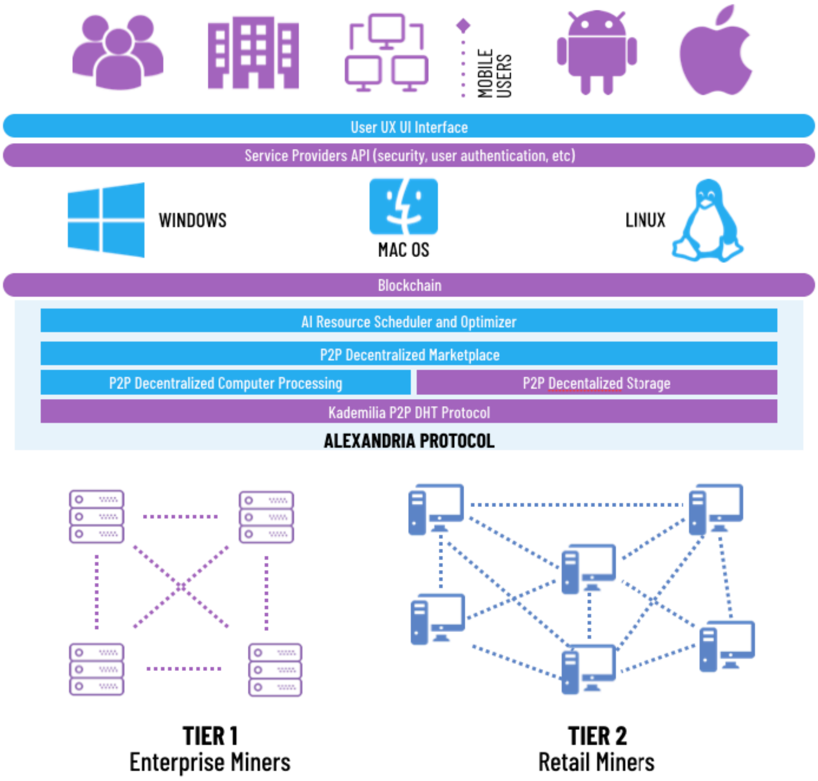

Figure 11. IAGON's System Architecture overview

IAGON system architecture is shown in Figure 11 (above), connecting client interface (Windows, Mac OS and Linux) to the distributed computing and storing resources network infrastructure through an intelligent and decentralized marketplace, using DLT/Blockchain as a control plane layer that authenticates, validates and secures the computational resources using an Artificial Intelligence layer that allocates, schedules and optimizes the distributed computing resources and matches with the client job requests. This layer may be called the "Alexandria Protocol".

Functionalities and Capabilities of the AI Resource Allocation and Performance Optimization

An AI platform is the key engine for the distributed computational resource allocation and performance optimization of this embodiment. It may be use a machine learning or deep learning algorithm that continuously learns from the interactions in the P2P network and optimizes the strategy for every participant in the network, it is described as:

1. Plan and optimize the distributed P2P resource allocation and performance
2. Builds a reputation for other nodes in the system, be it utilitarians, clients or marketplace owners;
3. Predicts the uptime and availability of utilitarians;
4. Predicts the approximate completion time of tasks for the clients based on task specifications;
5. Recommends the best pricing strategy for the utilitarians so as to maximize local resource utilization as well as profit potential.

As a compute platform scales with more tasks and participants, the machine learning models will learn from the additional data and will increasingly become more useful for the participants.

DESCRIPTION

Building a Decentralized Distributed Computing and Storing Marketplace

The design of the decentralized P2P Blockchain/DLT marketplace for distributed computing resources (storage & computation) is shown in Figure 12 (below). This architecture is formed by three layers.

A. DApps- (Decentralized Applications) and **Web**-client interface layer;

B. Blockchain/DLT (e.g. Ethereum Layer), and the

C. P2P Network Layer

The DApps/Web-client layer is where users may run their computational jobs, tasks or requests on the decentralized computing resource infrastructure, composed of Blockchain/DLT (control, consensus and marketplace layer) and P2P network layers. The Blockchain layer is where computing resources may be segmented and published in service tiers in a marketplace. These services may be allocated using encrypted hash tag pointers that relate to a particular computing node in the network, where the resources are allocated or processed. The P2P layer may be comprised of several network nodes, called "Utilitarian", connected via a P2P network technology, such as, for example, Kademilia, Corda, etc and having three functions as defined:

A. Resource Computational Node: processing and storing files and programs, providing distributed computational resources to the marketplace; ed as:

B. User Client Interface: a client interface that requests computing and storing services to the P2P network.

C. Marketplace or resource exchange: decentralized P2P computing and storing resource sharing and commercialization.

The underlying P2P platform may be based on, for example, the Kademilia network where any new nodes can join the Kademilia, be inserted and synchronized to other peers. Once these nodes are added, the computing resource providers (utilitarians) can then configure the way they want their computing resources to be available in the marketplace and their selected rewards for these services. The services are then added to the Blockchain/DLT, categorized by different tiers of services, where the nodes can automatically sign up to publish their resources availability using encrypted hash pointers.

Each tier creates a unique set of computing resources where clients and computing node providers can interact to commercialize these assets in a decentralized manner. Once the service match is identified and a smart contract or any smart code logic transaction takes place in the Blockchain/DLT layer, Iagon's tokens (IAG) may be exchanged with Utilitarian nodes to pay for the services rendered to the system.

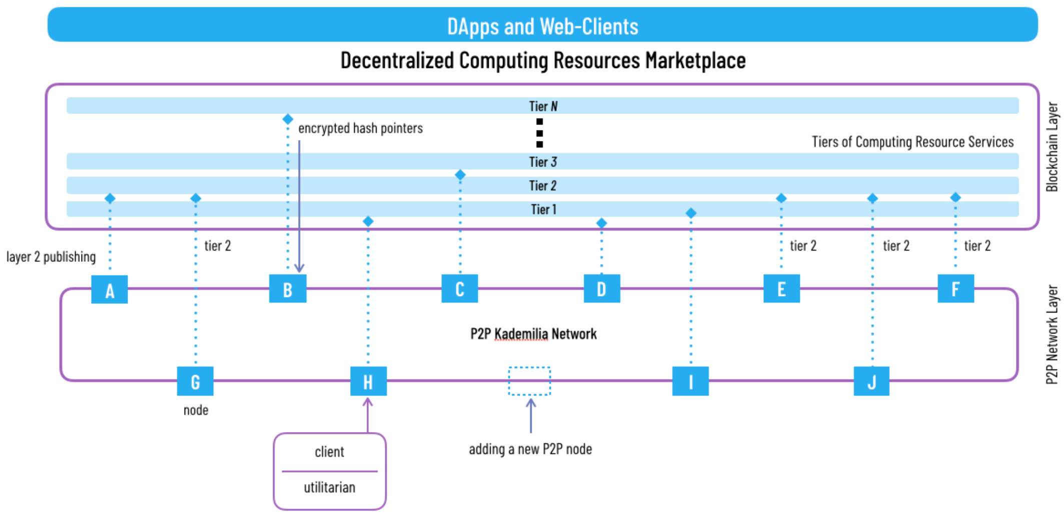

Figure 12: IAGON's P2P Decentralized Marketplace for Distributed Computing Resource

