

# INT: An economy driven solution to improve the device interconnection of Internet of Things

**Abstract:** INT will build a framework for machines and devices, and create a token, which will be used to facilitate the resource exchange between nodes and heterogeneous links (different nodes may create independent internal links). For example, a node may make a request and pay corresponding tokens to request other nodes (or links) to provide power, network, data, service and other possible resources. In addition, through zero knowledge proof (specific improvement as necessary), optional masking may be conducted to protect user privacy and improve security.

## 1 Preface

The Internet of things has developed rapidly in the last a few years, however, concerns have been raised for the standards of communication and data exchanges among manufacturers, the interests of manufacturers, user privacy, as well as fragmented model constraint on the overall IoT development.

It is expected that more than 25 billion nodes will be connected on the internet in year 2020, however, if the interconnection within the whole network is not smooth, the fragmented Internet of Things would not fully realize value of the nodes.

Without defining a common set of protocol standards, seeking support from individual manufacturers is but inefficient and costly. Through decentralized and economy driven methods, it is a new way to make standards for device interconnection.

### 1.1 Project objectives

INT is the acronym for *Internet Network Token*. INT attempts to build a scheme that allows data and resources to flow freely within the network and to ensure user privacy in untrusted and decentralized machine federations.

This paper is not a complete and detailed specification, just a preview of the development intent of the whole design, which attempts to propose solutions, and through experiments and projects, community support as well as confirmatory development, to make the INT a viable solution. Through experimental evidence, prototypes and data, as well as responses to community suggestions and comments, the content of this paper will be revised

gradually in the future.

## 1.2 Background introduction

Blockchain technology has proved its value in finance and other fields, but we believe its best usage is in the field of IoT. Highly distributed IoT field is especially suitable for blockchain applications.

At present, there are several issues with current development of IoT :

### (1) Lack of standard

The IoT vendors are very diversified, each holding their own data silos, so the information flow within the systems is everything but smooth, while cross-vendor access and liquidation is hard to implement.

### (2) Inefficiency

Under the current IoT ecosystem, all the devices are connected through central cloud server authentication. The connection between the devices is handled through the central servers, thus the efficiency cannot really meet the real-time needs of the IoT.

### (3) Cost

The infrastructure and maintenance cost of centralized systems, large servers, cloud service and network devices is very high. While the number of IoT devices increases to range of tens of billions, the additional communication cost also rises exponentially, which will make the IoT solution very expensive.

### (4) Security risks

Centralized network has very high security requirements for central servers, and the security vulnerabilities of IoT nodes will affect the whole network.

### (5) Privacy protection

Existing centralized networks can collect the user's information at will, and after the user realizes the value of their data, he or she may not be willing to just accept the situation. Because the IoT systems have more private information, including health information, vehicle driving information etc., the centralized network cannot be trusted to store that.

## 2 Project overview

The INT project stems from the Apache Mynewt community practice.

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The team initially tried to define hardware through software to reduce the complexity of hardware development.

However, even if we define the abstraction layer of the system, how to form a unified ecosystem between individual nodes is still a challenge. Later, through the team brainstorming, the team considers an economic way to drive the integration of different systems.

INT is a kind of blockchain application platform and interactive standard which is object-oriented IoT and based on economic driving mode. The parallel chain structure is used to form a distributed network between devices, and a consensus algorithm is adopted to guarantee the legal trustworthiness of the transaction between devices. At the same time, different kinds of devices can be connected to different parallel chains to avoid the explosive growth of the total ledger.

The existence of INT can greatly reduce the development difficulty of the application of the blockchain of IoT. It can relay different IoT, form edge computing networks, effectively circulate resources, and accelerate the progress of IoT popularization. INT is designed as a scalable heterogeneous chain, providing a relay chain platform on which a large number of verifiable, globally consistent and consensus data structures can be built. In other words, on the basis of ensuring overall security and inter-chain trust, INT is committed to making the IoT blockchain into a networking infrastructure like TCP/IP, which imperceptibly affects people's lives.

