



X - BLOCK I

The First Global Blockchain 4.0 Based on Fog Computing Creating a Light Blockchain Era Accessible to Everyone

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Introduction

This document is V1.0 of X-Block Ecology White Paper, which primarily introduces the background, positioning, technical features and applications of X-Block. In the future, we will continuously upgrade the document to maintain its consistency with technological realization. Please visit the official website: <http://www.x-block.io> for the latest news, technological white paper, software release, developers' community and other information of X-Block.

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Disclaimer

Along with continuous development of technology and blockchain, the X-Block team will keep on improving the technological plan and ecology white paper if necessary.



Abstract

As an outstanding representative of public chains in the era of Blockchain 4.0, X-Block is the first global public chain built on the Fog computing framework, which aims at creating a user-friendly, convenient and open light eco-blockchain.

Relying on the Fog computing framework, X-Block can, utilize various heterogeneous devices (including personal computers, smartphones, routers, etc.) to form a decentralized computing engine. By creatively designing the "Galaxy Super-Contract", it enables the smart contract to maximally invoke the powerful Fog computing proprietary technology. Meanwhile, computing resources of the surrounding idle equipment can be integrated via X-Block. This will further empower the blockchain to be integrated into everyday technological processes. Such as artificial intelligence, big data and Internet of Things. Thus, a disrupting smart blockchain era can be ushered in to deeply promote applications of blockchain technology in day-to-day life.

X-Block is committed to the construction of a complete blockchain ecosystem and X-Block has built X-Change along with X-Block's fog computing and blockchain tools to accomplish the token ecosystem. X-Change is a community-autonomous exchange that incorporates X-Block tokens with trading and mining.

1.0 Past and present

1.1 Development status of current blockchain

Bitcoin represents the era of Blockchain 1.0, which exists just as an account book system, not supporting any app development. With the advent of the era of Blockchain 2.0, Ethereum offered the value proposition of supporting smart contracts. This enabled Developer Apps to operate on the blockchain. However, Ethereum characterized by a poor performance and incomplete framework design, can only run simple app scenarios. The era of Blockchain 3.0, which adopts a new consensus mechanism and technical framework, generally focuses on blockchain efficiency.

Out of the pursuit of consensus efficiency, many new solution plans adopt Supernode approaches, this technology offers more versatility than nodes and allows for broader nodal analysis. This resulted in a quality over quantity paradigm; while there was improvement in the confirmation speed of blockchain, there was a concurrent rise of the community's participation threshold due to lacking and restrictive resources. Contrary to its perceived success, This has gone against the principle of decentralization – the original intention of the blockchain.

1.2 Problems facing Blockchain's current development

So far, most blockchain projects have been in the exploratory phase, which have evidenced the following problems:

1.2.1 High participation threshold

Extensive participation and consensus are the core of blockchain. The threshold for current blockchain has been rising, which is reflected not only as a higher requirement of technical performance, but also as increasingly fierce competition of computing power. Particularly in the early era of Bitcoin mining, the personal computer alone could easily mine the coin. Later, mining became more demanding of a computer's performance. This led to emergence of specialized mining computers. As a result, there is an increasing requirement of nodes. Most of which, are controlled by a select number of mining pools. This further isolates the blockchain from the masses.

Blockchain 3.0, however, improves the performance of Blockchain 2.0 by optimizing the consensus and computing framework. For example, EOS, which adopts the DPOS consensus and the super-node approach, has not only significantly cut electricity consumption of Bitcoin mining, but also upgraded the transaction confirmation efficiency. Unfortunately, many defects have arisen with the method. Assume that there are no more than 100 super-nodes in the world. They would have to compete with each other to be included in the blockchain. This has deviated from the intention to improve the blockchain's overall efficiency. Eventually, there are only a few able to join the blockchain due the node scarcity. Moreover, the blockchain is isolated from the general public, driving off the track of decentralization.

1.2.2 Inadequate practicability

Most applications in the used by the general public are a combination of the Internet and the Blockchain. They rely on carriers with a strong computing power, such as websites, online stores, multiplayer games and apps. Pitifully, a majority of blockchain solution plans feature a chain structure, which disables them from well sufficiently meeting the demand. What they can do is confined to each update of the chain technology. There lacks an integration between blockchain and other prevailing technologies, such as distributed computing, large-scale database and artificial intelligence required by large-scale Internet applications. Because of this, blockchain applications chiefly exist in the form of smart contracts, which have a limited application scope and a limited capability to cope with practical problems.

1.2.3 High learning and use cost

The current blockchain framework is still in the initial development phase, having not yet formed a unified set of industrial standards. Without adequate learning data nor sufficient development tools, working on the blockchain has been considered a privilege of a few researchers. This is a correlation for inadequate supply of blockchain applications. The most critical factor deciding whether a new technology can become a prevailing trend is whether it can be extensively adopted for free and support free application. The high cost of blockchain utilization has not only limited participation of developers in flexible development of free services, but also hindered developers and enterprises from creating valuable and accessible services.

1.2.4 A narrow scope of applications

At present, people have a high expectation of blockchain technology. As the digital monetary price continues to rise, media have also depicted a beautiful blueprint for the blockchain. However, blockchain technology is still in its infancy. Its service functions are calling for further diversification. An incentive mechanism has not yet been conceptualized in the blockchain development community.

Therefore, framework design of Blockchain 4.0 should be integrated with other predominant technologies, enabling the developer to comprehensively to develop more practical applications. When this is possible, Blockchain applications will be ubiquitous in people's life lives rather than remain smart contracts based on the blockchain.

The participation threshold should be lowered as much as possible to be inclusive of not only professional mining machines, but also a more extensive scope of devices. Based on different performances and framework characteristics of the devices, these participants get involved in different layers or "links" of the blockchain. This makes it possible for any device to serve as a node of blockchain.

2.0

X-Block—An outstanding representative of the new-generation Blockchain 4.0

2.1

Birth of X-Block

X-Block emerges in the era of Blockchain 4.0 to strengthen the bottom layer (or the foundation) of the chain. This additionally improves the encrypted algorithm, introduces multiple switch-in modes & consensus mechanisms, and application advancement of Blockchain 3.0. Many blockchain technical believers have begun a new attempt to solve the blockchain development from a new perspective.