Distributed Computing Service Tiers

As shown in Figure 13 (below), a decentralized computing system comprises P2P tiers, where computing resources are shared using an Blockchain/DLT (e.g. Ethereum, IOTA, Corda, EOS, Hyperledger, etc) for managing transactions involving compute resources. P2P tiers may be determined based on a computation resources market.

In summary, elements of this network technology include:

1. Clients: Nodes that are looking for compute resources for executing their tasks and are willing to make payment for those resources;

2. Utilitarian: Nodes that want to sell their spare compute and store resources for a reward;

3. Marketplace owners or exchanges: Dynamically selected nodes that facilitate clients to discover utilitarians. There can be multiple marketplace owners in the network depending upon the range of compute and store resources that utilitarians sell.

Nodes may have dual modes. For example, the IAGON App may have a dual mode, where it may function as a client or utilitarian P2P node (resource provider).

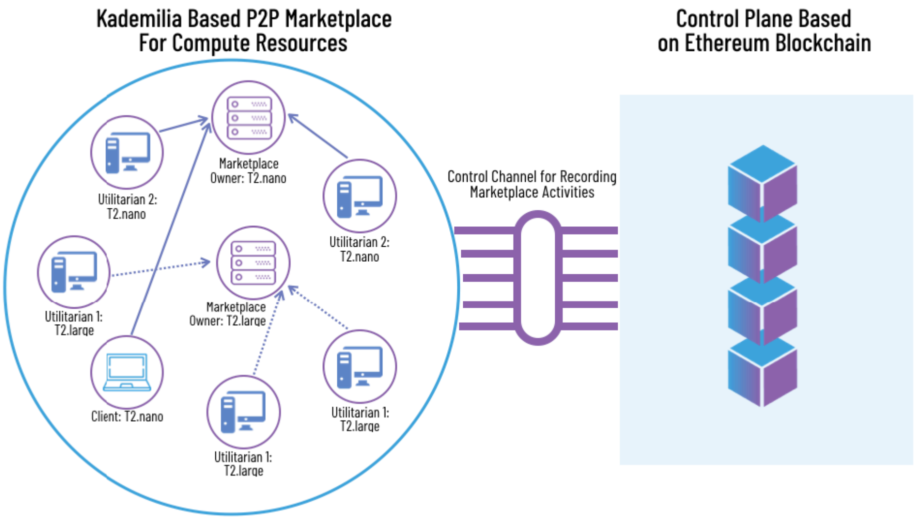

Figure 13 : IAGON's Tiers of Decentralized Computational Resources

As shown in Figure 3, for a particular example of a service tier, there may be two marketplaces for compute resources T2.nano and T2.large in the network. The utilitarians looking to sell these compute resources may list themselves in one of these marketplaces, by broadcasting their resource availability. Similarly, the client for T2.nano compute resource lookups the corresponding marketplace owner and gets a list of utilitarians who are able to provide that service.

There may be, for example, three sub-categories of computational resources within the Tier 2: nano, medium, large. Nano means small resource (computer storage and processing) that utilitarian can offer to the marketplace.

All the nodes in the instant system may have public Blockchain/DLT addresses. The nodes may be considered rational entities that participate in order to maximize the value they can generate from the network, where game theory principles apply. On the other hand, there may also be some malicious nodes in the network and a discussion on exemplary ways to minimize their impact on network operations is set forth below.

Broadly speaking below are exemplary operations related to the instant disclosure:

1. Nodes join a P2P network. A P2P network id is generated as follows:
   a. P2P network id = hash (Ethereum public address, IP address, country code)
   b. IAGON may have a list of published nodes that help new nodes to join the network. Alternatively, or concurrently, an API may be provided that returns a list of nodes from a Blockchain that returns a random list of verified nodes that are already part of the P2P network.
   c. These services may be provided via a directory service that IAGON can provide to allow new users to join the P2P network. Alternatively, these services may be made distributed by having new users query Blockchain directly to retrieve a list of users that are potential part of the P2P network.
2. Worker (aka utilitarian) nodes decide the tier of service they can provide. This may be based on the number of CPUs and RAM. The utilitarian nodes may need to have a CPU utilization of under 50% in last 1 hour to be eligible to sell computing resources. Other thresholds of CPU utilization may be application.

   There is a tier definition for different classes of compute resources.
3. Utilitarian nodes generate a P2P network id for the tier of service they can provide and do a lookup corresponding to that P2P network id. The returned node is the marketplace owner for that tier. However, in order to make sure that one single marketplace owner doesn't monopolize a given tier of service, the week number may be added in the hash function as well.
   a. P2P network id of Marketplace owner = hash(vCPUs, RAM, Week number)
4. Utilitarian nodes register themselves with the marketplace node. The registration information may be a tuple of the form (IP address, time interval of availability). The copy of this registration may also be stored in Blockchain for auditing purposes.
5. Users of the client nodes may specify the tier of the service they require for their task that is specified as a Docker image. Based on the tier selected, the client nodes may look up the corresponding marketplace owner. The lookup process here may be the same as what the utilitarian nodes used above in Operation 3.
6. The client node may receive a list of all the utilitarian nodes from the marketplace owner.
7. The client node may then conduct an auction. During this auction it may contact all the utilitarian nodes for their pricing information. A granularity of 15 mins may be used for specifying the price of execution. This operation may also serve as a verification that the worker nodes are still able to share their computing resources. Also, the client node can measure the latencies of all of the utilitarian nodes. All of the utilitarian nodes that have a latency more than some client specified threshold (e.g., default 5 secs) may be rejected.
8. Upon receiving the pricing bids from the utilitarian nodes, the client node may select the node with the lowest bid. However, the price that is paid to the winner may be the second lowest price. This is called a Vickrey auction. This form of auction mechanism ensures that workers best bidding strategy is to truthfully share their cost of providing computing resources. Auction details may also be recorded in Blockchain.
9. The client node may communicate with the utilitarian node and send a Docker image to be executed. The results of the computations are sent back to the client and stored in a predetermined directory or through a callback uniform resource indicator (URI).
10. The marketplace node may also pay by the client node. The amount of this payment may be the difference in amount between the lowest and second lowest bid.
11. The operations above, including the auction process, task assignment and completion, and final payments may all be governed by a smart contract.

