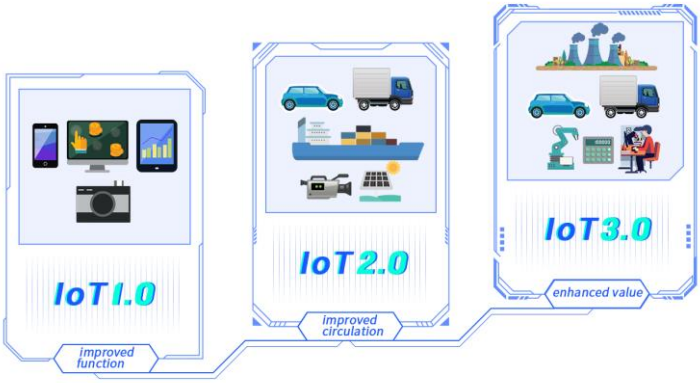
Waltonchain

WHITE PAPER

V2.0

Table of Contents

Preface



This white paper is a periodic summary of the technologies and applications related to the innovative Value Internet of Things (VIoT) concept proposed by Waltonchain. Waltonchain is committed to leading humanity into a reliable digital life, establishment of the Internet of Everything (IoE) and healthy development of a brand new business ecosystem via the blockchain technology.

We firmly believe that innovation creates value and blockchain helps us build trust. With equipment as the foundation, network as the bond, value as the center and data as the vein, we build the blockchain + IoT (VIoT) ecosystem and realize consensus, co-governance, co-sharing and co-integration of IoT data and services in the information era. We will

spare no effort to invest manpower and resources into this innovative IoT system.

The Waltonchain ecosystem framework has been applied to various business scenarios, such as collection authentication, high-end clothing identification, food & drug traceability and logistics tracking. Waltonchain uses a new IoT model to help traditional industries expand business models and product range, extend the value chain, improve operational efficiency and even reduce industry costs.

Realization of strong consistency, multi-connectivity and accessibility is among the technological breakthroughs and innovations achieved by Waltonchain. On this basis, we will eventually build a reliable, trusted, reusable and sustainable system targeted at IoT applications and data circulation.

This white paper provides a detailed overview of the Waltonchain system and guides our friends interested in blockchain. You can find the English, Chinese and Korean version on our official website (https://www.waltonchain.org).

Finally, we sincerely appreciate the valuable advice, feedback and suggestions on Waltonchain ecosystem construction and optimization from our global users.

1 The Call of the Era

With the development and maturity of the Internet, new technologies empower traditional industries faster than ever. The Internet thus comes to a turning point — the Internet of Things (IoT) era. The IoT undoubtedly brings a lot of business opportunities to individuals and enterprises in traditional medical care, logistics, transportation, warehousing and supplies. From a traditional complex network consisting of one smart device (centralized networking) to distributed interconnected physical devices, from machines and cars to household appliances — the IoT is gradually developing new service modes.

From the perspective of the whole network technology development, the number of things we can connect to increases constantly. From files and nodes to devices, it is no longer impossible to connect everything. However, while IoT penetration rates are soaring, there are some key challenges ahead.

1.1 The IoT Predicament

Fig. 1.1 Challenge faced by the traditional Internet of Things

IoT solutions focus on the security and privacy issues of devices and data collection. The predicament of IoT includes:

- **Poor compatibility:** With the increasing possibilities of hardware device interconnection, users are looking for integrated low-cost experience. Therefore, the purpose of object-object interconnection is achievement of greater operability. However, the interoperability (compatibility) of devices and platforms has become a key challenge in the development of IoT solutions because of the simple function of IoT equipment and coexistence

of multiple protocols. A single IoT platform lacks ability to connect all manufacturers' equipments.

- **Poor security:** With the rapid development of the IoT technology, its security and reliability have become a hot topic. Attackers can pose a real threat using the vulnerabilities in IoT devices and disclosing home data from online routers and private user information from social networks. DoS attacks on IoT devices prove that a large number of low-cost networking devices pose a major challenge to the IoT security. Massive data collected by millions of devices has always posed security risks and privacy problems to individuals, businesses and governments.

- **Low architecture flexibility:** When a centralized cloud-based IoT platform performs message routing (i.e. data transfer), any disruption could affect the entire network. In real society, it is a challenge to centralize the management of scattered devices, so reliability of IoT systems is relatively weak.

- **High cost:** The IoT is often associated with a large number of devices and respective network facilities. It turns out that costs associated with traditional IoT solutions are very high. The solutions also need to handle a lot of messages (communication

costs), device-generated data (storage costs) and analysis (server costs). The future development continues to add up costs.

- **Poor scalability:** As IoT communication methods and networking technologies fail to keep up with the growing complexity and interconnectivity demands of technology; the IoT is rife with problems such as outdated equipment, inefficiency and high costs.

- **Data uniformity**: The entire Internet of Things is still in state of data dispersion and information fragmentation. It is difficult to collect complete and accurate information about flow, circulation and quantity of materials, equipment and products. While there is data available for collection, aggregation and dissemination, still, ensuring data accuracy and application uniformity across business models remains a challenge.

In a survey quoted by *Biggest Opportunities and Challenges of IoT-Enabled Products and Services*, 51.3% of IoT implementers indicated that **cost** is the top issue they want to improve; **data analytics** (48.1%) and **safety** (47.5%) followed.

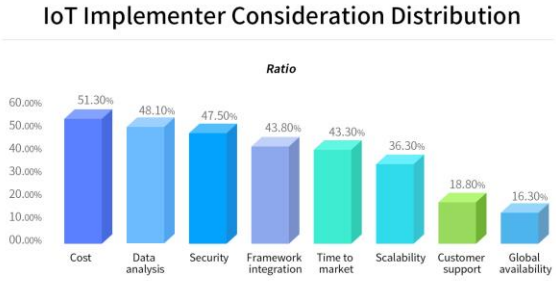


Fig. 1.2 IoT Implementer Consideration Distribution

Other issues to improve include **framework integration** (43.8%), **time to market (TTM)** for future products (43.3%) and **scalability** (36.3%), followed by **customer support** (18.8%) and **global availability** (16.3%).

5.6 percent of respondents expressed a desire to improve power consumption and performance, industry acceptance, user experience, technology and channel partnerships, and provide consumers with attractive value propositions.

1.2 The Opportunity of Blockchain

Two new concepts have recently emerged in the IoT. One is the NDN (Named Data Network). Another is the SCN (Service-Centric Networking). The user demand is no longer limited to how to connect to the network, but focused more on what can be done after accessing the network.The focuse has been converted from the connectivity of the total network to the service demand of the network.. People consider more about the use of the internet. The function of the Internet lies in information transmission; and data is the most important thing for us in the information era.

In a blockchain environment, people do not need to establish trust in advance to transact safely, because every transaction is recorded in the distributed ledger of blockchain, which is immutable and provides verifiable evidence. Blockchain can perfectly solve the trust and equity issues in the virtual world of the Internet. Waltonchain introduced the blockchain technology into the IoT to solve the centralization problems faced in the IoT development with a new idea:

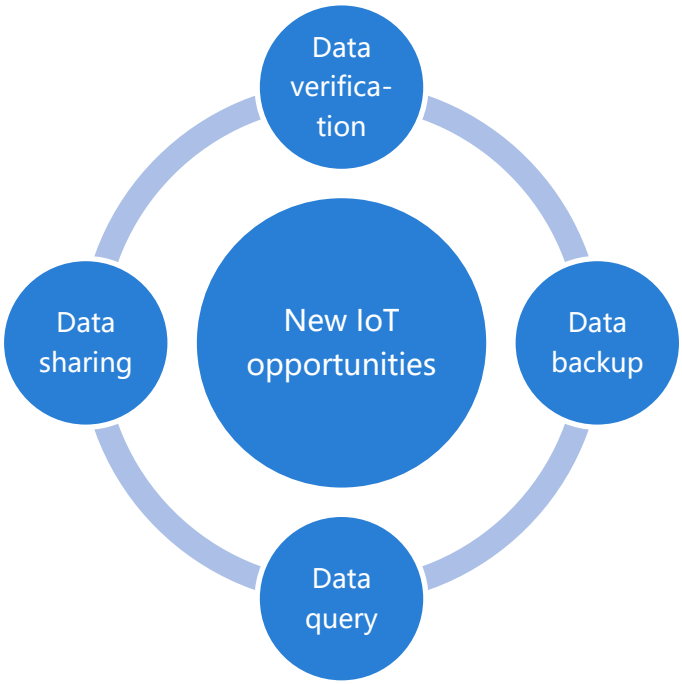


Fig. 1.3 New IoT opportunities

- **Data verification:** In the Internet of Everything, modified IoT equipment will become data generation nodes generating massive, polymorphic, time-varying and dispersive data . Therefore, enterprises face the lack of precise tools to deal with data. Waltonchain uses data labels, integrates and packages massive data and authenticates data stamps to solve the data verification problem in the IoT industry.