2.2

Definition of X-Block

X-Block adopts the new Fog computing design philosophy and strives to reduce the participation threshold of blockchain nodes. This makes it possible for smart devices around the nodes to participate in the blockchain to the greatest extent and contribute computing resources, bandwidth, and data to the X-Block ecosystem.

As the bottom layer of blockchain technology, X-Block can accurately reflect the quantity and value of resources shared by users and achieve a more efficient and stable shared computing ecosystem. The infrastructure of the Fog computing architecture not only reduces the threshold for mass participation in the blockchain, but also integrates with mainstream Internet technologies.

2.3

Vision of X-Block

X-Block is a user-friendly and lightweight ecological chain. X-Block, based on the idea that Fog is a lighter layer than cloud, adopts the idea of light node access and decentralized computing. The light blockchain constructed by Fog computing can utilize each device to become a node of the Fog computing layer and aid adaption to the high-concurrency business requirements and complete the seamless integration with the Internet. This ultimately forms an ecological chain with stronger overall performance, higher carrying efficiency, more practical applications, and accessibility for everyone.

2.3.1 Lower participation threshold and compatibility with multiple heterogeneous devices

The Fog supports multiple types of light node access with the characteristics of multiple nodes and stronger participation. Each device at the side can access the X-Block; not only the computer, but also a smart phone, an iPad, etc.

2.3.2 Technological integration and more diverse ecological applications

Through the design of the Fog computing architecture, the Fog framework can be integrated with mainstream technologies to utilize the interoperability and integration of technologies.

2.3.3 Compatibility with multiple consensus and support of cross-chain and multi-chain

The unique consensus adapter design enables X-Block to be compatible with multiple consensus mechanisms and implement cross-link communications including Ethereum, EOS, NEO, and more.

2.3.4 Upper-layer strong sealing and developer-friendly

Based on a complete virtual computing service, developers can quickly develop blockchain applications and quickly obtain both computing and blockchain resources. Developers get computing resources on the X-Block just as easily as buying virtual servers on the Amazon cloud without having to build their own servers from scratch.

X-Block provides developers with a highly encapsulated development interface and components that can adapt to multiple domains, such as social components, financial payment components, and artificial intelligence components.

2.3.5 Less Internet delay to create a smoother user experience

User equipment is in itself a node in blockchain. It frees the user of the trouble of waiting several minutes and can ensure less Internet delay. During the operation process, the user can use the DApps developed by the X-Block framework intuitively. Meanwhile, blockchain at the bottom layer can guarantee its safety, decentralization, and enhance UX as well.

2.4 X-Eco-Blockchain

2.4.1 X-Block is blockchain at our hands

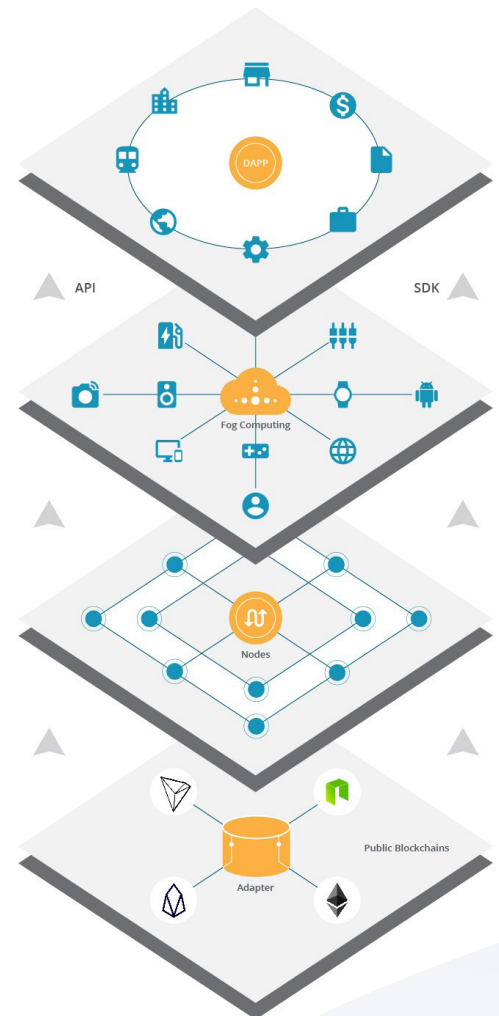
As long as a device can have access to the Internet the device can become a Fog node providing services without relying on high-performance CPU. Therefore, Fog computing can support switch-in of more devices, get closer to the Internet bottom layer, and is characterized by less delay. At the same time, what Fog computing builds is a complete set of the network for local users. The distribution form of Fog computing is similar to that of blockchain nodes. Therefore, integration between the two is easier, which can promote broader blockchain application for daily use.

2.4.2 X-Block can realize activation of idle resources

X-Block, can identify idle resources, users and developers can hone higher efficiency and lower costs. The Fog computing layer enables DAPPS on the blockchain to be based on smart contracts on the chain, and can also implement the virtual computing resources for Fog calculations to connect various devices in our lives, allowing idle resources for multiple devices to be available. Convergence into a vastly distributed computing space. Developers only use payment tokens to obtain Fog computing resources at a low cost, which is much lower than traditional cloud computing resources. Users only need to rent idle devices to form decentralized virtual computing spaces such as CPU and storage. Space, bandwidth, and more, you can get token rewards.

2.4.3 Innovative economic incentive model design

Design of a well-functioning economic model can dictate long-term operation of a project. The token economy incentive model of X-Block, which is accessible to all, is innovative and capable of meeting user demands more efficiently under the prerequisite of a safe economic model. All these advantages give the token economy an incentive model a competitive edge.