Any of the above-described operations (or any methods of the invention as described herein) may be implemented in one or more modules as a set of logic instructions stored in a machine- or computer-readable storage medium such as random access memory (RAM), read only memory (ROM), programmable ROM (PROM), firmware, flash memory, etc., in configurable logic such as, for example, programmable logic arrays (PLAs), field programmable gate arrays (FPGAs), complex programmable logic devices (CPLDs), in fixed-functionality hardware logic using circuit technology such as, for example, application specific integrated circuit (ASIC), complementary metal oxide semiconductor (CMOS) or transistor-transistor logic (TTL) technology, or any combination thereof.

For example, computer program code to carry out operations may be written in any combination of one or more programming languages, including an object-oriented programming language such as JAVA, SMALLTALK, C++ or the like and conventional procedural programming languages, such as the "C" programming language or similar programming languages. Additionally, logic instructions might include assembler instructions, instruction set architecture (ISA) instructions, machine instructions, machine dependent instructions, microcode, state-setting data, configuration data for integrated circuitry, state information that personalizes electronic circuitry and/or other structural components that are native to hardware (e.g., host processor, central processing unit/CPU, microcontroller, etc.).

Additional Features

A new and non-obvious distributed computing solution using the marketplace concept is described herein above. Below it is explained how different tiers of compute resources and how utilitarian and client node configurations may be defined.

Service Tier Definition

Utilitarians in the network may be predominantly home users with laptop and desktop machines. This may be defined as Tier-2 utilitarians. Enterprise grade hardware, software providers and datacenter operators may also join the inventive platform to sell compute power and storage. These may be defined as Tier-1 utilitarians. Finally, the Tier-3 may be defined as being related to the category of mobile and Internet of Things (IoT) devices, which may have low computing and storing capability but still can offer these resources to the peer-to-peer network of the instant disclosure.

The Tier-2 level may be further subdivided into several sub-categories that represent a range of computing power as shown below. For example, T2.small may represent any machine with up to two CPUs, between 2 and 4 GB of RAM, and with the CPU speed of up to 2 GHz. The tiering and sub-categorization strategy accounts for future addition of Tier-1 providers. This service tiers are listed in Table 1 below.

Table 1 - IAGON's Service Tiers Categorization based on Utilitarian Computing Resources.

Tier Level	OS	Up to Number of CPUs	Up to Memory (RAM in GB)	Up to Speed (GHz)	Instance Name
2	Windows/Linux	2	2	2	T2.nano
2	Windows/Linux	2	4	2	T2.small
2	Windows/Linux	2	8	2	T2.medium
2	Windows/Linux	2	16	2	T2.large
2	Windows/Linux	2	32	2	T2.xlarge
2	Windows/Linux	2	2	4	T2.nano.fast
2	Windows/Linux	2	4	4	T2.small.fast
2	Windows/Linux	2	8	4	T2.medium.fast
2	Windows/Linux	2	16	4	T2.large.fast
2	Windows/Linux	2	32	4	T2.xlarge.fast
1	Windows/Linux	More than 2			T1.default

Utilitarian Configurations

An agent determines the number of CPUs and RAM for the node and automatically determines the tier the nodes' resources fall into. The agent may then also look up the marketplace owner for that tier and list the node with the marketplace owner for selling the compute resources. The users may have the option to list the time period during which the compute resources should not be used by others. Also, the user can provide the price in USD for every hour of sharing their compute resources. The clients however may be charged in the increments of N minutes (e.g. 15 mins) intervals for using utilitarian resources. Once a node is listed at a marketplace for providing compute services then it may be referred to as a utilitarian.

The agent may also be called a software agent or App and is a piece of software. As shown below in Figure 14, the processing settings section in an IAGON app would allow utilitarians to configure values for selling their compute capacity.

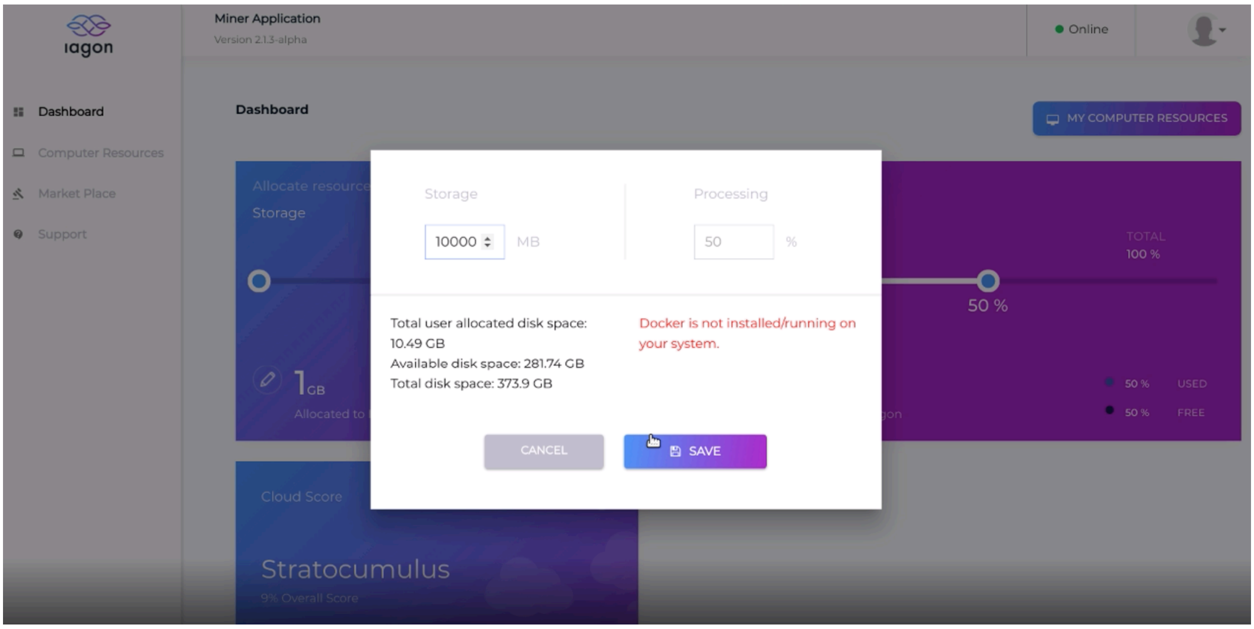

Figure 14: IAGON's Utilitarian Computational Resources configuration

Client Configurations

The users of the IAGON app may also choose to buy compute resources from others in the network for distributed execution of their tasks. These nodes or users are referred to as clients.