- **Data query:** In the large multi-chain and cross-chain ecosystem of Waltonchain, each child chain can accurately store its own data and upload it to the big parent chain ecosystem to realize cross-chain

query through data union and professional distribution of modules.

- **Data sharing:** Although the “decentralized” data sharing claimed by blockchain is a sensitive behavior in many business fields, in the Internet of Things, transparent and open data processing by blockchain can greatly reduce the communication, analysis and data storage costs, and realize differentiated data processing and sharing.

- **Data backup:** Due to immutability of records in the distributed ledger of blockchain, blockchain + IoT not only realizes data backup efficiently, but also increases the cost of data falsification.

Therefore, in the future, there should be a network where all you need to think about is the use, access channels and location of data, but not the source, security or access.

In the new era of information society, everything interconnected together should be data-centered; and data should be the core of the entire Value Internet of Things. In other words, blockchain empowering via the IoT directly adds the “credible value channel” to it, not only solves the inherent pain points of the IoT but also creates the new IoT definition.

1.3 The Vision of Waltonchain

Advancement of the entire network architecture, high cost, devices, terminals or services used for connection are no longer the focus in the IoT. What we really consider is the meaning of connection.

Blockchain just happens to establish faith to build a new-generation IoT ecosystem with software and hardware fusion, multi-chain network integration, data sharing, cross-domain query verification and value transmission:

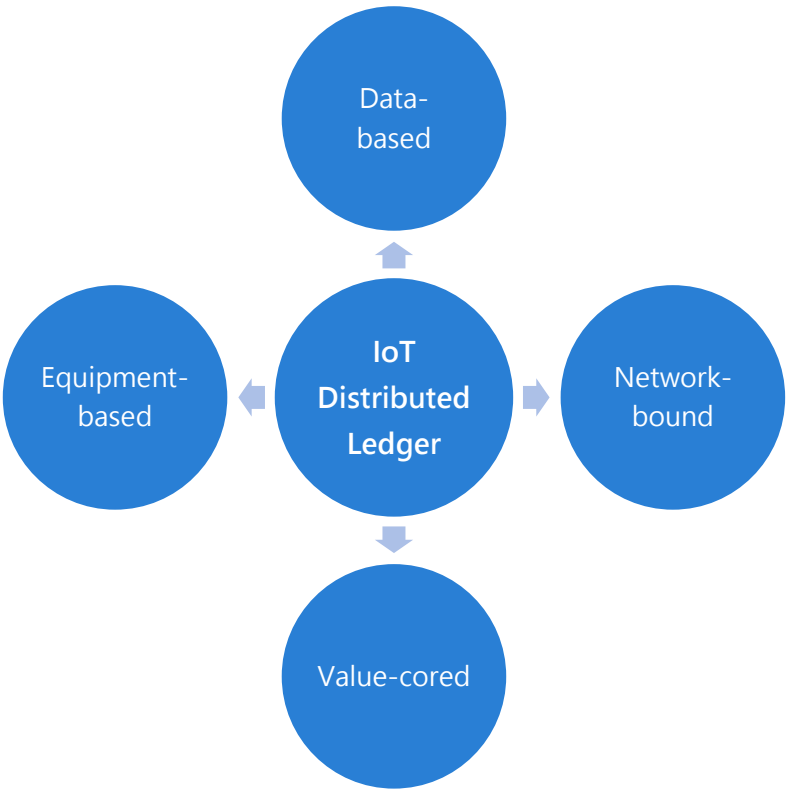


Fig. 1.4 New IoT model

- **Data-cored:** Data is valuable only when it is used. Data sources and channels are not the top concerns for the general public. The public is more concerned about data access and usage. Different access roles and scenarios should have corresponding data management and control.

- **Equipment-based:** Since data mostly happens to be multivariate and mobile, multiple vectors exist when devices connect large amounts of data. When data amount is large and problems of accuracy, credibility and consistency occur, distributed devices provide better and more convenient uploading to blockchain and distributed storage.

- **Network-bound:** Since IoT data is distributed, multivariate data will raise the standardization or uniformity problem. Blockchain's distributed ledger is naturally compatible with IoT data distribution. New business models will emerge as this distributed data begins to circulate effectively.

- **Value-veined:** The space where data exists is fragmented. The existing network data circulation is not smooth enough and therefore affects data value. When effective data circulation starts, value circulation follows and brings transactions and exchange.

This is also a problem that could be solved by blockchain's unification.

The vision of Waltonchain is to lead humanity to the reliable digital life via blockchain, realize the consensus, co-governance, co-sharing and co-integration of IoT data and services in the information era.

Fig. 1.5 Vision of Waltonchain

- **Consensus:** The blockchain technology can ensure consensus. Its real-time data uploading, tamper resistance and continuity ensure unity and integrity. These features promote effective data circulation and cooperation.

- **Co-governance:** Blockchain's distributed storage brings decentralization. With consensus mechanisms, effective data co-governance and coordination can be achieved through encryption algorithms or confidentiality agreements.

- **Co-sharing:** Waltonchain is a cross-chain ecosystem where the parent chain and child chains serve as the framework. Here data

can access data on other chains, thus realizing cross-chain data co-sharing and effective and quick indexing.

- **Co-integration:** Waltonchain is developing a main chain surrounded by various blockchains, the parent chain. In the cross-chain ecosystem with the parent chain and child chains as the framework, the exchange between data circulation and value can be realized between child chains.

Therefore, the blockchain technology will be a game changer for the traditional Internet of Things. It can add up the missing links to the IoT P2P distribution, bring IoT transactions where no third-party confirmation is needed, gradually solve the problems of scalability, single-point failure, time-stamps, records, privacy, trust and reliability.

2 Technological Superiority

At the current development stage, the superiority of Waltonchain comes not only from the combination of software and hardware, but also from the advanced equipment, software, protocols and algorithms.

Fig. 2.1 Core technology advantages of Waltonchain

Waltonchain has its own mainnet (parent chain) and works on its extension and development. We have a blockchain explorer, user terminals, management tools and on top of that the core hardware equipment of our own. We consider how to extend the existing technological base, ideas and architecture into a wider space.

2.1 Overall Structure

In acquisition, perception and processing of all available data in the IoT or an ecosystem network, Waltonchain mainly focuses on two aspects:

1) data reliability;

2) data value circulation.

We have redefined the architecture of the Waltonchain ecosystem network, which is composed of six layers: object layer, base layer, core layer, extension layer, service layer and application layer.