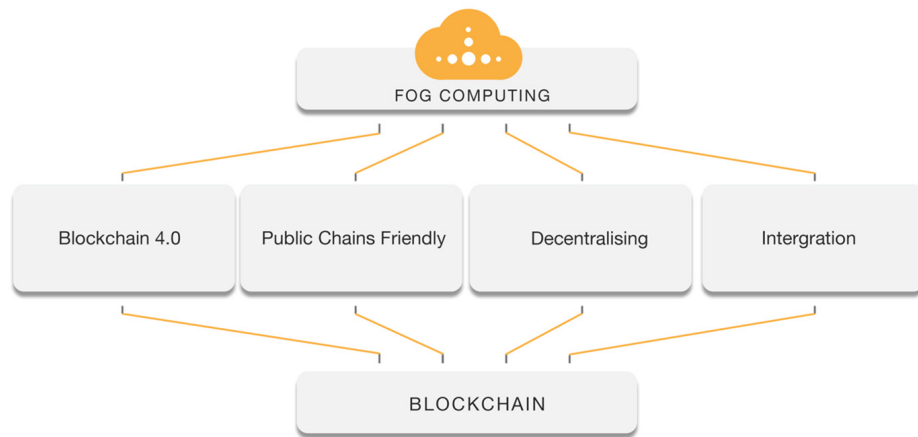


2.5 Technical features of X-Block

2.5.1 The global first Blockchain 4.0 based on Fog computing

The concept of “Fog computing” was developed by Cisco. Compared to cloud, it is closer to the source generating data. All relevant data processes and applications concentrate on marginal network devices. They are not all stored on the cloud. In this sense, Fog computing is an extension of the concept of “cloud computing”. It is advocated by Cisco as the structure of IoT for the purpose of utilizing worldwide applications. As a distributed computing model, the concept of Fog computing is introduced to cope with challenges facing traditional cloud computing in blockchain. When a subset of nodes sends data to a larger and central connecting point, Fog computing can process data to connect with a larger integrated central network. To be more specific, Fog computing can tackle the problem of delay and bandwidth in sending a large amount of primary data to the central network.

Fog computing is intrinsically decentralized. This provides it with a strong compatibility with the essence of the blockchain. Based on this attribute, X-Block proposes the new concept of building Blockchain 4.0 based on Fog computing.



2.5.2 Easier node switch-in of X-Block and friendly to all kinds of equipment

The Fog computing ecology is made up of various heterogeneous systems and nodes. The computing power and storage of every heterogeneous device are different. Under the application environment of Fog computing, different types of nodes are responsible for executing different functions.



2.5.3 Effective integration and gathering of idle resources to form a distributed computing system

Based on the token economy, X-Block builds the computing resource market through integration of various idle device resources. Devices with different frameworks can be constructed according to different resource demands. The storage, CPU, and bandwidth can be gathered to form a virtual server. This is similar to Amazon's decentralized AWS (Amazon Web Services), which not only improves the use efficiency of users' idle equipment, but also disrupts the oligopoly of cloud computing giants, allowing developers to acquire necessary computing resources at a low cost.

2.5.4 Combination between intelligent contracts on blockchain and fog computing off blockchain

Accelerate integration between blockchain technology and mainstream technology so that blockchain technology can be more accessible. Solution plans offered by Blockchain 2.0 and Blockchain 3.0 mainly focus on improvement of the chain performance and operation efficiency of smart contracts. However, not all applications in real life have to be operated on blockchain smart contracts. X-Block redefines the concept of the Galaxy Super-Contract. Its central idea is combination between smart contracts on the blockchain and Fog computing off the blockchain. Only those operations which are required to ensure safety and prevent tampering should be operated on the blockchain. This means a large number of operations are conducted off the blockchain. Because of this, smart contracts on blockchain can drive operation of Fog computing to utilize in-depth integration between the two. For example, the final transfer accounts and records are handled via blockchain when the bank is handling clients' transfer requests. However, technologies, such as big data and artificial intelligence, are more suitable for analysis of clients' user portraits, analysis of data statistics, and analysis of anti-money laundering behaviors.

2.5.5 Building a complete token ecosystem

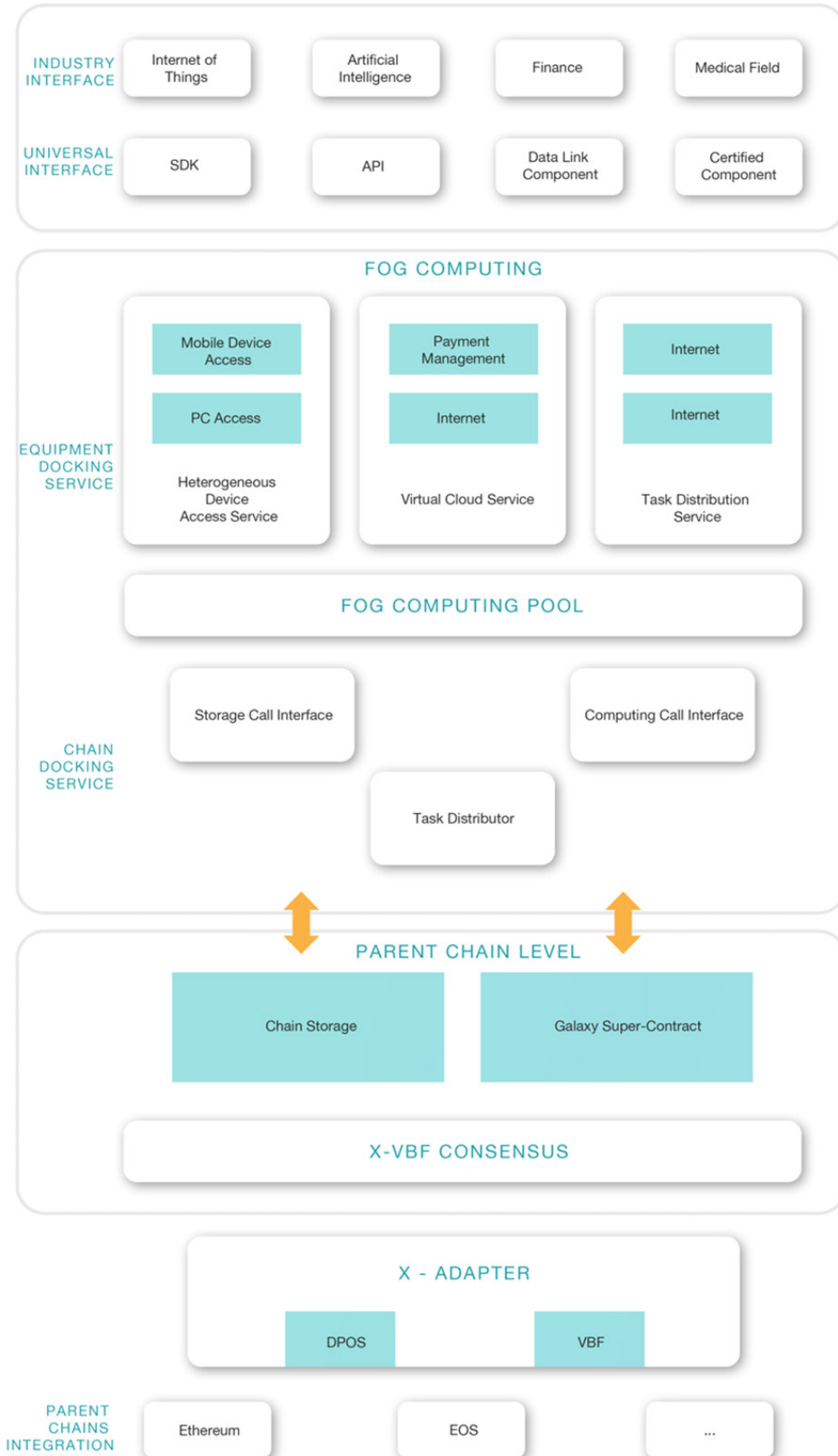
X-Block is committed to building a complete blockchain ecosystem, and has built X-Change along with X-Block's computing and mining tools to accomplish the token ecosystem. X-Change is a community-autonomous exchange that incorporates X-Block tokens with trading and mining. Through Dapp, developers generate tokens on the X-Block blockchain. They can directly implement X-Change transactions to utilize token circulation and token market pricing, to form a closed loop with X-Block and a complete currency economy.