In order to achieve these objectives, we must do the following:

## 2.1 Software defined resources

There is a fundamental difference between hardware development and software development. Because of cost and design constraints, the hardware resources are generally scarce, so when we want to add additional costs and provide additional resources in the hardware, it is relatively hard (for example, to provide additional computing power and extra external power supply).

So the problem we want to solve is not to provide additional resources, but if the hardware itself is a WIFI, or a temperature collector, when it needs to provide its own value to other services or hardware, the corresponding charging strategy can be proposed. And the resources we are involved in, according to different devices, are abstracted from the real world, mapping existing entities (whether hardware or data) to provide consistent invocation in the form of services.

There is no way to add additional functionality to existing devices, but in a relatively hardware

ecosystem, perhaps we can allow the various devices to open their own functions, so as to gain more revenue through the economic-driven. Because the nature of the standard monopoly is profit, and the tokens themselves can provide profit, and because of the volatility of the price of tokens, it may generate additional economic benefits. Relative income is not less than absolute profit.

So we're going to try a new model that drives the hardware to open itself up by sharing benefits, to get profits decentrally, rather than through a centralized monopoly.

## 2.2 Monetization of resources

In our definition, we need a steady measurement, and we do not use INT in the settlement of the IoT, but use GAS mechanism, which is similar to ETH. Because devices resource settlement needs a relatively stable measurement, the resources will be settled in the following ways:

Price tag type: pay according to the marked price.

Metering type: Pay according to the timeline, or other dimensions of subsection.

Competitive bidding type: Bid on all devices that need to invoke the resources.

CPP (Cost Per Purchase): Pay based on the end use of the resource.

Because of the existence of smart contracts, many traditional architectures which cannot be completed in a way that can be taken here, and then implement coordination and interaction, the specific way can be agreed on the chain in the form of a smart contract.

## 2.3 Resource transaction configuration

Related nodes shall purchase resources in a semi-automatic manner through a custom policy.

## 2.4 Privacy protection principle

There is also a particularly important problem in the current IoT: User privacy. The user privacy protection of IoT is extremely fragile. It is easy to predict user behavior because of the large amount of data collected by the sensor. Moreover, for the current architecture model, even if use the OpenID to implement user desensitization, as long as analyze multiple dimensions, it is easy to reverse deduce the identity of the user. To solve this problem, we try to adopt our innovative Behavior Private Key (BPK) algorithm model based on zero-knowledge proof algorithm, by passing the user intent (intent) to other hardware, without the need to pass the user symbol, which not only can effectively protect the user's privacy, but also can resolve concerns about the loss of users.

Our innovative BKP algorithm model uses unsupervised learning or strategy model and

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clustering behavior, through zero-knowledge proof algorithm to implement user desensitization.

This allows for the sharing of resources based on intent between devices, and does not require users to share data, which can effectively address user privacy problem.