Figure 15 of the IAGON app shows how the clients are able to configure their requirements for the tier of compute capacity that they require for executing their tasks.

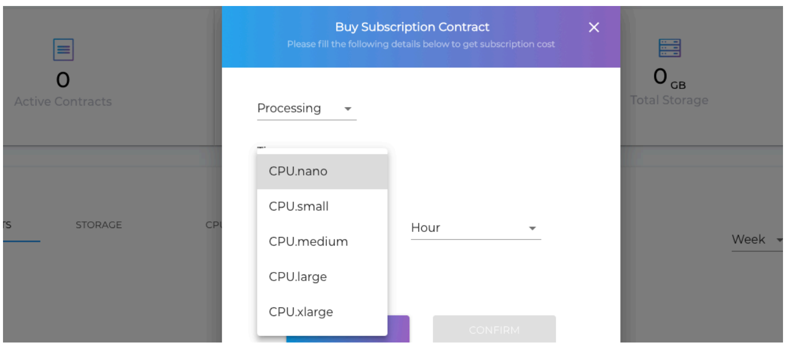

Figure 15: IAGON's Client Interface

After the client node has specified its task requirements and specified the Docker image to be executed, the IAGON agent may reach out the marketplace owner for that tier and get a list of available utilitarians. The user may be provided the details of the utilitarian along with the option for selecting one as shown below. This is shown in Figure 16 below.

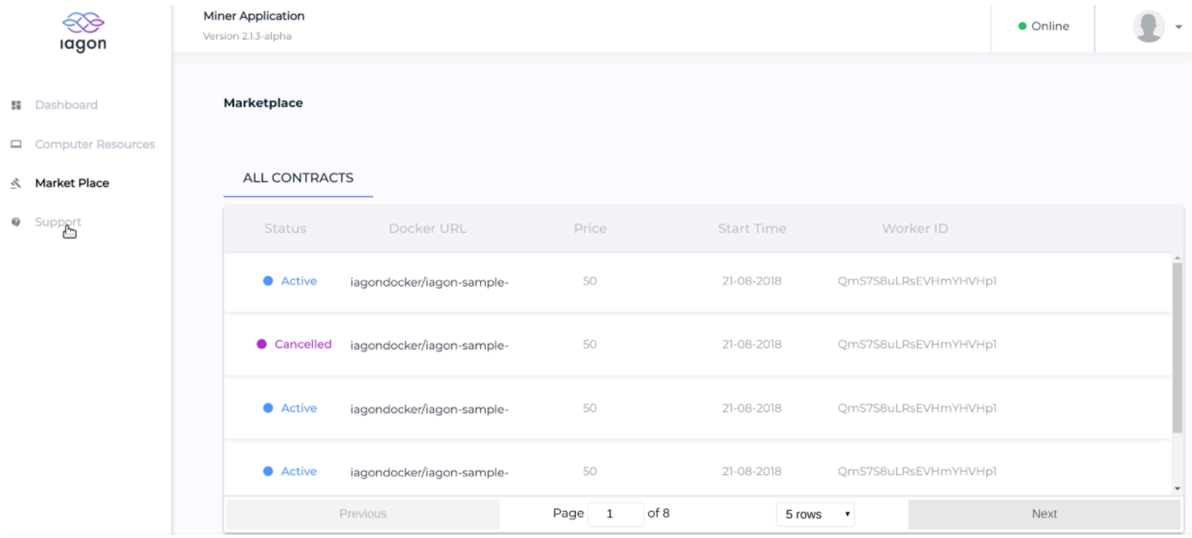

Figure 16: IAGON's list of Utilitarian Resources provided to the Marketplace

If a user does not select one of these resources, then the agent can also be configured to automatically select the utilitarian with the lowest possible cost as long as the latency to the utilitarian from the latency test is under 2 secs. The client node can also configure a directory where the test results are stored. Once the results from the computation are available the user has the option to receive an email confirming the work done. Also, the IAGON app may provide a notification for the same actions.

Threat Model Scenarios and Solutions

Since there will exist a completely or substantially decentralized system with no critical centralized governance, there are potentially various scenarios in which different participants might try to manipulate the system for selfish gain. This section describes several such key scenarios and proposed technical solution for ensuring that the overall system continues to function with high performance and fidelity. The solutions proposed here may be totally new technology or new and non-obvious improvements of existing technology that provide innovative technical protocols as well as clever incentive engineering, which help to ensure that abiding by system rules is the most rational strategy for the participants.

Eclipse Attack

In the Eclipse attack, as described in the research "Eclipse Attacks on Bitcoin's Peer-to-Peer Network", an adversary can eclipse an individual node from participating in a P2P network. Such an attack is possible if, for example, more than 50% of network nodes are controlled by an adversary. In the research "Low-Resource Eclipse Attacks on Ethereum's Peer-to-Peer Network" the authors have recommended that by adding IP address along with the Ethereum public address, such can help to mitigate the impact of Eclipse attack. According to an exemplary embodiment, adding IP address along with the Ethereum public address may be used to generate the P2P network id for nodes, such as:

Kad P2P network emlia id = hash (Ethereum public address, IP address, country code)

Thus, the risks associated with an Eclipse attack may be mitigated.

Sybil Attack

The Sybil attack is an extended version of the Eclipse attack wherein an adversary is able to control most of the nodes in the network so as to bring down the overall reputation and functioning of the network. In fact, this attack is a prerequisite for the Eclipse attack to succeed. One manifestation of the Sybil attack in IAGON's system is that an attacker can control the marketplace and utilitarians and take control of client computations wherein they get paid for their work without doing any actual work. A client who is relying on a single utilitarian or set of utilitarians for performing the work for them will have no way to know whether the output received is correct or fake. So, it is an important variation of the Sybil attack that can happen in the system.

The technical solution and mitigation strategy described above for the Eclipse attack can be useful. There are couple of other techniques that can be employed that will also help for "good" nodes in the network to be able to minimize the impact of a Sybil attack. These techniques revolve around reputation management and cross-checking computation results. For example, the technique described in the study "A Framework for Reputation Management and Using Reputation as Currency in Large-Scale Peer-to-Peer Networks" may be applied.