3.0

X-Block solution plans

3.1

X-Block framework



3.2

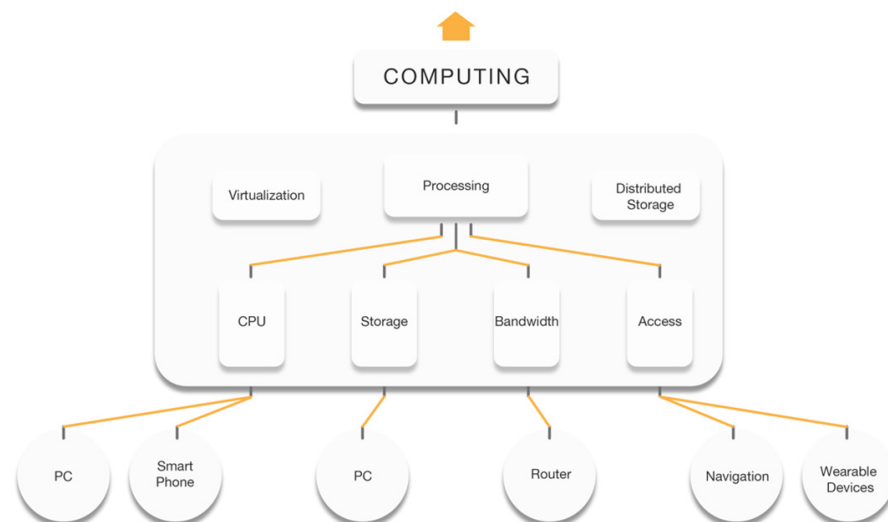
X-Block solution plans

3.2.1

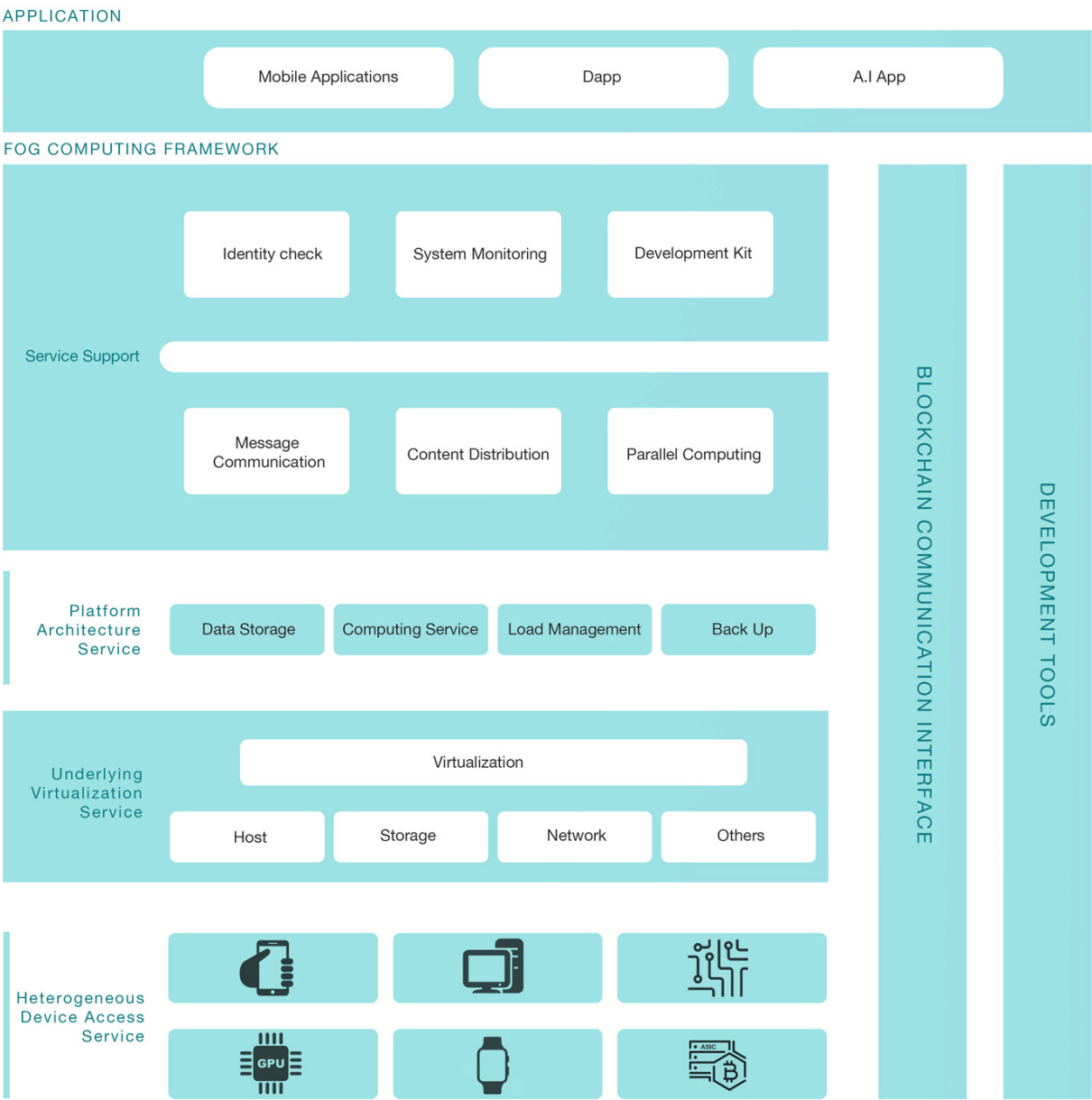
Connection of heterogenous equipment to fog computing