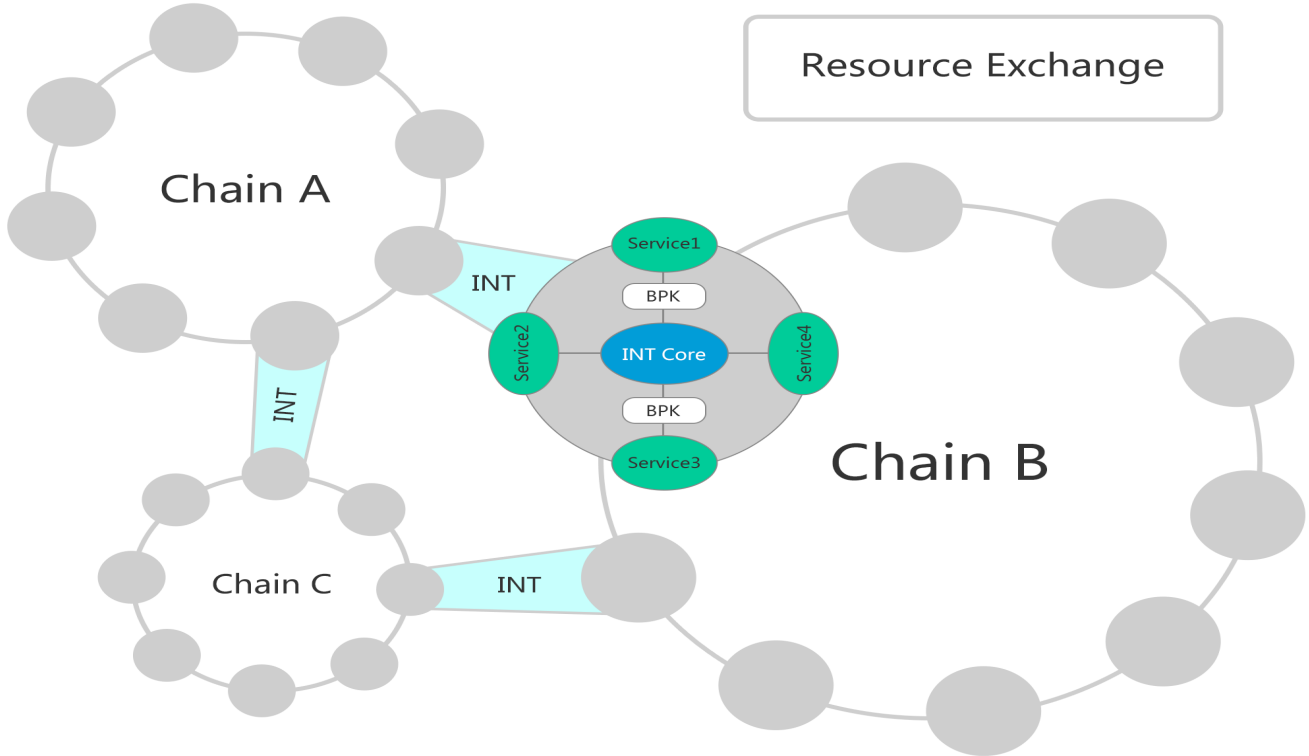
### 2.5 Security

Is the device likely to kill like a mechanical bee

in a magic mirror (Black Mirror)? This may not necessarily be the case, but it must not be a rarity to drive a automatic car to hit a person into death. The security of the future IoT is the most important, and the INT will try to filter the intent through the innovative BPK algorithm, trying to ensure the user's security.

### 3 System architecture

Figure 1 INT system architecture



## 4 Service

Each machine node can shelve corresponding SKU based on their own wishes, which is to be suitable for different bidding, sales, distribution strategy, authority strategy, forming self-discovery of metadata. This layer is a definition of software services and an abstraction of hardware services.

## 5 Trading market

### A. Machine automatic matching

Through smart contracts and semi dynamic configuration, for basic services, such as network, power, calculation, self-discovery, implement plug-and-play access.

### B. Developer API trading market

For data and services, a trading system is formed in the cloud.

## 6 INT token

INT token will take a two-tier structure. The first tier is the traditional token structure that participates in exchange transactions. The second tier uses the first tier token structure, launches a timed auction and float aiming at fiat money, mainly to solve the problem of token volatility, reduce volatility which is easy billing.

## 7 Machine node

A node may be a traditional PC server node, or a STM32 node that is configured tailoring according to machine performance. IoT is a typical edge fog computing scenario (Fog Computing). In fact, the existing blockchain network is not suitable for IoT. In such a scalable network with high computational power, how to share computational power, in fact, the core is also economic-driven, so we need to define an INT such a solution.

## 8 Consensus

In the consensus, INT will basically adopt the same pattern as Polkadot, because as the same of the multi-link parallel algorithm, and INT through the asynchronous (asynchronous) Byzantine Fault-Tolerant (BFT) algorithm to achieve mutual understanding of effective blocks. The algorithm is originated from Tendermint and HoneyBadgerBFT, and HoneyBadgerBFT can provide an efficient fault-tolerant algorithm as long as most of the verification people are honest in the framework of any network defect.