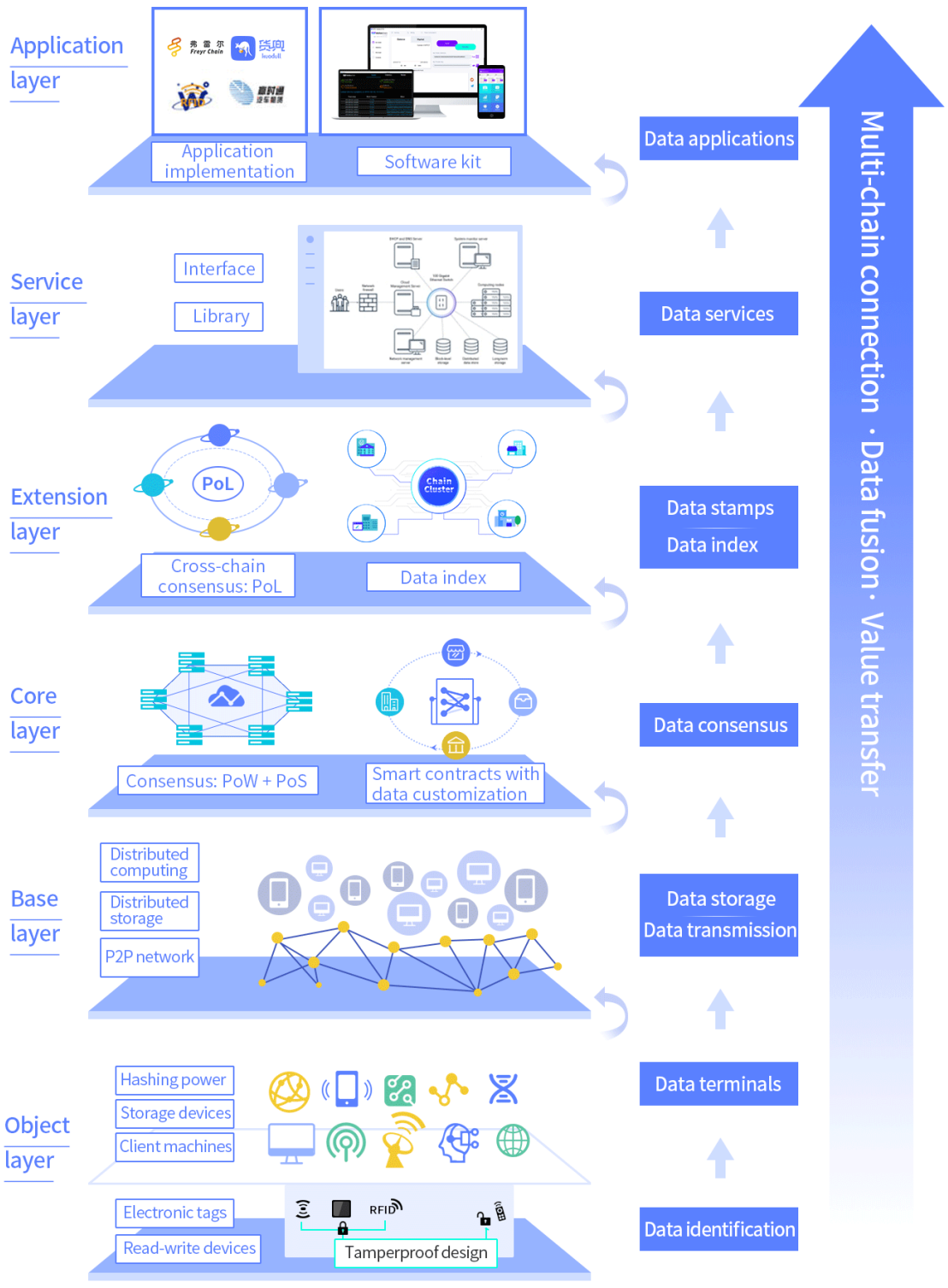


Fig. 2.2 Structure of the Waltonchain ecosystem

2.2 Hardware Design — Object Layer

We hold the idea that pure software IoT solutions are vulnerable. Programs are written by people and can be tampered with; data can also be modified. How do we ensure that it is true from the source? The solution is to upload true data to the chain, so that it is tamper resistant.

The existing blockchain applications mostly adopt software solutions and lack hardware support. Although the blockchain technology can guarantee data tamper protection, openness and transparency, because of the lack of hardware support the existing application schemes cannot guarantee authenticity and reliability of data sources. The key feature of Waltonchain is implementation of a blockchain hardware system ensuring that data is authentic and reliable from the source.

2.2.1 Two-way Authentication RFID Chip

We developed an RFID chip design with hash-and-signature-based data self-verification. This self-verification method ensures that, having a correct Access-Pass, a reader-writer can read and write to RFID chips and also provides certain control. With the hash and signature algorithm, two-way authentication between the RFID reader-writer and the RFID chip is realized to ensure that all read and write operations are undeniable and

tamper-proof, i.e. suitable for RFID technology applications and industries with safety requirements.

The working process of the two-way authentication RFID chip in blockchain applications is shown below:

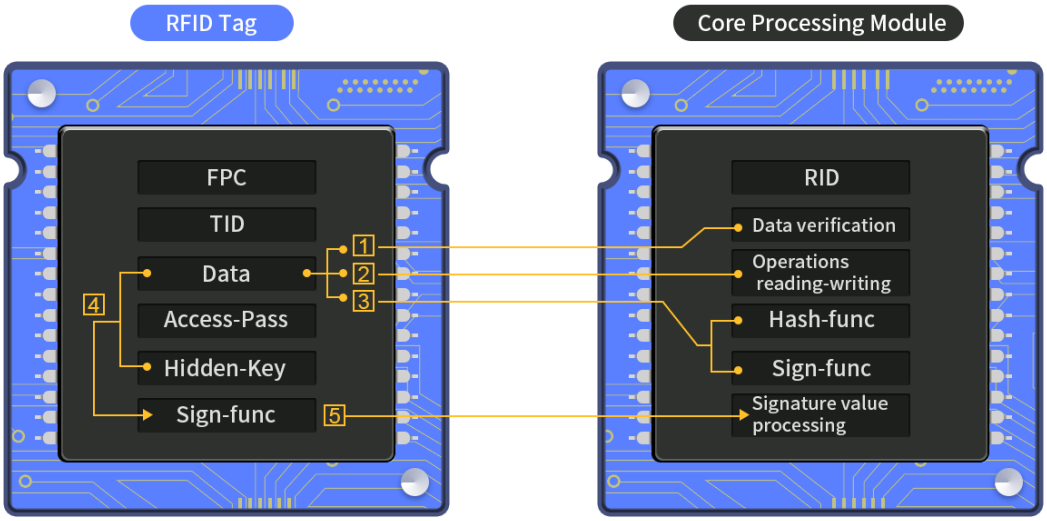


Fig. 2.3 RFID data self-verification system

Advantages of the two-way authentication RFID chip:

1. On the read-write terminal side, hash calculation helps ensure data tamper protection, integrity and accuracy.

2. Based on the signature algorithm, the two-way authentication between the RFID reader-writer and the chip is realized to ensure that the reader-writer's operations on the chip are undeniable and that a certain reader-writer is operating on the chip, thus avoiding impersonation, tampering and denial of reading and writing.

3. When signing, the signed data contains a timestamp and a reader ID (RID) for secondary reading and writing, which ensures uniqueness of each independent operation of each RFID chip and prevents replay attacks.

4. Data self-verification based on hash and signature is integrated into read-write terminals of the RFID system. It allows businesses to pay more attention to business realization, reduces the degree of coupling, but provides security and control.

2.2.2 Sensing Equipment

Data is acquired by sensing equipment, transmitted to the core control module through the interface, processed and organized into standard packets. A data stamp is extracted through hash calculation and signed. Then the master control module automatically uploads the signed data stamp or data index to the blockchain network through the communication module and at the same time uploads the assembled original data to the centralized server.

Sensing equipment can be used to monitor, analyze, process and transmit data and also perform basic AI operations to learn and identify specific source data. It will serve as a data source for blockchain

applications. Automatic stamp extraction from sensor data and automatic uploading to blockchain reduce manual operations and software processing workload. They also help verify the correct processing of products during the whole circulation process, track delivery of goods and prevent theft and falsification. Ensuring data authenticity and reliability from the source has high application value and will greatly promote the blockchain implementation.