Equipment in the real world has different structures. Their CPU, storage space and network position are all different. Fog computing is to combine computers distributed scatteringly in a physical space so that the individual device with limited performance can be gathered together. The Fog computing framework of X-Block is compatible with heterogeneous equipment. Based on different structural characteristics of the equipment, the Fog computing framework endows every device with various roles in the whole system so that advantages of the hardware can be fully utilized.

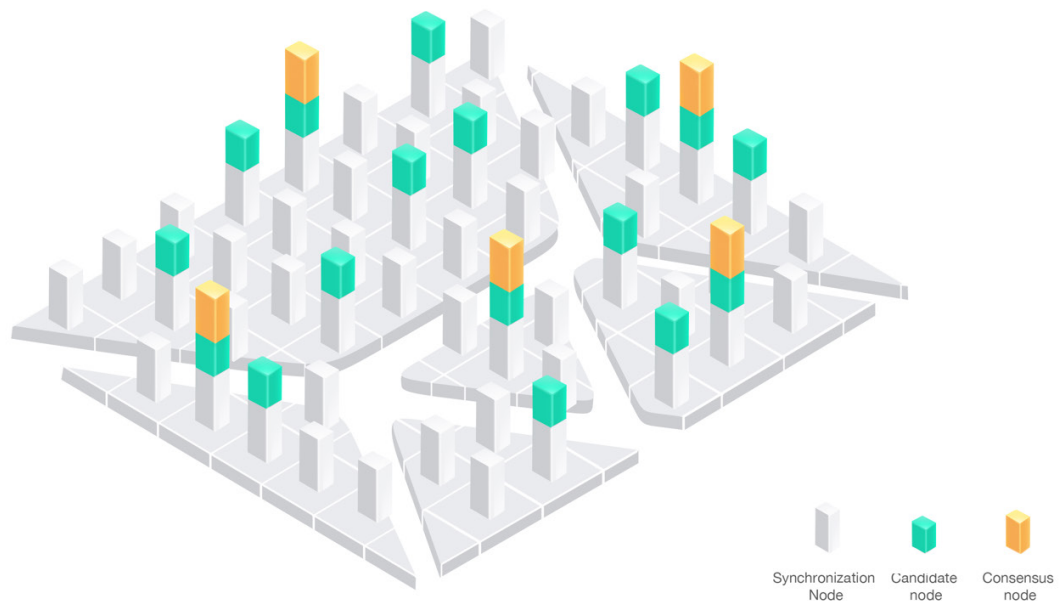
- Only nodes capable of computing, such as smartphones and iPads, can serve as light nodes in the blockchain layer, responsible for providing light computing resources.
- PCs can provide more storage space and CPU resources, so its computing performance is better, which can thus be adopted as the main computing resource for the Fog computing layer.
- Other idle resources without adequately excellent computing performance, such as the router, can also be adopted as the data transmission node. Data transmission can be spread to the whole blockchain network via transactions, providing blockchain with bandwidth resources.
- Large-scale mining machines can serve as central notary nodes of blockchain.



3.2.2 Decentralized Fog computing



Through integration and utilization of multiple idle equipment resources, X-Block builds decentralized computing. Equipment with different framework can be connected with the Fog computing resource pool via different interface programs to gather storage, CPU and bandwidth resources. This is then provided for the upper layer via virtualized services.

3.2.3**Consensus algorithm****X-BFT consensus algorithm**

X-Block adopts the X-Byzantine Fault Tolerance (BFT) consensus algorithm based on the verifiable random function (VRF). The algorithm is a consensus mechanism built on the VRF and BA algorithm. The consensus mechanism can randomly select a few nodes as consensus nodes to reduce a large amount of network transmission consumption in the traditional consensus mechanism and greatly improve the consensus efficiency. Meanwhile, the whole selection process of consensus nodes is fully conducted among local nodes. This can effectively cut down the probability of consensus nodes being attacked, thus ensuring the whole network can operate safely and efficiently. Moreover, the X-Block consensus nodes based on the X-BFT algorithm are randomly generated, which can largely prevent the occurrence of bifurcation and reduce the theoretical probability of bifurcation to only 10^{-100} . The BA-VRF consensus is a mechanism built on VRF and BA algorithm. The consensus mechanism can choose a few nodes as notary nodes and confirm the priority level of notary nodes.