Indeed, one (PoA) mode of network is enough, but INT is a network that can be deployed in a fully open and public environment. Therefore, we need a mechanism to manage the validation of people and motivate them to obey the law. Because of the

performance requirements of hardware transactions, we will choose to use a POS based consensus algorithm, in order to avoid the disadvantage of POS, and because most nodes may be low performance nodes, we will use POS+POW hybrid method for improvement. Simple single chain, must not solve the performance problem, so we try to solve performance problems through the parallel chain and consensus access.

In the future, there are access devices with number of billions of level, and especially many devices will be high frequency chain in low block time, there is also a lot of demand for the alliance chain, so we adopt the parallel chain structure, through the INTStream to achieve value and data transfer between the INT and other parallel chains, because the parallel chain is an independent system, technical and economic innovation will not be hindered by other factors.

An INT parallel chain can be created at any time of running time by any account. The creator can tailor the detail features of the parallel chain according to the application requirements and the services provided by the parallel chain and the specific information of the parallel chain tokens. These custom information forms a parallel chain of data structures that are recorded in block of the current time period in a manner similar to an INT transaction. At this point, the parallel chain will act as a separate blockchain, recording transactions of parallel chain tokens.

## 9 How blocks are packaged

Between different chains, there may be high-frequency low block time chain, or there may be a highly encrypted block. Therefore, each parallel chain adopts different package packaging methods, through the relay chain to integrate consensus. With regard to consensus integration, we shall use Polkadot or make improvements based on Polkadot, accounting for the main node.

## 10 Network design

IoT network is special in a way that the data transmission delay varies in a large range, and a large amount of different protocols and precision requirements are used. Therefore, in the aspect of network architecture, specific implementation and protocol improvement for MQTT will be used to meet the requirement of blockchain.

## 11 Application Scenarios for INT and INT DAPP

The Internet of Things devices increases exponentially and machine intelligence level changes greatly. Various DAPPs have been installed on smart devices that machines with the growth of IoT and

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mobile Internet, and here comes a need for humans and machines to perform real-time, reliable, automated data exchanges and automated transactions via distributed networking.

INT will realize the data transmission directly between the nodes of the IOT. The Internet of things solution does not require the introduction of large data centers for data synchronization and management control that data acquisition, instruction sending and software updating can be carried out through the network of blockchain. Some typical INT application scenarios include:

1. Industrial Manufacture: The manufacturing cycle begins to move into a completely virtual world, including product research and development, customer demand monitoring, production and inventory management. As devices and systems become more intelligent and interactive, the blockchain will also be a factory, regional, global supply chain level book to greatly reduce costs, to strengthen JIT production, and to improve operational efficiency.

2. Connected Driverless Vehicles: Auto running DAPP in Connected Vehicle turns the vehicle into an intelligent application terminal that automatic data exchange between cars and cars to achieve more secure autopilot, automatic navigation, road rescue and so on.

3. Traffic: Internet of Things + Blockchain = Connected Traffic. There are many scenarios in the vehicular network, for example, it transmits all traffic information to avoid traffic jams and so on. Extend it into Global trade that the transportation network can embrace water, air and ground transportation networks and track freight traffic.

4. Public technology facilities and intelligent cities: Smart devices have been used to track bridges, roads, power grids and so on that blockchains can connect all of these together, sharing high efficiency, maintaining, and predicting usage and contamination. Another important application is to help remote areas to monitor natural disasters, and prevent large-scale fires, pests and other disasters.

## 12 Roadmap

INT is designed to address the issue of value transfer in fragmented and dispersed IoT markets. INT will be a ERC20 token. It will be a new infrastructure platform based on IoT: decentralization, open, open source and efficient. In ecosystems, different parties can get the right cost and profit and share with each other. The two areas of blockchain and IoT have a fast-growing dividend. As a transparent and open system, INT is expected to promote the development of IoT, not to the unification of standards, to drive the interconnection of different standards through economic means, and to form an effective and decentralized market.

The first step of the solution is to build the many modular products that RUFF now have in the RUFF ecosystem. We will build a complete unicom system in modular products.