2.2.3 Mobile Full Node Equipment

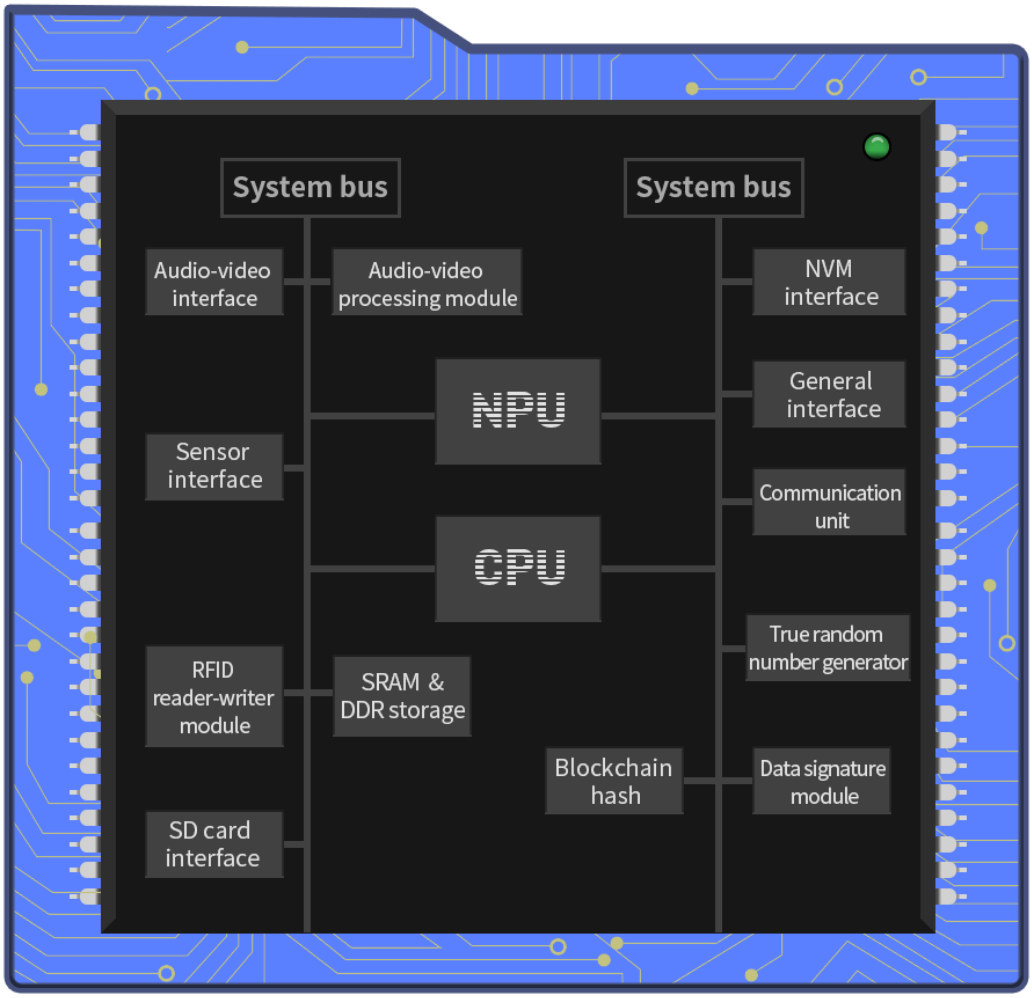


Fig. 2.4 Diagram of the core processing module of mobile full node equipment

The core processing chip of full node equipment is a powerful SoC which can also be built of separate components to realize data collection, processing, storage and running of full node programs. During the whole-core processing, a program run by the main processor controls each interface of the perception layer and obtains perception layer data.

Data cache is stored in the SRAM & DDR storage module. The program assembles the data, forms a standard data packet and invokes the blockchain hash and data signature module to calculate hash and sign the original data. A node program uploads the calculated data stamp to the blockchain, and the original data is uploaded to the centralized server — all through the communication module.

2.2.4 Network Communication Equipment

IoT protocols and interfaces are diverse; therefore our hardware integrates multiple popular physical interfaces. Other units, such as sensor interface, NPU, video processor, common interface, etc., can be Plug and Play add-ons according to user requirements.

As shown in the figure below, the existing IoT protocol standards and interfaces are diverse. A large number of sensing devices are deployed at various application sites. Due to commercial, technological immaturity or historical reasons, various IoT standards are inconsistent, e.g. hardware protocols, data model standards, network protocols, sensor standards, equipment connection standards, platform compatibility, third-party application interfaces, service interfaces, etc. The inconsistency may lead to waste of resources and problems in equipment interoperability. Thus users need to develop various perceptual networks independently, which

increases the difficulty and complexity of upper-level application development.

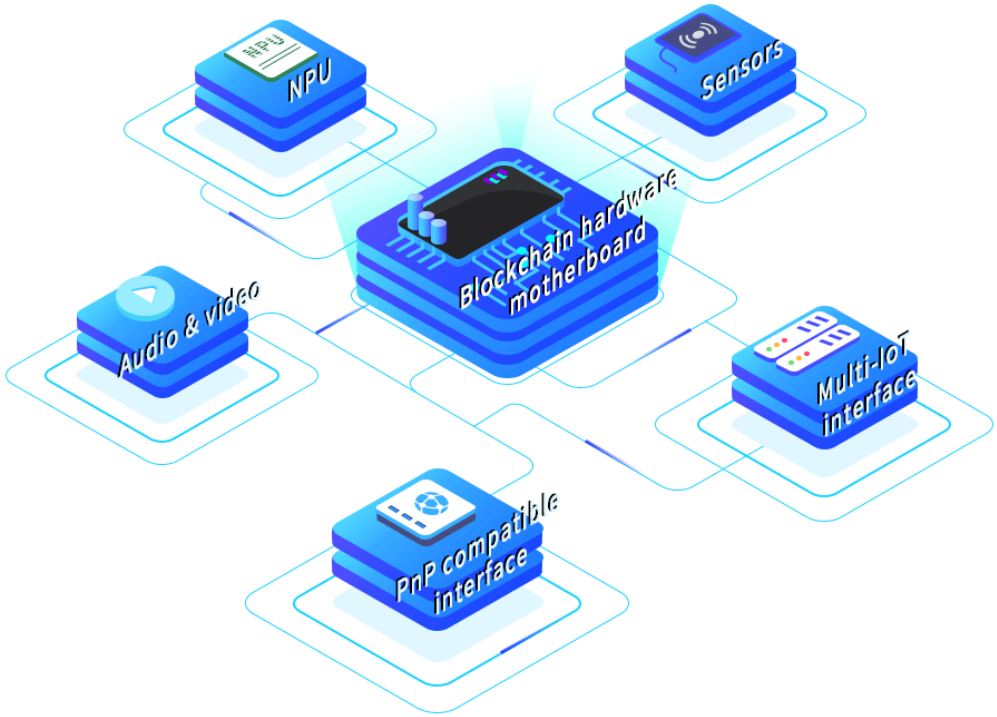


Fig. 2.5 Plug and Play compatible interface

In the existing network layers, interface protocols are not unified. The Waltonchain hardware system is a blockchain hardware system with independent intellectual property rights. It can be compatible with mainstream IoT communication interfaces and adopts the hardware asymmetric encryption technology to ensure data security and prevent attacks. Compatible IoT transmission standards include 5G, NB-IoT, LoRa, ZigBee, PLC and other common interfaces.

The first step to realize the data-oriented value blockchain ecosystem is construction and gradual improvement of the data network through acquisition of terminal data.

2.3 Core Layer and Extension Layer of the Waltonchain (Parent Chain)

In general, data in a blockchain + IoT ecosystem is also a simple ecosystem. Parts of the ecosystem are fragmented. Different domains build their own data ecosystem around their data, or build their own blockchain architecture. Even blockchains may adopt different structure and technical systems. The main aim of Waltonchain is to connect data. We use integrated hardware and software, smart contracts with data customization, the Waltonchain cross-chain technology and WPoC consensus mechanism to achieve data integration, circulation, verification and storage between different blockchains (child chains), and thus connect different data sources and obtain wide data circulation.

As the Waltonchain (core layer) has evolved from Go Ethereum, it carries and extends its consensus mechanism and smart contracts. However, to realize data circulation and value transfer, Waltonchain has to change its core features in the following aspects:

2.3.1 WPoC Consensus Mechanism

Waltonchain consensus mechanism WPoC (Waltonchain Proof of Contribution) is one of the important mechanisms to maintain the benign development of the Waltonchain ecosystem. WPoC includes three

components: PoW (Proof of Work) + PoS (Proof of Stake) +PoL (Proof of Labor).