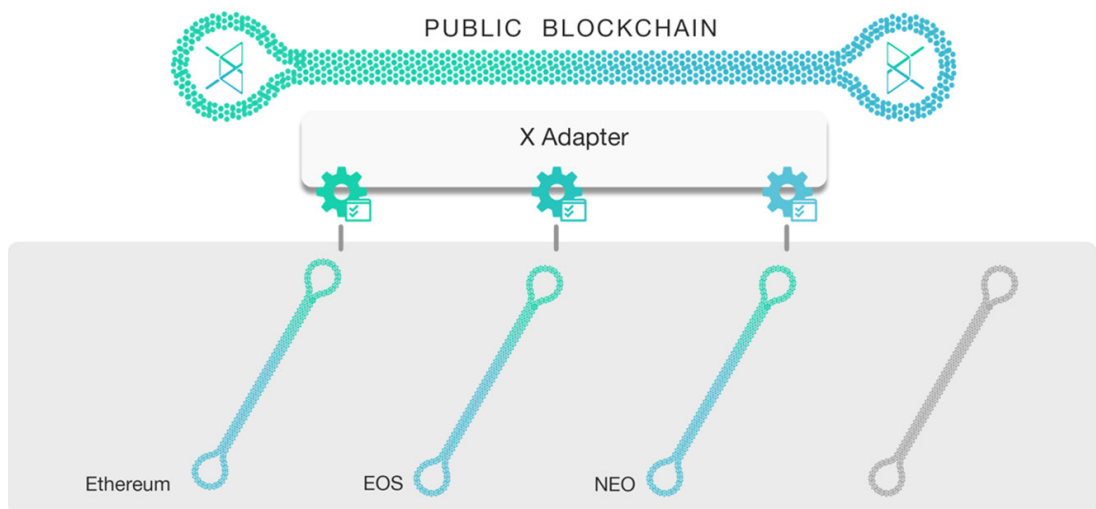
Consensus adaptor—X-Adaptor

X-Block innovatively designs X-Adaptor, a consensus adaptor: apart from the X-BFT consensus algorithm on the main chain, X-Adaptor also supports the pluggable consensus algorithm and can swiftly switch to other consensus algorithms, such as PoS, DPoS, DBFT and VBFT, according to specific application scenarios.

3.2.4

Cross-chain communication and multi-chain integration

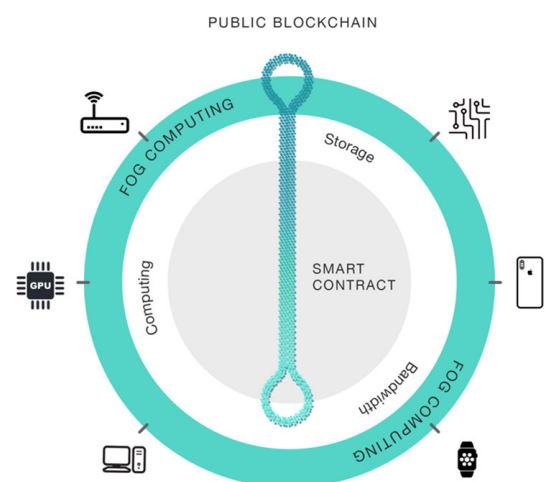
In the practical application scenarios, different service demands are used through different chains. Besides, these service demands are complexly interconnected with each other rather than existing independently. Therefore, in-depth boundless integration between chains is required. X-Block adopts the X-Adapter consensus adaptor to redefine and enrich cross-chain interaction protocols, thus significantly improving the compatibility and expandability of the whole framework. Apart from promoting compatibility among communications of chains following the same consensus algorithm, X-Adapter can also use integration and communicate among chains adopting different consensus algorithms.