In the second part, we will get through many open hardware platforms, based on Arduino, Raspberry pies and so on.

## 13 INT team

The INT team core members include the first batch of IOT development experts in China as well as globally, developers with vast experience in communication and large systems, architects for operating systems, and engineers in the financial field. The R & D team has a deep understanding and research and development experience in the fields of Internet of things, signal transmission, security system design, blockchain, bottom layer of bitcoin, Ethernet floor, automated trading, machine learning, the big data and so on.

The core members of the INT team include the earliest group of IoT developers, IoT operating system architects, and blockchain development engineers. The R & D team has a deep understanding and research experience in the fields of IoT, blockchains, the bottom layer of Bitcoin and Ethernet, automated transaction, machine learning and big data technology.

### Core members

**Xiang Ruofei** : Chief Architect of INTchain at INT Foundation.

He is a young expert in the Next Generation (5G) Wireless Communication and IoT technology, and now majors in the applications of “Blockchain - IoT” technological convergence. He once did post-doctoral research at CAS, and took charge of an “863” Project. Dr. Xiang writes many papers, and applies for many patents.

**Chen Guanghui** : Graduated from Fudan Computer Software, once worked for the EASTCOM, HUAWEI and other enterprises. He has extensive experience in communication infrastructure, system architecture, research and development, project management, software development, mobile Internet and other fields.

He worked in EASTCOM from 1993 to 2005, and served as research and development engineer of CDMA switch Development Department, test manager and deputy general manager. Joined HUAWEI in 2005, and served as Minister of enterprise communications MKT, Minister of Railway Signal Architecture Design. And he started business in 2012 with the direction for the mobile phone taxi service market.

**Wang Hongwei** : Master of Sichuan University, 10 years of technology research in the field of IOT, early

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platform architect of "Truck Gang", leader of HUAWEI's first industrial route AR531 device, inventor of the high speed iron signal 3oo3 combination fault and safety system, inventor of intelligent packaging.

**Roy Li:** Well-known network security experts, IoT experts, Ruff operating system founder, Fudan University Master Mentor, Ruff has won the Kesin fund, King Capital, and Hike capital investment over the past three years.

**Cao Yanming :** Bachelor of Science in mathematics, Peking University, Master of Science in computer science from the University of Wisconsin Madison, with more than twenty years of IT experience, worked in Microsoft, SAP, HCL and other well-known software companies. Responsible for large database systems, banking systems, e-commerce systems, bank clearing blockchain application development with a wealth of financial system development and project implementation experience. Now focus on blockchain and intelligent contract bottom technology research and development in the banking, IOT and other industries.

**Yin Xiangyu:** Bachelor of Science from the University of Electronic Science and technology of China, IOT deep lover, the earliest domestic IOT research and development practitioners, Internet serial entrepreneur, stationmaster, Apache My newt code contributors.

2003-2005: Participated in the design and development of wearable remote life test instrument based on GPRS, anesthesia depth tester and early diabetic neuropathy tester, 2005-2008: Founded the apparel wholesale network, smoking cessation network, depression, obsessive-compulsive disorder community and many other Internet projects, 2008: Began operating local stations and other stations, 2013: the most early supporters and promotion leader of China's first micro token networking device, WeChat printer "welomo".

**Zhang Hangjun:** Graduated from Electronic University Of Science & Technology Of Hangzhou, 11 years hardware development experience, responsible for more than 10 kinds of EMC inspection equipment research and development, leader of HUAWEI's first industrial routing hardware for the hardware R & D of high-speed rail, Metro and tram, on-board, CBI and wayside signal systems.

**Wang Ye:** Graduated from Beijing University of Posts and Telecommunications, employed by EASTCOM, UTStarcom, HUAWEI, software systems engineering and R & D quality management specialists. 1999-2005: Served on the Hangzhou Oriental Communication Network Station, engaged in CDMA2000 mobile switches, PHS platform and protocol software development and testing work. Work on platform software development for AN8000

broadband access products in the inauguration of broadband division in UTStarcom. In December 2005, he joined the HUAWEI Research Institute in Hangzhou, and was responsible for enterprise communications, IP, PBX products, product introduction, architecture and system design of SEG, leader.