PoW and PoS are used on the Waltonchain parent chain and both ensure that parent chain blocks are unique and secure. PoW provides reliable data protection through computing (hashing) power; still, it does not prevent the risk of 51% attacks and also lacks the features of environmental protection and energy saving. Therefore, to reach the balance we use PoS, as it reduces wasting of calculation resources and the risk of 51% attacks. Through the interaction of PoW and PoS algorithms, our parent chain can solve the trust issues of data verification, storage and circulation in economic activities within the ecosystem.

PoL is a brand new consensus mechanism for data transmission and token exchange between various parent chain, child chain and cross-child-chain nodes on the Waltonchain network, i.e. SMN (Super Master Nodes), GMN (Guardian Master Nodes) and MN (Master Nodes).

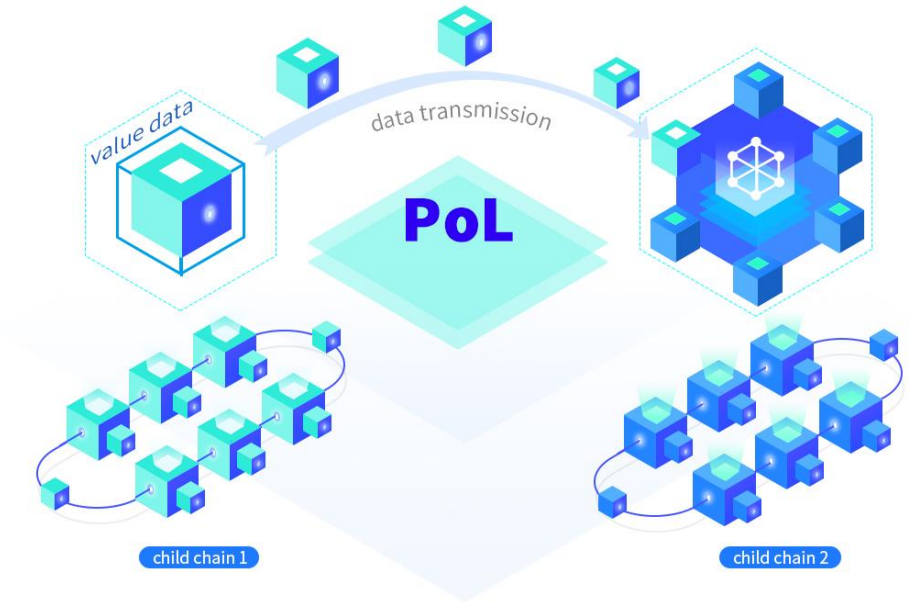


Fig. 2.6 PoL cross-chain consensus mechanism

The whole Waltonchain ecosystem ensures blockchain self-protection through calculation and tokenization based on the reasonable fuel (Gas) mechanism. Therefore it is necessary to both realize cross-chain transmission without affecting data circulation and maintain the Turing complete ecosystem mechanism of Waltonchain as follows:

- **Cross-chain data transmission:** Extraction of hashes or indices basing on data features and storage on the Waltonchain parent chain makes it convenient to search for data in the Waltonchain network in the future. Using our cross-chain index mechanism, the required data can be found quickly; its authenticity can be verified quickly through cross-chain data.

- **Cross-chain token exchange** is realized via a ledger based on atomic token swaps; it is used to record every transaction between Waltoncoin and child chain coins or tokens. Refer to the conversion process between a child chain token and Waltoncoin below.

Only in this way can we realize multi-chain connection and data fusion. With the implementation of "black box" operations of traditional network communications to obtain data, ecosystem users and enterprises no longer need to consider problems such as access, communication protocol or absence of network connection for IoT devices and can focus on what data is needed, what to use it for and how to show it to the others.

Fig. 2.7 Cross-chain token circulation

The second step to realize the data-oriented value blockchain ecosystem: with data storage and query index, users get accurate data according to their requests; all the relevant data is not provided directly without filtering; data rights are allocated effectively; data privacy is protected.

2.4 Smart Contracts with Data Customization Support

The smart contract language supported by the Waltonchain network is also Turing complete. It is because of the powerful smart contract language that the originally complex real-world business logic and applications can be easily implemented on blockchain. However, due to the operating mechanism of blockchain, even if smart contracts are abnormal, they will run repeatedly and independently on all blockchain nodes. Therefore, in terms of computing and storage resources, it is very expensive to run smart contracts on the Waltonchain parent chain and child chains (alliance chains).

Application users and enterprises are more concerned about the data format used. Where is data stored? How to get this data? What about Gas?

We set up the unique Data Pattern for Smart Contract to drive business events. We keep the logic of the data-specific smart contract language simple, reduce Gas consumption, standardize operations such as data reading and event triggering, and provide output data in standard formats (e.g. Json). Our smart contracts can be reused and inherited.

In fact, many operations (such as writing data to blocks of the Waltonchain parent chain) are not suitable for direct execution on the

parent chain; therefore contracts support events at the language level. The relevant parties can be directly notified to start processing when the expected event occurs. The contract developer doesn't need to repeat the same logic, thus cross-chain data transmission is standardized in the ecosystem. Refer to the principle in the following figure:

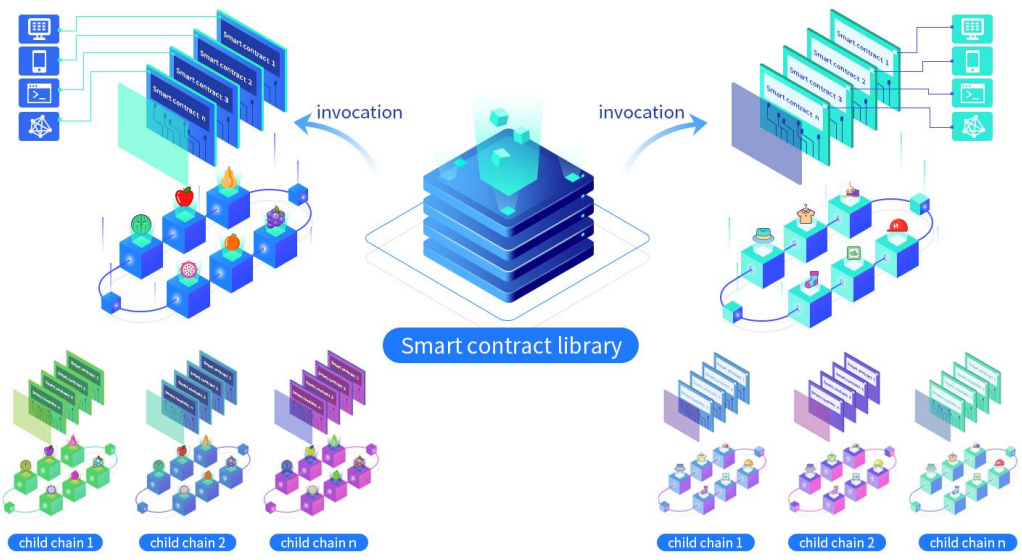


Fig. 2.8 Smart contract library

We designed and built a number of smart contract libraries where smart contracts can be quickly queried, invoked, inherited and reused via the event function index. The relevant data is self-generated. After a developer, user or enterprise obtains a relevant standard data file, data interaction between an application and other child chain systems can be achieved.

Data consistency, normalization, access and circulation within the Waltonchain value blockchain ecosystem can be realized step by step:

- **Consistency:** The core of consistency is consensus. Due to a huge amount of data in the IoT ecosystem, data recognition problems occur among different industries, equipment and attributes. Therefore, the unique mechanism of blockchain is used for data consistency.
- **Normalization:** The diversity of data leads to the lack of data standards or uniformity. However, the basic condition for unification is actually the liquidity of data. Only when data can circulate on more levels can it be normalized in social networks.
- **Accessibility:** Data circulation also has its value — usability. The real value of data can be realized only when more people can access it from different environments and devices.
- **Liquidity:** Data is like scattered pearls; the space where it exists is fragmented. Only after we arrange and combine this scattered data can we truly realize and develop its value and thus complete the transaction and exchange process in social networks.