Greedy Utilitarians

In this attack it is possible for utilitarians to submit a low-cost bid for tasks but then provide a poor quality of service for clients. The clients will not know immediately that utilitarians provided poor quality or incorrect computation on the tasks provided to them. This is a form of Sybil attack, but on a small scale wherein there are greedy utilitarians who want to get compensation for tasks without actually completing those tasks. The techniques proposed for dealing with the Sybil attack will also be useful for both avoiding these utilitarians from winning the auction process and also from detecting output wherein utilitarians did not perform the necessary computation.

Malicious Marketplace Owners

In this attack scenario it is considered the impact of having malicious marketplace owners in the network. Here are the kinds of attacks that are possible - a) colluding with the malicious utilitarians and suppressing good nodes from participating in the auction process, b) not storing and or sharing utilitarians' information with the clients in an effort to diminish overall system utility.

These problems may be addressed in the following manner as part of the solution::

1. Building a reputation for the marketplace owners similar to the way of building reputation for the utilitarians (described more in the future work section).

2. Rotating the marketplace owners every week for a given tier of service. As 15 explained in the system overview section, for computing the hash of a tier one of the input values use the week number of the year. So, every week the utilitarians, even for the same tier, re-list themselves with a new marketplace owner, the clients are able to find the new marketplace owners since they also keep updating the hash they use to do a lookup for them. It should be noted that all times in the instant 20 system may be based on UTC. Also, it may not be required to globally synchronize clocks. If a client does a lookup for the marketplace owner for a tier and no utilitarian information is received, the system may automatically retry for the new marketplace owner by bumping up the week number by 1.

3. There may be redundant marketplace owners for every tier. The redundant nodes 25 may be the immediate successor neighbors of the designated marketplace owner. So, for example, say Node 1 is the marketplace owner for Tier-1 then utilitarians may also list themselves in the immediate successor which is Node 2. The clients when getting the list of utilitarians from Node 1 may also contact Node 2 and get the list of utilitarians. If the two sets of data vary significantly even after contacting 30 the utilitarians then the client can skip the payment to Node 1 and also broadcast the poor reputation for the node.

Free-loading Clients

It's possible that clients can also misuse the resources in the network by getting their tasks executed, but not marking the payments to the utilitarians and marketplace owners. This is solved by using Blockchain/DLT as an escrow and enforcing the transaction through a smart contract.

Other Claims

Public REST APIs

A marketplace may be integrated into an app that also allow users to sell and buy storage capacity. The same capability may be provided through RESTful APIs for selling, buying and managing compute resources. Such an open platform will allow developers to build new innovative apps to leverage massive, inexpensive and easy to access compute resources. This is shown in Figure 17.

Here's an example of how these APIs may look:

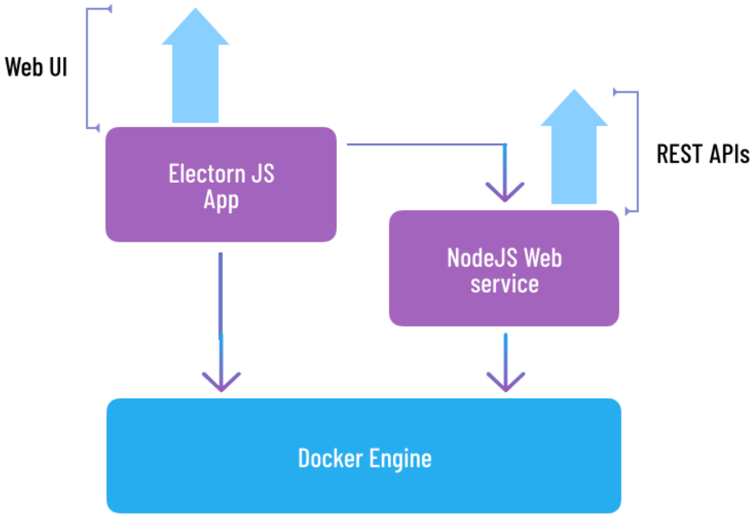

Figure 17: IAGON's Client Configuration and Open Developer's Interface Using Rest APIs

Create a compute resource to sell POST /compute


```
{
 "tier_name": "string",
 "kademlia_id": "string",
 "public_address": "string",
 "ip_address": "string",
 "country_code": "string",
 "price_per_15_mins": "double",
 "availability_window": "string",
 "cpu_count": "int",
 "speed_in_ghz": "int",
 "memory_in_gb": "int"
}
```


Get a list of utilitarians providing a particular tier of compute resource GET /compute/{tier_name}


```
[
{"kademlia_id": "string",
 "public_address": "string",
 "ip_address": "string",
 "country_code": "string",
 "latency_in_msecs": "int",
 "price_per_15_mins": "double",
 "cpu_count": "int",
 "speed_in_ghz": "int",
 "memory_in_gb": "int"},
{},...
]
```

Submit a Docker instance for execution on the selected utilitarian POST /compute


```
{
 "client_kademlia_id": "string",
 "client_public_address": "string",
 "client_ip_address": "string",
 "docker_image": "blob",
 "return_uri": "string"
}
```


Workflow Management

A task for a client that is packaged as a single docker container may be managed. There are variety of workloads that require a set of interdependent tasks that need to be executed sequentially with some intermediate parallel operations. A general workflow management system is provided, which clients can use to define and submit a workflow of tasks. In turn, the workflow management system may automatically schedule, manage and optimize the execution of all the tasks so as to provide best reliability, performance and cost benefits for completing all the necessary tasks.

Region Demarcated Compute Resources

According to an exemplary embodiment, there is provided a single P2P network and clients have the option to select utilitarians from a specific country and/or utilitarians with certain latency characteristics. Multiple P2P networks that are region specific are supported. For example, a P2P network for US West, US East, EU West, EU East, India, South-East Asia, etc. This not only may simplify selecting utilitarians that are geographically close, but also may make it possible to meet region specific data handling requirements like the GDPR regulations in European Union.

Reputation Management

According to an exemplary embodiment, innovative reputation management and incentives engineering is used to enable the system to be self-sustainable. Malicious or non-performing utilitarians and marketplace owners, as described in the previous sessions, will get weeded out from the system, and at the same time freeloading from clients should be avoided.

Every node in the network may have a copy of everyone else's reputation. This reputation may be an aggregate representation of the node's direct experience with working with the other nodes, and also the reputation broadcast messages that the node has received. This reputation may be calculated for every other node be it a utilitarian, marketplace owner and client.