**Zhang Bo:** Master of Science from the Huazhong University of Science and Technology, 12 year experience in system architecture, leader of H3C DDOS protection equipment, leader of HUAWEI high speed rail signal 2 multiplied by 2 take 2 security mechanism, architect of HUAWEI's first industrial routing software, architect of Metro ATP&ATO System.

**Li Mengran:** Graduated from South China University of Technology, core maintenance engineer for large-scale Telecom backbone network, former deputy director of international business division in China Telecom group, early participant of China Telecom narrowband networking NB-IoT project.

**Zhang Yuli:** Master of Science from Institute of Physics CAS , previously served as senior developer in ChinaSoft , was responsible for several blockchain projects.

**Xu Chun:** Master of China Measures the Institute, worked in HUAWEI and CETHIK, software systems engineering specialist, expert in high reliability, security, system design. During the inauguration of HUAWEI, he was responsible for the design and development of the high-speed signal system and the design and development of the RBC system. During the inauguration of the CETHIK Group IOT Research Institute, he took the "Huzhou wisdom" project and was responsible for top level planning, network design and application, hardware terminal deployment and development, etc..

**Chen Yuqi:** Graduated from the Department of mathematics of Sun Yat-sen University, former development Engineer SouFun distributed system, Google Brillo code contributors.

### Team Advisor

**Roy Li:** Celebrated security and IoT expert, founder of the IoT OS Ruff.io, Advisor for Master students in Fudan University. Ruff.io was funded by Geek Founders, Jinglin Capital and Hike Capital.

**Tan Lei:** Celebrated blockchain and big data expert, North American Blockchain Association co-founder, 13 years of Microsoft experience, Bachelor of Science from FuDan University, Master of Science from Duke University, author for "Blockchain 2.0" and seven other technical books;

**Ramble:** Chairman of the North American blockchain Association, architect for the Guiyang blockchain financial Supervision Sandbox, Chairman of Guiyang blockchain financial incubator, founder of GooCoin

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and SwiftCoin;

**Kong Huawei:** Director of Shanghai Institute of Computing Technology, CAS; Chief Scientist for Zhangjiang Hi-Tech Venture;

**Wang Zhongtao:** Senior Engineer of Google Digital Encryption currency, senior blockchain engineer;

**Ge Lei:** Founding partner of Guangdong Southern law firm.

**Zhao Yafu:** Director of risk management in Guangdong Zhuo Tai Ci Capital Ltd

**Liu Jinhua:** CPA, CTA, Co-partner of Shandong Shixin certified public accounting firm, An accountant and tax consultant for several listed companies, Former Shandong state tax official.

### **INT Angel investment team**

Zhang Shousong: Chairman of jubi.com;

Zhu Jun: CEO of China National Cyber Games;

Zheng Zhiping: Founder of aizhan.com;

Xu Bin: Founder of 4.cn and etc.cn;

Bian Jiang: Hong Thai fund GP;

Hu Xiang: Former Tencent Strategic Investment VP, Partner of Pine Wo ;

Zhang Zhu: Partner of United Capital;

Huang Zhiyi: Founding partner of Venture Capital;

Alex.F: Partner of Banyan Capital

### **Team achievement**

China's first generation of remote single soldier life status detection wearable clothing based on GPRS

China's first depth of anesthesia tester concept products

PHS products, communication platform and communication protocol system

The first CDMA switch in China

HUAWEI's first industrial routing hardware, AR531

High speed iron signal 3003 combination fault and safety system

H3C 100 G class DDOS protective equipment

HUAWEI high speed rail signal 2 take 2 take 2 security system

Chinese subway ATP&ATO system

Interbank settlement blockchain application system

In 2014, Ruff networking operating system was born, which allowed software programmers to develop hardware, and won the Microsoft's most investment value award, the first Tech Crunch 2016 venture competition, GITC 2016, the best Internet technology

innovation award, Predix hackthon Best Innovation Award and other awards.