3.2.5

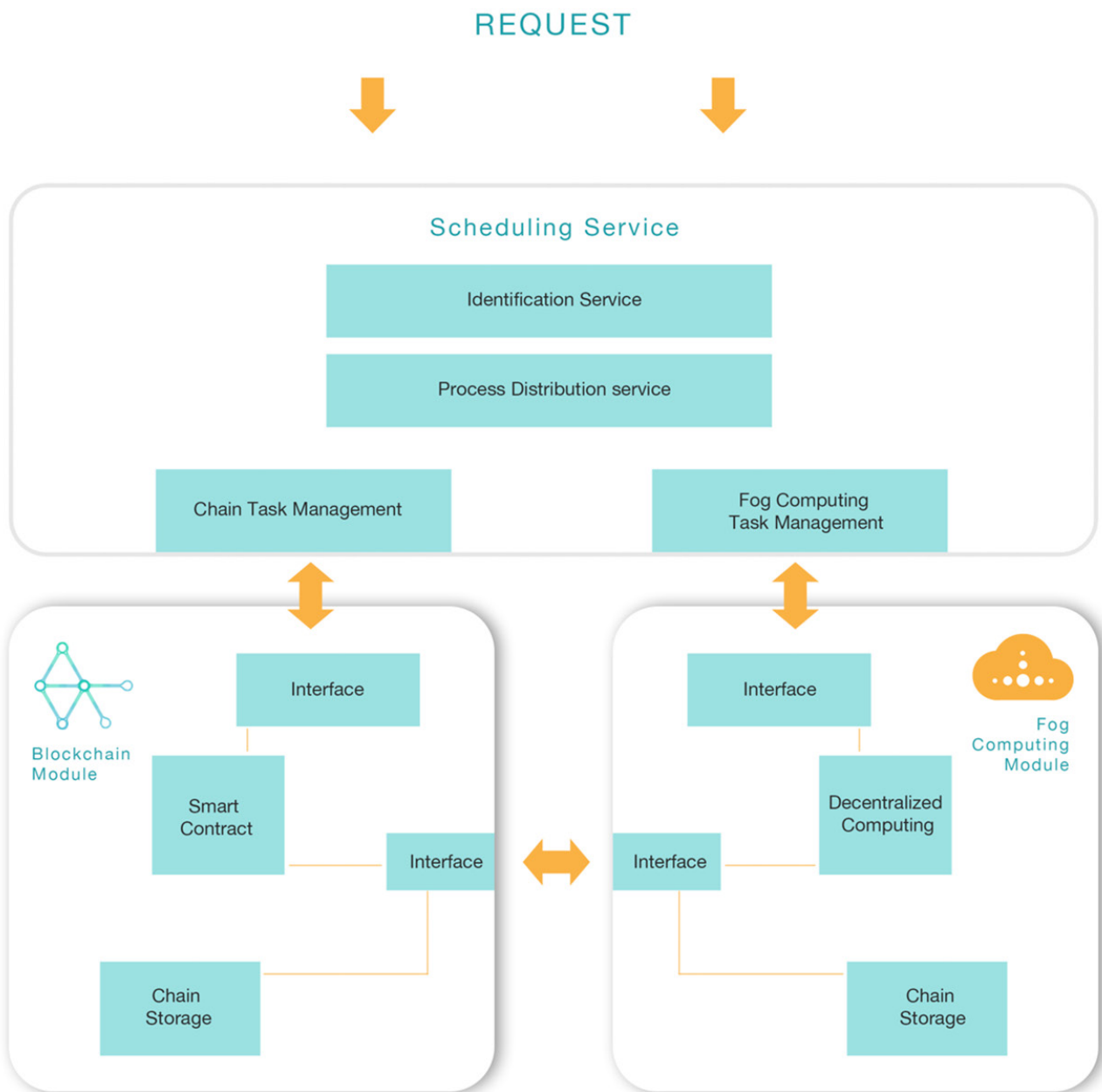
Galaxy Super-Contracts

It has been a publicly-acknowledged fact that not all service demands are operated on smart contracts. Most of them require collaboration of resources off the blockchain. Considering the situation, X-Block puts forward the idea that “resources operate around smart contracts” and creatively designs the “Galaxy Super-Contract structure”. This not only strengthens the ability of smart contracts on the blockchain to gather mass computing resources, but also revolutionarily expands smart contracts. This makes establishment of an all-accessible light blockchain possible.



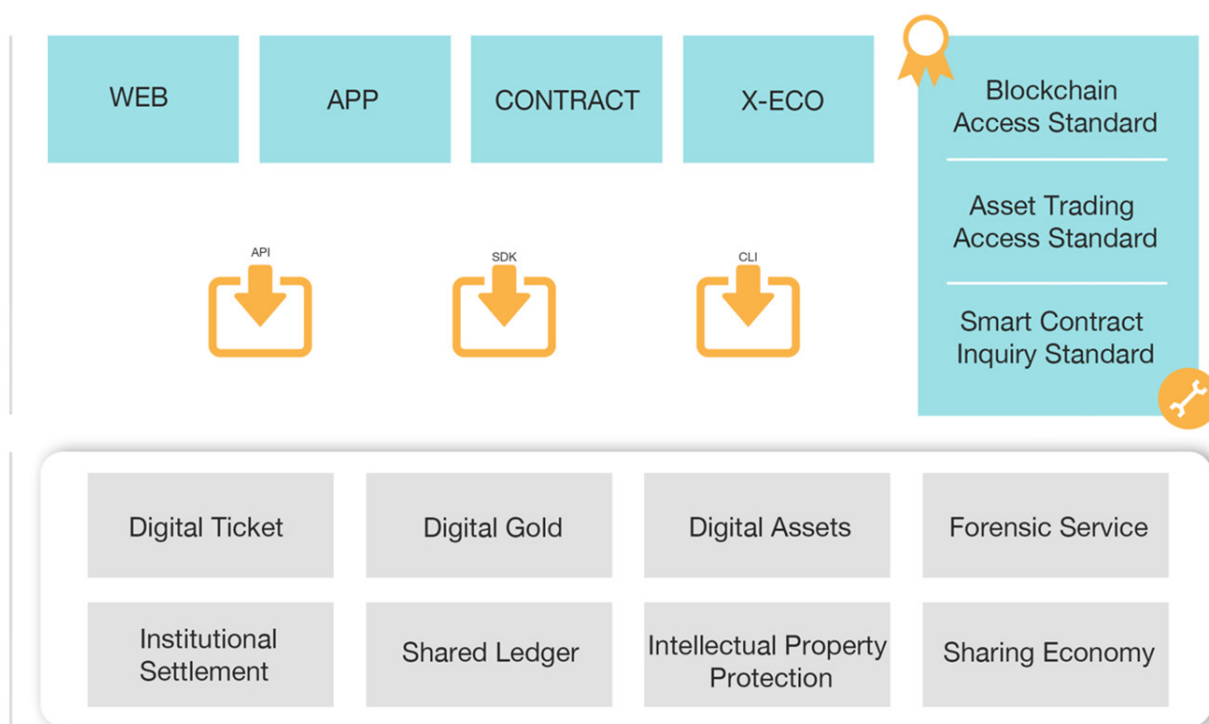
3.2.6 Integration of resources on and off blockchain

Restricted by the node scale, the storage space and operation performance of the blockchain are often inadequate. Therefore, Blockchain 3.0 represented by EOS proposes super-nodes as the solution plan, but this solution plan is realized at the cost of decentralization, which cannot fundamentally solve problems with the blockchain performance. In the X-Block Fog computing system, the off-blockchain resources get integrated with and supplement blockchain resources. Based on the attribute of application requests, the off-blockchain operation and blockchain operation will be formed to repeatedly use CPU, storage and bandwidth resources, which are idle in the Fog computing pool, and to supplement intelligent contracts and storage performance on the blockchain. Finally, optimization of the overall performance can be utilized.