The third step to realize the data-oriented value blockchain ecosystem is data services. The questions arising here are: What to use the data for? How to present it? How to make it visible to others?

2.5 Child Chain Data Application Templates

The Waltonchain supports smart contracts of popular blockchains, such as Fabric and Ethereum. Therefore we provide child chains with different architecture according to requirements of different scenarios. Rapidly constructed prototype child chains serve as data application templates. They help users and enterprises quickly build child chains, regardless of their experience in blockchain development. The child chains built in the Waltonchain ecosystem can also quickly link the interface and functions of the Waltonchain parent chain and realize the ability to derive and expand.

2.5.1 Fabric Smart Contracts

Fabric smart contracts (chaincode) are divided into system chaincode and user chaincode. System chaincode realizes system level functions; and user chaincode realizes user application functions. Chaincode is compiled into a stand-alone application that runs in an isolated Docker container.

Unlike Ethereum, Fabric's Chaincode is separated from the distributed ledger. During Chaincode upgrades, there is no need to transfer ledger data. Thus the real separation of logic and data is achieved. Chaincode supports writing in Go, Java and Node.js; it interacts with peer nodes via gRPC to realize data applications for alliance chains (Fabric child chains).

2.5.2 Ethereum Smart Contracts

When it comes to writing smart contract programs on Ethereum, Solidity is the main programming language. Its four key elements are: Contract, Variable, Function and Event.

Contract is the core concept in Solidity, so we use Web3 to transmit data and provide API on Ethereum alliance chains (child chains).

When a token is defined using the ERC20 standard, a new event is defined. When token transactions occur, such events can be detected by the JavaScript API and its Web3 service is invoked.

Many basic chains use Solidity as a programming language for smart contracts. Some basic chains such as EOS provide a C++ API for writing smart contracts. This is just a matter of choice by different platforms for different purposes. Therefore Waltonchain smart contract library will be constantly updating to provide more data application services and meet the needs of different blockchains.

2.6 Chain Cluster

Multiple chains need to be effectively connected to form a cluster. A chain cluster is a natural derivative under the large public-chain ecosystem. A public chain can carry countless child chains through hierarchical structure. It is assumed that as this “data value machine” becomes bigger, data in circulation must seek normalization. Thus chain clusters are inevitable. Different chain clusters can realize secondary propagation and integration of data value, more efficient cross-chain exchange and query.

Fig. 2.9 Chain cluster

The Waltonchain is the first public chain in the industry to advocate for such data value specifications. This public chain will also carry child chains of multiple industries to form an expansive business ecosystem with a benign development model. In this business environment, data generated

between different child chains can be exchanged, traded, queried, etc. Data between different child chain ecosystems must coincide to a certain degree. Thus we believe that, with data circulation, exchange and integration, ecosystem chain clusters will inevitably appear. In the vast Waltonchain ecosystem, these chain clusters realize the second reorganization of value and enrich the whole ecosystem order.

3 The Current Ecosystem

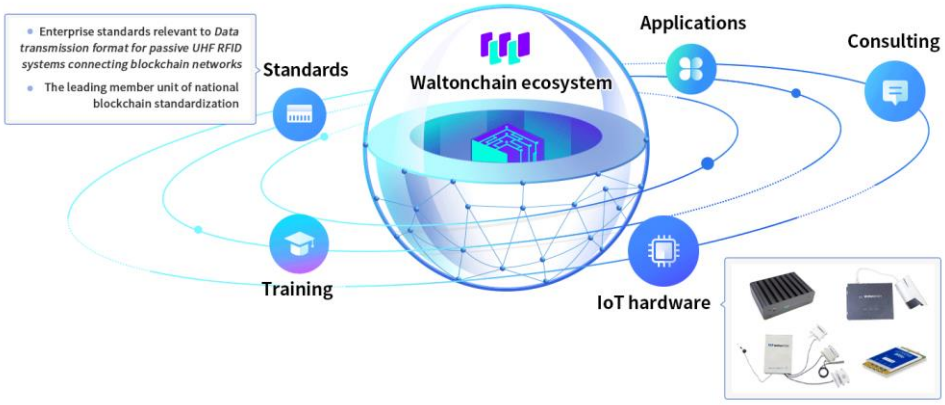


Fig. 3.1 Waltonchain ecosystem

The Waltonchain team and the community have been committed to establishing a complete, reliable, credible, scalable and transferable data-value-oriented blockchain ecosystem of the Internet of Everything, and strives to make Waltonchain an integrated data collection equipment manufacturer, data communication researcher and developer, and data service provider.

3.1 Equipment Developers

The Waltonchain technical team has developed a smart RFID reader-writer with independent intellectual property rights, which can collect data, process it and upload to blockchain automatically.

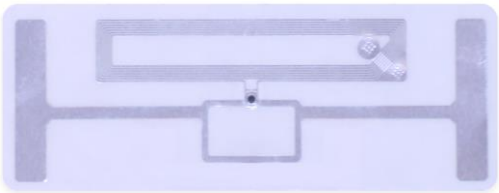


Fig. 3.2 RFID tags

Fig. 3.3 RFID read-write terminal

Fig. 3.4 Encrypted data collector

We also developed a smart data collecting device with independent intellectual property rights, which automatically collects, processes and uploads various sensor data, audio and video, location information, etc. to blockchain.

3.2 Application Designers

3.2.1 Food Traceability System

The food traceability system based on the Waltonchain blockchain technology and relevant hardware equipment includes video collecting equipment, sensors, smart terminals, a food traceability child chain, cross-chain nodes and a data inspection system platform. After adopting the system, data hashes can be extracted and uploaded to blockchain automatically through smart terminals to ensure that the data is tamper proof. Consumers can easily check the relevant data through the data inspection system platform.

Fig. 3.5 Food traceability: soil information collection

Waltonchain technical team developed the S.I. Two-way Traceability Marketing Platform targeted at traditional traceability systems in the food

industry. Waltonchain conducted the Blockchain+ transformation of its traceability platform: to ensure tamper protection, traceability information is uploaded to blockchain.

Fig. 3.6 Food traceability system

3.2.2 Clothing Traceability Authentication System

The clothing traceability authentication system based on the Waltonchain blockchain technology and relevant RFID hardware system includes RFID tags, smart RFID reader-writers, clothing child chains, cross-chain nodes and an inspection system platform for data applications. The system can facilitate data circulation in production, logistics,

warehousing, sales and other links, and ensure data authenticity and traceability of each garment. It can simplify the process, reduce cost for enterprises and ensure consumers' interests by allowing them to check authenticity and quality of the purchased clothes easily.

Fig. 3.7 Functions of the clothing traceability authentication system

The KALTENDIN Production, Warehousing and Store System is an information management system for the clothing industry developed by KALTENDIN Group through adoption of the RFID IoT technology and blockchain technology. It utilizes RFID tags to read commodity information quickly and the blockchain technology to link traceability information and ensure it is tamperproof.

Fig. 3.8 Demonstration of the clothing traceability authentication system

3.3 Technology Disseminators

As the saying goes, “It takes ten years to grow trees, but a hundred to rear people.” The Waltonchain team is dedicated to training new forces and ensuring sustainable development.

Waltonchain has established a curriculum system, experimental system and professional laboratory in Blockchain + IoT. It trains professionals with industry competitiveness for global secondary and higher vocational colleges, universities and training institutions to build a team of talents.

Together with authoritative educational and marketing platforms in the industry we have selected educational products to develop and promote Blockchain + IoT. We have reached comprehensive cooperation on respective training platforms, courses, textbooks, skill appraisal, skill competition and school-enterprise cooperation. Our educational products will also include short-term theoretical training and applied practical courses on blockchain.

Waltonchain will cooperatively provide new-generation smart chip, module and system solutions based on the sensor technology and strong technical support for the industry layout, product positioning and promotion, and secondary development and application of Blockchain + Education.