According to an exemplary embodiment, reputation management may be performed as follows:

1. The reputation may be associated with the P2P network id of a node, which in turn means that it's associated with the Ethereum public address.
2. Reputation may be a monotonically increasing integer. Higher the value means higher the reputation and 0 being the worst. The value of 0 also means that a node's reputation is unknown. Worst reputation and unknown may be treated interchangeably since a malicious node can always regenerate its P2P network id and re-join the network as an unknown node.
3. A utilitarian, after successfully completing a transaction, may create a completion certificate and broadcast to all nodes that it is aware of in the network. The completion certificate may contain a hash pointer to the Ethereum block that records the payment transaction from the client to the utilitarian. A node after receiving the completion certificate calculates the reputation of the utilitarian as follows:
    - 3.1. utilitarian reputation new = f(utilitarian reputation old * client reputation) or 1 if either of the two values are 0
    - 3.2. For the same pair of utilitarian and client nodes increase the reputation at most once in a week

4. Reputation of a node is decaying function of time. So if a utilitarian does not provide service it gradually degrades over time:
    4.1. New Reputation = Ratings in last 30 days * α + Previous ratings * (1 -), where controls the weightage assigned to newer ratings

Trojan Injection for Results Verification

One of the results verification technique that is employed to make sure utilitarians are not just returning junk results back to clients is called Trojan injection. In this technique automatically inject a step in client computation that has a known output value. When a task is completed the output results set should have this known value included in the output results set. If it is missing then it will be known that a utilitarian has not processed the task as per the client's specification and therefore should not be paid. This technique is similar in principle to the Proof-of-Work concept (PoW) used in Bitcoin network with the goal to ensure that the utilitarian is indeed expending it's computing power.

PUBLIC REVIEW OF THE TOKEN CONTRACT

The Token Contract and associated audits will be published at a later date on Etherscan. We invite all potential participants to review them for features and functionality.

ROADMAP FOR NEXT 12 MONTHS

June 2021:

- IDO and Funding raising

Aug 2021:

- Staking/Rewards Model

Sep 2021:

- Migration to Cardano
- GDPR Complaint Live Tracking Service
- Opening of Oslo office - with focus on Market acceptance of Iagon solution in Nordics and worldwide
- New simplifed UX with custom dashboarding

Nov 2021:

- Update on national/regional Patent application in USA/Canada/Australia/Japan/Korea/China/Israel/SAU
- Complete performance testing and benchmark against competitors

Jan 2022:

- Update platform to support both mobile as well as enterprise grade resource providers
- New ML model for resource providers to guide them how to best configure and sell compute resources

May-June 2022:

- Integrated enterprise grade apps on top of IAGON's platform targeting verticals like photo-sharing, medical transcription, etc.

2022:

- NFTs
- Reputational model
- Digital Data Ecosystem

2023:

- Decentralized Compute
- Alexandria protocol

THE IAGON TEAM

IAGON's executive team is led by Dr. Navjit Dhaliwal, a highly experienced professional in the field of cryptocurrency investments and financial operations. IAGON's team members are:

Dr. Navjit Dhaliwal
Chief Executive Officer

Dr. Navjit Dhaliwal is IAGON's CEO and founder, aiming to revolutionize the world's centralized cloud industry by offering a decentralized cloud services platform. In the past, Navjit was a medical entrepreneur in the field of dentistry, successfully leading Norway's Mjøsa Tannklinikk's operations and doubling its revenues in one year.

Dr. Elad Harison
Co-Founder

Dr. Elad Harison in an expert on DataMining and Machine Learning, Economist and Industrial Engineer, who is in charge of IAGON's architecture planning and operations. He is the former Head of the Industrial Engineering Department at Shenkar College and an accomplished economic advisor and analyst in the private sector in Israel and in the EU, where he led business feasibility studies, market research and statistical analysis and IT architecture changes for the European Commission, several European governments, KLM-Air France and an Israeli Bank, among others.

Dr. Claudio Lima
Co-Founder

Dr. Claudio Lima is a seasoned executive, global CTO, VP of innovation and thought leader in advanced energy and telecom/IT working with emerging technologies, new businesses and digital transformation. At IAGON he identifies new areas of technology, landscape, developments and opportunities and creates plans to implement them for IAGON and its clients.

Dr. Rohit Gupta
Co-Founder

Dr. Rohit Gupta has remarkable background in innovation, and a proven track record for establishing a culture of customer focus, operational excellence, and continuous improvement in a range of domains, including Travel, Ecommerce, Healthcare, Telecommunications, Fraud and Cloud computing. Always up for new challenges, Gupta is a Co-Founder of Iagon.

Bjørn Bjercke
Chief Technology Officer

Bjørn has vast experience of over 20 years in financial IT infrastructure. With the invention of blockchain, Bjørn was early to adapt to this technology. Bjercke has solid knowledge of emerging trends and is at the forefront of blockchain and fin-tech. He plays a key role in how verifiable decentralized cryptographic secure technology will be exploited in Nordic and Central Europe.

DISCLAIMER

By participating in the IAGON AS' ("IAGON") Pre-sale and/or Token Generating Event (the "TGE") Crowdsale (the Pre-sale and the TGE together referred to as the "Crowdsale"), as defined in the IAGON whitepaper (the "Whitepaper"), or making use of any information in the Whitepaper or in IAGON's business plan or available on the iagon.com website, you agree to the statements provided in this disclaimer (the "Disclaimer"). You further understand and accept that the information provided in the Whitepaper and on the website are of descriptive nature only, and does not provide any legal rights to the user unless explicitly stated.

GENERAL WARNING – By using the services provided by IAGON, you as either a Crowdsale participant or User of IAGON's alpha products or services (the "User"), fully understands and agrees with the following:

- IAGON AS is a Norwegian incorporated entity, being subject to Norwegian laws and regulations. The TGE is being performed from Norway under Norwegian rules and IAGON does not intend or issue any tokens in any other jurisdiction. The User understands and accepts to be subject to the laws and regulations in the jurisdiction in which the User is domiciled and that IAGON accepts no responsibilities for the legal status of the User as a Crowdsale participant or otherwise being linked to IAGON (e.g. as token holder after the TGE). The User should obtain local legal advice to clarify the legal status of the User in its own jurisdiction before participating in the Crowdsale.