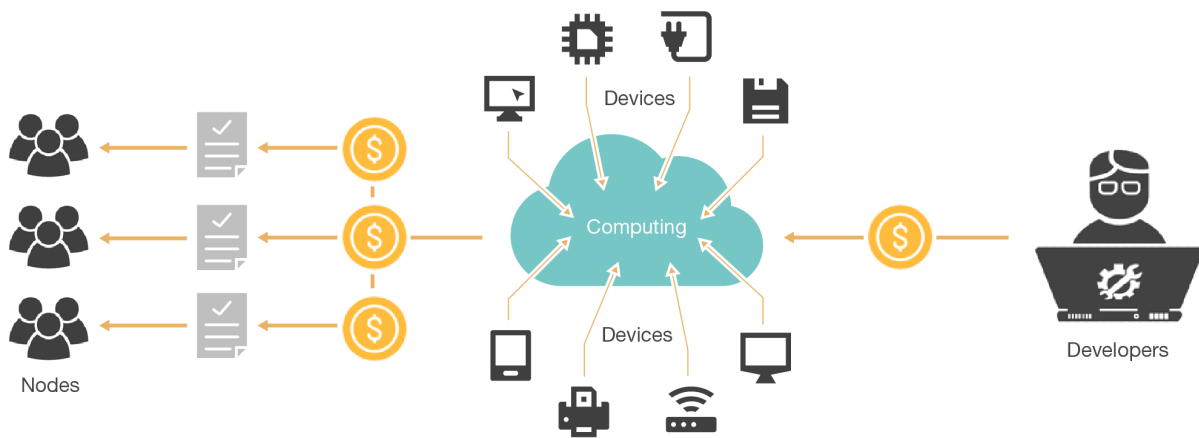


3.2.7 Upper layer protocol sealing

The bottom layer of X-Block possesses a complete distributed account book with interactive protocol. On that basis, it is capable of providing the API with more inclusivity and ease of use. Meanwhile, it is compatible with interactive protocols commonly used in the industry, including REST-JSON, RPC and WebSocket. At the same time, X-Block has defined multiple protocols, including the blockchain operation standards, asset transaction standards and intelligent contract checking standards. At the same time, a variety of interfaces, such as API, SDK and CLI, are provided, based on which Web applications, APP, smart contract programming (IDE) and ecology- related applications are developed. This helps provide not only a unified set of standards for various industrial applications in X-Block ecology, but also a solid foundation for large-scale ecological prosperity of X-Block



4.0 Token economy



Token economy of X-Block can maximize the commercial value of idle equipment resources. In the X-Block system, users can lease out idle equipment resources, such as bandwidth, CPU and storage space, to get IX tokens as rewards. Or they can participate in notarization generation of blockchain to get mining rewards. Developers purchase virtual computing resources with IX tokens to get operation support from blockchain smart contracts as they do to Amazon cloud services. In the X-Block system, IX tokens use win-win cooperation between the computing resource receiver and the resource provider to finally achieve a virtuous cycle of the whole blockchain ecology.

Different devices can gain different rewards according to different resources contributed by them. The rewards are distributed by the distribution management module all-together.

In order to solve the X-Block token transaction and market pricing problems, we built X-Change, the X-Block mainchain can interoperate with the X-change, and the X-Block token can directly trade on the X-Change to achieve the pricing of the token. At the same time, the X-Block smart contract engine provides token production and supports Dapp operation. Similar to Ethereum ERC-20 tokens, these tokens can directly trade on X-Change.

X-Change obtains X-Block tokens through trading. Meanwhile, people who hold X-Block tokens can possess exchange rights, enjoy dividends and co-govern the exchanges.

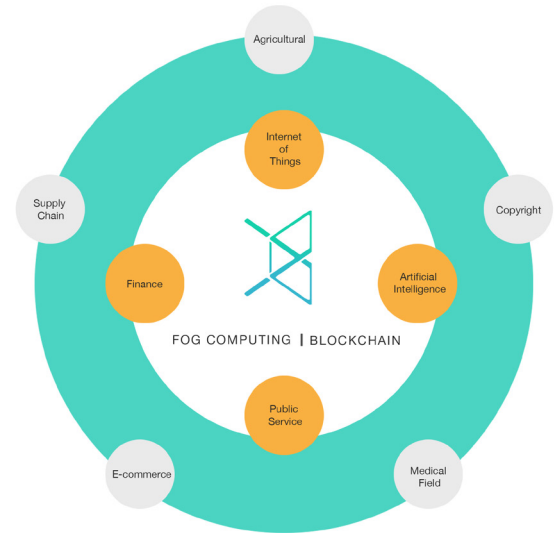
X-Change can also be utilized as an exchange platform for other crypto currencies. Not only can developers use X-Block's tools during the development process, but also offer their tokens on the platform when the time comes for their ICO. By including their token on the exchange, developers can eliminate the struggle of finding a platform for their mainchain to reside while participating in X-Block's elite compatibility system. This makes their own chains more accessible – crucial facet of the offering process. X-Change can effectively be difference between a successful ICO and the collapse of a token.



5.0 Industrial applications

5.1 “Fog computing + Blockchain” is a better plan which can replace the traditional cloud computing

Almost all Internet services need the computing ability to support products, such as mobile Apps, e-commerce and game companies requiring big data. However, traditional solution plans rely on expensive options such as Amazon or Microsoft cloud computing services. Thus, enterprises can have access to more service resources at a low cost by using the X-Block Fog computing services.



5.2 Further empower industrial applications of the Internet of Things

The idea at the core of the Internet of Things (IoT) is to combine all aspects with the Internet via the information sensing equipment for information exchange and use of intelligent recognition and management. The blockchain is a framework which promotes transaction processing and collaboration among devices interacting with each other. Every device on the Internet can operate as an independent and smaller-scale commercial entity. The concepts provided by the two are consistent with each other. The previous applications of IoT were limited by the idea of decentralization to utilize connection of everything. Besides, as the network scale expands, the infrastructures, including the decentralized cloud server, large-scale server and network facilities, and their maintenance will become increasingly expensive. The X-Block Fog computing solution plan can create widespread computing efficiently at a low cost, develop equipment with the autonomous resource production capability, and use interconnection in daily application.

5.3 Reform of artificial intelligence

By gathering multiple nodes, X-Block can collect more scenario data from the fog layer more accurately and facilitate use of the artificial intelligence algorithm for machine learning. Operation of the algorithm on blockchain and Fog computing layer can obtain mass data via the light nodes to support large-scale scenario operation.

5.4 Public service

Traditional notarization relies on the government, but limited data dimensions and historical data information chains, which have not yet been built up, usually result in failure of public service subjects such as governments and schools to obtain complete and valid information. Fog computing of X-Block can provide vigorous computing resources, enabling the acquisition of mass information more efficiently at a lower cost, thus cutting the overall public service cost.

6.0 Roadmap