3.4 Consulting Service Providers

The foundation of our self-development is the Waltonchain Value Blockchain. In the course of our business services which include development of blockchain systems and DApp products, alliance chains, exchange platform systems and product uploading to blockchain, we have been constantly accumulating experience and benefit from a clearly defined corporate culture. Due to the bold and innovative thinking, we have attracted a large number of outstanding high-tech and business talents from ZTE, Huawei, domestic and overseas blockchain companies to join our team, and aim to make Waltonchain the leading blockchain consultant in China.

Refer to the list of project requirements and related services below:

Project	Industry	Application	Service Content
Skynovo	Agricultural products	Food traceability	Cooperation in application development; technical and consulting services
Huodull	Logistics	Logistics tracking	Technological development and consulting services: child chain construction

Project	Industry	Application	Service Content
KALTENDIN	Clothing	High-end clothing traceability	Technological development and consulting services: child chain construction and DApp development
Freyrchain	Art collection	Collection traceability	Technical consulting
ProdutorAgro (Brazil)	Agriculture	Food traceability	Solution consulting and technical support
Yandeh (Brazil)	Auto parts	Auto parts tracking	Solution consulting and technical support
Volcity Wine (New Zealand)	Red Wine	Product traceability	Solution consulting
MitoQ (New Zealand)	Biology	Product traceability	Solution consulting
Global eSolutions Group (USA)	Medical care	Medical certificates	Solution consulting

3.5 Standard Setters

Based on practical experience in technology development, the technical team of Waltonchain has developed enterprise standards related to *Data transmission format for passive UHF RFID systems connecting blockchain networks* and work on their promotion to industry standards and national standards.

When data is collected by a UHF RFID reader and uploaded to the blockchain network to increase data integrity and authenticity, a UHF RFID data storage and management method is combined with the blockchain technology. Standardization of data transmitted by readers to blockchain networks is favorable for reader manufacturers and facilitates equipment interconnection between blockchain network service providers.

Although the industry welcomes progress in implementation, there is still no consensus on blockchain industry standards in China. On August 1, 2018, the National Standard Kick-off Meeting of the *Information Technology, Blockchain and Distributed Ledger Technology Reference Architecture* was held in Kunming, China. This is the first national standard approved in the blockchain field. The Waltonchain technical team was invited as a member of the China Blockchain Technology Standards Working Group and is actively participating in development of standards.

We will contribute to the formulation of cross-chain service management, smart contracts, storage and other domains; promote the benign industry ecosystem development and the new industry stage.

4 Development Blueprint

Waltonchain has divided its path to build the complete Waltonchain ecosystem into five steps.

The first step is to realize token circulation. Waltonchain built, deployed and launched its parent chain and WTC client applications in 2018. Nodes on the Waltonchain can exchange tokens and maintain the parent chain.

The second step is to realize data circulation. In 2018, we focus on the implementation of:

- Freyrchain, the art collection chain; uploading to blockchain and transmission of all kinds of collection data;
- the Huodull logistics child chain; uploading to blockchain and transmission of all kinds of online logistics data;
- the KALTENDIN clothing child chain; uploading to blockchain and transmission of all kinds of clothing industry data.

Waltonchain will enter more child chain domains and upload data from different industries to blockchain for circulation.

The third step is to realize value circulation. Waltonchain are about to complete and deploy the cross-chain architecture. It connects the parent chain and child chains; child chain data can be uploaded to the parent chain. Using the cross-chain mechanism, child chain tokens are exchanged for WTC and can be further exchanged for other child chain tokens, thus value circulates on blockchain.

The fourth step is provision of customized services. After the completion of the cross-chain architecture, the parent chain and child chains connect and interact. Waltonchain has started to provide customized services for various industries. Meanwhile, child chain nodes will query information or use services on other child chains simply by using child chain tokens.

The fifth step is the ecosystem construction. After the above four steps, the Waltonchain business ecosystem is formed via the parent-child and child-child chain integration.

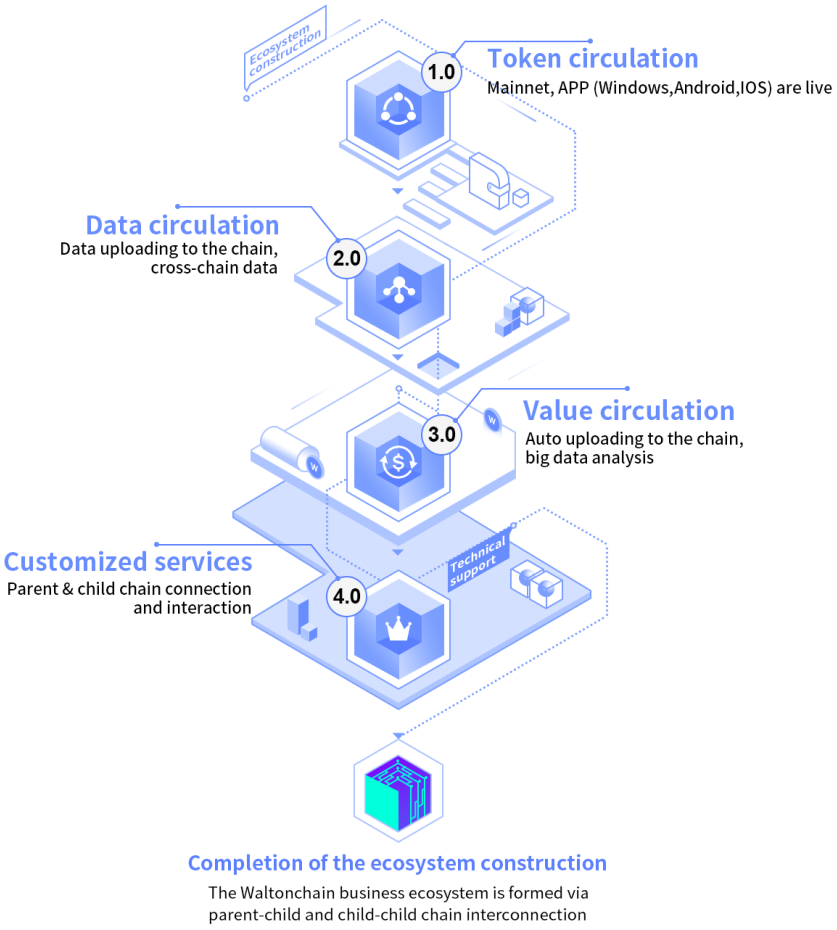


Fig. 4.1 Waltonchain development roadmap

5 Walton Chain Foundation

Walton Chain Foundation Ltd. (the Foundation) is a non-profit organization established in Singapore in 2017. As the management organization of Waltonchain, the Foundation is committed to the Waltonchain ecosystem construction and its benign development, including promotion of technology R&D, project cooperation, massive implementation of applications and community maintenance.

Walton Chain Foundation Governance Structure

The Foundation advocates a transparent and efficient operational philosophy to promote the healthy development of the Waltonchain ecosystem. The governance structure focuses on the effectiveness, sustainability and financial security of project management.

Having established a reasonable governance structure, Walton Chain Foundation agreed on the working rules and procedures of each sub-committee, so as to make rational decisions on major issues of the Foundation and promote daily work precisely.

Members of the Decision Making Committee change every four years and generally include two representatives recommended by each subcommittee, one community representative and one member of the

Waltonchain team. Members of the subcommittees change every four years; they are generally prominent people from related industries.

The Committee is the top decision-making body of the Foundation. Its main goal is to discuss and resolve important issues faced in the course of the Foundation and community development, including:

- change of the Foundation governance structure;
- formation and rotation of the Committee;
- appointment and removal of members of each subcommittee;
- review and amendment of the Foundation Statute;
- decision on the Waltonchain development strategy;
- change and upgrading of the core technology of Waltonchain;
- urgent decision making and crisis management agenda.

The overall structure of the Foundation is shown in the following figure. There are four committees under the Decision Making Committee, namely Technical Committee, Operation Committee, Incentive Committee and Audit Committee.