- By transferring Ether (ETH) to the Smart Contract System and the Smart Contract System creating IAGON tokens ("IAG tokens"), the User understands and accepts that the User makes a contribution into a Smart Contract System for the development of the IAGON platform, as described in the Whitepaper. The User understands and acknowledges that IAG tokens will be provided by the Pre-sale and/or TGE smart contract in the order that transactions are received by it and no alteration of this can be made by any party. However, the User understands and accepts that smart contract technology is still in an early development stage and its application of experimental nature, which carries significant operational, technological, financial, regulatory and reputational risks.

- User understands and accepts that IAGON AS, including its shareholders, directors, management, employees and any other person affiliated with IAGON, carries no liability for the ability to take part in the Crowdfunding for reasons beyond the control of IAGON including but not limited to the Pre-sale and/or TGE duration, transaction mining delays and node-related issues.

- Pending a successful Crowdfunding, the IAGON team members will be focused on completing the company start-up and delivering on milestones according to the Whitepaper. Furthermore, the User understand and accepts that while IAGON will make reasonable efforts to develop and complete the IAGON platform, as described in the Whitepaper, it is possible that such development may fail and that User's IAG token may become useless and/or lose its value due to reasons of technical, commercial or regulatory nature or any other reason, within or outside IAGON's control.

- The User is also aware of the risk that even if all or parts of IAGON's platform is successfully developed and released in full or in parts, that the IAGON platform could be fully or partially closed, remain commercially unsuccessful or shut down due to lack of public interest or for any other reason. IAGON has the right to engage subcontractors to perform the entire or partial development and execution of the IAGON platform. The scope and extent of the development of the IAGON platform will be determined by the amount of contribution received during the Crowdsale, as set forth in the Whitepaper

- The User understands and accepts that IAGON undertakes no obligations to act on behalf and in the interests of the User in any Pre-sale and/or TGE being held in the future.

- By transferring ETH through the IAGON Crowfunding address under the smart contract system of the Ethereum blockchain protocol (address TBD (to be decided)) (the "Smart Contract System"), the User expressly agrees to all of the terms and conditions set forth in the Smart Contract System code existing on the

Ethereum blockchain and in this Disclaimer. The User further confirms to have carefully reviewed the Smart Contract System code, its functions and this Disclaimer, and hereby confirm to fully understand the risks and costs of creating the IAG token and contributing into a Smart Contract System for the development of the IAGON platform.

- The User understands and accepts that by transferring ETH or other assets to IAGON as part of the Crowdsale through the Smart Contract System, the User makes such decision upon his/hers own discretionary consideration and has no right of refund of the transferred amount, unless explicitly provided by the Pre-sale and/or TGE smart contract code itself as stipulated in the Whitepaper (that being, a 100% refund when capital raised during the Crowdfunding is under the minimum cap after the Pre-sale and/or TGE period has expired). The User therefore understands and accepts that the transfer of ETH through the Smart Contract System thereby creating IAG token, carry significant financial, regulatory and/or reputational risks (including the complete loss of value of created tokens, if any, and attributed features of the IAGON platform).

TAX WARNING – The User understands and accepts that IAGON does not act as a tax agent of User. The User bears the sole responsibility to determine its tax responsibility of the contribution into the Smart Contract System to create and obtain IAG token(s), and to determine whether the ownership, usage, the potential value appreciation or depreciation, or any gain or loss by the purchase or sale of the IAG token, have tax implications for such User. More specifically, the User fully understands and agrees to the following:

- The User and IAGON carry their own tax obligations solely under the applicable laws of the jurisdiction they reside in.

- If Value Added Tax (VAT) obligations or other indirect taxes will apply as a result of trade of products/services provided by Iagon or by third parties, we reserve the right to adjust the product/service price by adding a VAT/ indirect tax as applicable for each respective country (e.g. 25% for Norway and as applicable in other jurisdictions) which are sold from the time the VAT / indirect tax obligations comes into place. We will spend time and resources with qualified personnel to structure the Iagon platform optimally within legal frames to ensure transactions flow as efficient as possible.

- The User understand and accepts that IAGON may have to disclose information on the User, including but not limited to the value of any IAG tokens held, if explicitly requested by any government authorities in accordance with any applicable jurisdiction.

- By creating, holding or using the IAG token, and to the extent permitted by law, the User agrees not to hold IAGON or any associated third party, including developers, auditors, contractors or shareholders, liable for any tax liability associated with or arising from the creation, ownership or use of IAG token or any other action or transaction related to the IAGON platform.

NO WARRANTIES – All information provided within the Whitepaper and within IAGON's business plan is provided "AS-IS" and with no warranties whatsoever on the IAG token, the Smart Contract System and/or the success of the IAGON platform, including the accuracy, completeness or the use of any information provided therein, to the extent permitted by any applicable law. This includes, but is not limited to, express or implied warranties of title, merchantability or fitness for a particular purpose, are made with respect to the information, or any use of the information, on this site or platform.

DISCLAIMER OF LIABILITY – The User acknowledges and agrees, to the extent permitted by any applicable law, that the User will not hold IAGON or any associated parties, including but not limited to any group entity, management, developers, contractors or shareholders, liable for any and all damages or injury whatsoever caused by or related to the use of, or the inability to use the IAG token, the Smart Contract System or the IAGON platform, under any cause or action whatsoever of any kind in any jurisdiction. IAGON specifically, without limitations, disclaims liability for any loss or damages, including incidental or consequential damages, and assumes no responsibility or liability for any loss or damage suffered by any person as a result of the use, misuse or reliance of any of the information or content in the Whitepaper or in IAGON's business plan or on the www.iagon.com website.

Under no circumstances shall IAGON, or any associated parties as stated above, be liable to the User for any special, indirect, incidental, consequential, exemplary or punitive damages (including lost or anticipated revenues or profits and failure to realise expected savings arising from any claim relating to the services provided by IAGON) whether such claim is based on warranty, contract, tort (including negligence or strict liability) or otherwise or likelihood of the same.

The User further specifically acknowledges that IAGON, or any associated parties as stated above, are not liable, and the User agrees to not hold them liable, for the conduct of any third parties, including other creators of IAG token(s), and that the risk of creating, holding and using IAG token(s) rests entirely with the User.

USE AT YOUR OWN RISK – By utilizing the Crowdsale Smart Contract System for IAGON, the IAGON platform or the www.iagon.com website, including but not limited to, the transferring of any assets to IAGON AS, the User undertakes and understands all possible risks that directly or indirectly arise from the activity connected with the User's participation in the Crowdsale and/or use of IAGON's services and products.