In 2016, the test of a vehicle connecting blockchain application "Automatic Traffic Interchange System" based on ETH was successful.

### **INT foundation**

INT Foundation is a non-profit organization that has been established specifically to support the application of the IoT based on the INT platform.

The INT foundation was established in Singapore, abiding by the laws of Singapore.

### **INT Foundation committee governance**

The INT Fund Alliance committee uses the rotating presidency of the Union to carry out its work, every two years, select the rotating president by the vote, the rotating president only takes charge for one period, the INT Fund Alliance committee establish a number of management centers, including blockchain technology development center, blockchain business application center, financial management center, wind control center and integrated services management center, respectively to guide the business sector to carry out the work.

### **Source and management of fund**

1) The fund that maintain the operation of the INT project mainly comes from the yearly release of the original asset, the venture capital and affiliate membership dues, donations, etc., when needed, some INTC will be converted to fiat money to have the necessary payment funds.

2) The encrypted digital assets and raw assets raised will be saved in a hard wallet and managed by a professional cryptographic asset management service to manage the private key in the form of multiple signatures.

3) Financial management instructions

INT foundation financial management principles: Overall arrangement and integrated management; Thrifty and pragmatic; Count best, and live within means, the INT foundation assets management is integrated into the overall budget management, and according to the actual operation situation, prepares the financial budget.

The annual financial revenue and expenditure budget is considered by the Committee, the monthly financial budget is considered by the Executive Committee and the Financial Management Centre is responsible for the preparation and implementation. Quarterly financial reports are disclosed on official website <https://intchain.io/>.

The INT foundation will introduce third-party audits, oversee the financial operation of the project, conduct financial audits and provide audit reports, and the audit report will be announced in the annual

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information disclosure.

## **Progress disclosure**

The INT project team is committed to managing and using the encrypted digital assets. In order to protect the interests of investors, strengthen the management and efficient use of INTC and promote the healthy development of the INT project, the INT project sets up information disclosure system.

INT hopes that through its own demonstration role, to standardize the management of the project digital assets, increase the self-discipline of the blockchain industry, enhance the transparency of the blockchain encryption digital asset management, and maintain the long-term development of the blockchain industry.

INT will disclose quarterly reports within two months of the end of each quarter, and prepare and disclose annual reports within three months from the date of each fiscal year (December 31), the report content including, but not limited to, the technical milestones and progress of the INT project, application development milestones and progress, digital asset management, team performance, financial situation, etc.

INT will disclose the important temporary information of INT project in real time, including not limited to major cooperation matters, change of core team members, litigation involving INT, etc.

INT will disclose information report on official website <https://intchain.io/>

## **Advisory committee**

INT will invite domestic and foreign experts engaged in the field of blockchain industry for many years, notables with rich experience in work performance, legal entertainment culture and other professionals, and people familiar with government policy to form a third-party expert advisory committee, and to provide consultants, assistant decision-making, and other outside brain staff, including:

1) Demonstrate and guide the team's work plan and major projects, assist the project development planning and design;

2) Undertake projects of government research and industry commission to carry out industry research;

3) Organize the research on the hotspot issues of IoT and blockchain, and provide consulting services for the team;

4) Strengthen the exchange of information, regularly hold industry forums, guest discussions, academic exchanges, etc.

INT Expert Advisory Committee experts include:

Kong Huawei: Director of Shanghai Institute of Computing, China Academy of Sciences;

Wang Zhongtao: Google digital encryption currency senior engineers, blockchain technology expert;

Zheng Zhiping: Founder of aizhan.com, network marketing expert;

Zhao Zhitao: Securities regulatory authorities.

## **INT Legal Services**

The INT Foundation will employ well-known law firms in China as an INT project legal advisor to provide comprehensive legal services for the design of the digital asset transaction structure, operational compliance, legal wind control system design, and overseas legal advice for the INT project.

## **Disclaimer**

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