Fig. 5.1 Walton Chain Foundation governance structure

6 Team Introduction

6.1 Member Introduction

Xu Fangcheng (initiator in China): Chinese, majored in Business Management, former Director for Supply Chain Management of Septwolves Group Ltd., has rich practical experience in supply chain management and purchasing process management. Angel investor.

Do Sang Hyuk (initiator in Korea): Korean, Vice Chairman of the China-Korea Cultural Exchange Development Committee, Chairman of Korea NC Technology Co., Ltd., former Director of the South Korea Electronic News Media Bureau, Director of ET News, Former Director of Korean Standards Association, Chairman of Small and Medium-Sized Enterprise Committee in Seongnam, South Korea.

Kim Suk Ki: Korean, one of the key persons in South Korean electronics industry, Doctor of Engineering (graduated from the University of Minnesota), previously worked at Bell Labs and Honeywell USA, served as a Vice President of Samsung Electronics, senior expert in integrated circuit design, IEEE Senior Member, Vice President of the Korean Institute of Electrical Engineers, Chairman of the Korea Semiconductor Industry Association. He has published more than 250 academic papers and possesses more than 60 patents.

Zhu Yanping: Taiwanese, Doctor of Engineering (graduated from National Cheng Kung University), Chairman of the Cloud Computing & IoT Association in Taiwan. He won the Taiwan Ministry of Education Youth Invention Award and Taiwan Top Ten Information Talent Award. Has deeply studied blockchain applications over the years and led a blockchain technology team to develop systems for health big data and agricultural traceability projects.

Mo Bing: Chinese, PhD in Engineering, post-doctor. Research professor of Korea University, expert in the IoT, expert in integrated circuits, senior member of the Chinese Society of Micro-Nano Technology, IEEE member. Evaluation expert of science and technology programs at Fujian Province Science and Technology Department, evaluation expert of science and technology programs at Jiangxi Province Science and Technology Department, Director of Xiamen City Integrated Circuit Association. At present, he has presided over 10 scientific research projects, published more than 20 articles and applied for 18 invention patents. Since 2015, he has been mainly engaged in research of integrated circuits and blockchain. A number of commercial chips have been successfully developed under his guidance.

Wei Songjie: Chinese, Doctor of Engineering (graduated from the University of Delaware), blockchain technology expert in the field of computer network protocol and application, network and information security. Has published more than 20 papers and applied for 7 invention patents. Previously worked at Google, Qualcomm, Bloomberg and many other high-tech companies in the United States, served as R&D engineer and technical expert; has a wealth of experience in

computer system design, product development and project management.

Shan Liang: Chinese, graduated from KOREATECH (Korea University of Technology and Education) Mechanical Engineering Department, Venture Capital PhD, GM of Walton Chain Technology Co., Ltd. (Korea), Chinese Market Manager of the heating component manufacturer NHTECH (a subsidiary of Samsung SDI), economic group leader of the Friendship Association of Chinese Doctoral Students in Korea.

Chen Zhangrong: Chinese, graduated in Business Management, received a BBA degree in Armstrong University (USA), leader of Chinese clothing & accessories industry, China's well-known business mentor, guest of the CCTV2 "Win in China" show in 2008. Researcher in the field of thinking training for "Practical Business Intelligence" e-commerce and "MONEY&YOU" course, expert on success for "Profit Model" course. Has a wealth of practical experience in business management, market research, channel construction, business cooperation and business models.

Lin Herui: Chinese, successively served as Nokia R&D Manager, Product Manager and Microsoft Hardware Department Supply Chain Director. In 2014, started to set up a number of IoT enterprises and laid out the IoT production chain. Products and services developed under his guidance are very popular.

Zhao Haiming: Chinese, Doctor of Chemical Conductive Polymers of Sungkyunkwan University, core member of Korea BK21th conductive polymer project, researcher of Korea Gyeonggi Institute of Sensor, researcher of ECO NCTech Co., Ltd. (Korea), Vice President of the Chinese Chamber of Commerce (Korea). He has been engaged in transfer of semiconductor, sensor and other technologies in South Korea.

Liu Cai: Chinese, Master of Engineering, has 12 years of experience in design and verification of VLSI and a wealth of practical project experience in RFID chip design process, SoC architecture, digital-analog hybrid circuit design, including algorithm design, RTL design, simulation verification, FPGA prototype verification, DC synthesis, back-end PR, package testing, etc. Has led a team to complete the development of a variety of navigation and positioning baseband chips and communication

baseband chips, finished a series of AES, DES and other encryption module designs, won the first prize of GNSS and LBS Association of China for scientific and technological progress. Expert in the consensus mechanism principle of blockchain and the related asymmetric encryption algorithm.

Yang Feng: Chinese, Master of Engineering, worked at ZTE. Artificial intelligence expert, integrated circuit expert. Has 12 years of experience in VLSI research and development, architecture design and verification and 5 years of research experience in artificial intelligence and the genetic algorithm. Has won the Shenzhen Science and Technology Innovation Award. Has done an in-depth research on the principle and realization of the RFID technology, the underlying infrastructure of blockchain, smart contracts and the consensus mechanism algorithm.

Guo Jianping: Chinese, Doctor of Engineering (graduated from the Chinese University of Hong Kong), IEEE senior member, integrated circuit expert. Has published more than 40 international journal & conference papers in the field of IC design and applied for 16 patents in China.

Huang Ruimin: Chinese, Doctor of Engineering (graduated from the University of Freiburg, Germany), integrated circuit expert. Mainly explores digital signal processing circuit and system implementation, works on R&D of digital signal processing technology for a long time.

Guo Rongxin: Chinese, Master of Engineering. Has more than 10 years of experience in design and development of hardware and software for embedded systems, works on R&D of RFID and blockchain in the IoT for a long time.

Li Shuai: Chinese, Master of Engineering, research focus: network security and the blockchain access authentication technology. The project on blockchain distributed authentication completed under his direction won the final first prize of the “2016 National Cryptography Technology Competition”.

Huang Hongtai: Chinese, Bachelor of Engineering, has five years of experience in WEB front and back-end development, develops IoT and educational information platforms for a long time. Has a strong interest in the blockchain technology.

Liu Dongxin: Chinese, received an MBA from China Europe International Business School, strategic management consulting expert, investment and financing expert. Research interest: the impact of the blockchain technology on the financial sector.

6.2 Angel Investors

Song Guoping: Doctor of Medicine, President of Chinese Chamber of Commerce (Korea), Director of Beijing Overseas Friendship Association, representative of Ping An International Co., Ltd., representative of Oriental Xu Fu Anti-Aging Center, Representative of Sumei Beauty Shaping.

Qiu Jun: Chairman of Shenzhen Hongtao Fund Management Co., Ltd., Vice President of Shenzhen Shanwei Chamber of Commerce. Has 20 years of capital market investment experience, experienced many magnificent market changes, achieved a number of classic investment cases, including SMIC, China Merchants Securities and Guangdong Danxia Biopharm, etc. Guangdong Danxia Biopharm was acknowledged as one of the top ten successful cases of biopharmaceutical investment in 2016.

Yan Xiaoqian: Chairman of Kaltendin Clothing Co., Ltd., Executive Vice President of Shenzhen Shanwei Chamber of Commerce.

Lin Jingwei: Director of Guangzhou Jiuying Investment Management Co., Ltd., received a master's degree in Senior Financial Accounting and an EMBA degree from Sun Yat-sen University; has 27 years of work experience at large state-owned enterprises in China and abroad and more than 15 years of work experience as Secretary of the Board of Directors, Chief Financial Officer and Deputy General Manager of large Chinese state-owned enterprises, has been

in charge of enterprise listing, capital operation, investment, financing and financial management for a long time. Has a wealth of experience in capital operation and financial management. Has qualifications for Secretary of the Board of Directors or Independent Director of listed companies.

He Honglian: Director of the Waltonchain Investment Division, Certified Public Accountant, received an MBA degree from Xiamen University. Previously served as Investment Center Manager of Meiya Pico, currently leads the Waltonchain investment team to research and plan investment in the field of the IoT and integrated circuits.

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