FORCE-MAJEURE – User understands that IAGON will not be liable to User for any breach hereunder, including for failure to deliver or delays in delivery of the Services occasioned by causes beyond the control of IAGON including but not limited to unavailability of materials, strikes, labour slowdowns and stoppages, labour shortages, lockouts, fires, foods, earthquakes, storms, droughts, adverse weather, riots, thefts, accidents, embargoes, war (whether or not declared) or other outbreak of hostilities, civil strife, acts of governments, acts of God, governmental acts or regulations, orders or injunctions, or other reasons, whether similar or dissimilar to the foregoing (each a "Force Majeure Event").

MISCELLANEOUS / FINAL WARNING – Pre-sale and/or TGE participations can be considered high-risk trading; utilizing IAG tokens via the Crowdsale or utilizing services offered in the Whitepaper, through the Smart Contract System, the IAGON platform and on the www.iagon.com website, may result in significant losses or even in a total loss of all value submitted and obtained.

- This Disclaimer, the IAGON Whitepaper, the IAGON website and platform or any related documents or site do not constitute a prospectus of any sort, is not a solicitation for investment and does not pertain in any way to an offering of securities in any jurisdiction.

- The User guarantees that he is a legally capable person of a sufficient age, and that the User complies with all legal rules and applicable laws of the jurisdiction where the User lives when transferring ETH to the Smart Contract System to create IAG token. The User further confirms to be legally permitted to hold and use the IAG token in the jurisdiction where the User is domiciled, and accepts to hold IAGON harmless should the User not be compliant to any such laws and regulations.

- IAG tokens are only functional utility tokens and its ownership carries no other rights other than being intended to be applied on IAGON's platform, if successfully completed and deployed as stipulated in the Whitepaper. In particular, the User understands and accepts that the IAG token do not represent or constitute any ownership right or stake, share or security or equivalent rights or any right to receive future revenues, IP rights or any other form of participation in or relating to the IAGON platform, other than enabling access for token holders and Users to IAGON's platform. IAGON tokens and IAGON's platform are not for speculative investment. No promises regarding value or future performance are made regarding IAGON tokens. No promises regarding any particular value of IAGON tokens are made. No other rights associated with holding IAGON tokens are given. Proceeds of the IAGON token Crowdsale may be spent as the company sees appropriate, which may change as deemed necessary in the maturation and advancement of the IAGON token and IAGON's platform.

- IAGON's team is investing heavily in the safety and security of the services that IAGON provides. However, we cannot protect against all possible sources of error and malicious deeds initiated by any party. Therefore all risks assumed by using IAGON's platform in any capacity, transferring, receiving and accumulating IAG tokens are solely assumed and accepted by the User.

- IAG tokens are meant to be held and used by those well experienced and knowledgeable in cryptographic tokens, their acquisition, transfer, and use only for accessing the services offered on IAGON's platform. By transferring ETH through the Smart Contract System for the creation of the IAG token, the User represents and warrants that it has deep understanding of the functionality, usage, storage and transmission mechanism associated with cryptographic tokens and blockchain-based software systems.
- The User further represents and warrants to have knowledge of the token creation process and that the User will have its own account on the Ethereum network, with a private key associated to this address and password. The password is used to encrypt the User's private key. Following the creation of the IAG token by the Smart Contract System, the IAG token will be transferred to the User's address by the Smart Contract System. The User understands that the User must keep his password and private key safe and that the User will not be able to generate a new password or recover his private key should this private key and/or password be lost or stolen. The User understands that if such private keys and/or password is lost, the IAG tokens associated with the User's account will be unrecoverable and will be permanently lost. In such instance, IAGON or any other no person or entity will not be able to help the User retrieve or reconstruct the lost password and/or private keys, and the User will not be able to access any lost IAG tokens.
- The User understands and accepts that the IAGON platform will be run on a blockchain through a network of resource providers which will ultimately be in control of the Smart Contract System. The User understands that a majority of these resource providers could agree at any point to make changes to the ofcial Smart Contract System and to run a new version of the Smart Contract System, which could lead to the IAG token losing its intrinsic value.
- By transferring ETH to the Smart Contract System and/or receiving IAG token, no form of partnership, joint venture or any similar relationship between the Users and/or other individuals or entities involved with the deployment of the Smart Contract System and the setting up of the IAGON platform is created.
- The User understands and accepts that no market liquidity may be guaranteed with regard to the IAG token and that its value may experience extreme volatility over time, including depreciation in full.
- Should the User be a consumer and should any applicable consumer legislation or cancellation rights apply to such User in relation to the creation and obtainment of the IAG token, the User waives any such consumer and cancellation rights, unless otherwise prescribed by mandatory law. The User further acknowledges and accepts that any applicable cancellation rights are waived and lost when the User transfer ETH through the Smart Contract System and thereby creates and obtains IAG token(s), unless otherwise prescribed by mandatory law.
- The User understands and accepts that the blockchain technology allows new forms of interaction and that it is possible that certain jurisdictions will apply existing regulations on, or introduce new regulations addressing, blockchain technology based applications, which may be contrary to the current setup of the Smart Contract System and which may, inter alia, result in substantial modifications of the Smart Contract System and/or the IAGON platform, including its termination and the loss of IAG token for the User.
- By participating in the Crowdsale by either the Pre-sale and/or TGE, the User confirms that he has read, understood and agree to comply with all restrictions set forth above. The User further confirms to not obtain the IAG token for any illegal purposes and that the ETH transferred through the Smart Contract System has not been obtained by any illegal means, including but not limited through money laundering or corruption of any sort or any other illegal means in the jurisdiction in which the User resides.
- The User acknowledges and agrees that if any part of this Disclaimer or the Whitepaper is found illegal or unenforceable, in whole or in part, such provision shall be ineffective solely to the extent of the invalidity or unenforceability under the laws of the applicable jurisdiction without affecting the validity or enforceability thereof in any other manner, and without affecting the remaining provisions of this Disclaimer or the Whitepaper, which shall continue to be in full force and effect.

- This Disclaimer is governed by Norwegian law and any claims brought forward against IAGON arising out of or in connection with the creation of IAG token and the development and execution of the IAGON platform, shall be resolved and fnally settled by the ordinary courts of Norway. IAGON and its team will in any case abide within the laws set forth in each of its operational country(ies), and each operational unit shall be subject to its local laws and jurisdiction for the explicit operation such unit provides.
- IAGON's Whitepaper, its business plan, its website and this Disclaimer, may be subject to changes by IAGON's discretion, either before, during or after the Crowdsale.

This Disclaimer is valid as of 1 January 2021, as amended from time to time.

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