



# FOGLINK

## **FOG LINK WHITE PAPER**

Value Transfer Protocol and Fog Link OS Open Platform

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# Contents

|  |           |
|--|-----------|
| <b>Abstract</b>  | <b>5</b>  |
| <b>1. Combination of fog computing and block chain</b> | <b>7</b>  |
| 1.1.1. Scalability                                     | 9         |
| 1.1.2. Openness  | 9         |
| 1.1.3. Operation independence                          | 9         |
| Fig. Combination of open Fog and block chain           | 12        |
| <b>2. Design principle of fog link</b>                 | <b>13</b> |
| 2.1. Modular design of fog link                        | 13        |
| 2.2. Architecture based on IBM ESB bus and FNK         | 14        |
| 2.3. Network characteristics of IPFS                   | 15        |
| 2.4. Security and performance of fog chain             | 15        |
| 2.5. Systematic strategy of the fog link               | 16        |
| <b>3. Fog link OS solution</b>                         | <b>16</b> |
| 3.1. Fog link system architecture                      | 16        |
| 3.2. FNK OS application scenarios                      | 17        |
| 3.3. Example of fog link codes                         | 19        |
| 3.4. Fog link system equipment                         | 20        |
| Fig. DEMO of FNK fog computing miner                   | 21        |
| Fig. Fog Link OS UI design                             | 22        |
| 3.5. Open source plan of fog link                      | 22        |

|                                      |           |
|--------------------------------------|-----------|
| 3.6. Fog link community.....         | 22        |
| 3.7. Alliance.....                   | 23        |
| 3.8. Road Map.....                   | 24        |
| <b>4. Team Introduction.....</b>     | <b>25</b> |
| 4.1. Members of project team.....    | 25        |
| 4.2. Adviser team.....               | 26        |
| 4.3. Early investors.....            | 26        |
| <b>5. About this whitepaper.....</b> | <b>26</b> |

## **Abstract**

Fog Ling (called as FNK) will construct FNK super nodes, inter planetary file system (IPFS) and fog computing node. The FNK will realize network transfer and recycle resources such as storage spaces by using computers and computer' s peripheral devices, implement the value transfer protocol, store and transfer capabilities according to capability contributions provided by the fog computing devices.

The Fog Link OS is the kernel capability of the FNK decentralized application development platform (DAPP platform). The Fog Link OS can release the application boundaries and technology boundaries tremendously and make more users enjoy convenience and changes brought by the block chain technologies to their work and lives.

The FNK will establish a sound and good development environment for application developers. The developers will define their digital assets by using the visual operations and realize application porting and development via the self-defined digitals. The Fog Link OS will break through at the traditional terminals.

The Fog Link OS will support the Fog Computing miner, block chain mobile phone and private cloud disk in the early period. With deepening of the business and gradual maturity of the fog link OS, the Fog Link OS will adapt more hardware terminal devices. The FNK will open the source code of the OS, enables more developers to realize development and porting of their devices by using the Fog Link OS, and contributes much to the block chain industry.

We imagine to reasonably optimize value transfer of the Inter Planetary File System and several fog computing nodes by using Fog Link OS in the early period and create the super link with the Inter Planetary File System according to the rule of preferential circulation of high-quality resources. The high-quality resource for IPFS nodes will be directly transformed to IPFS via FNK. The FNK forwarding function will display as the concept of the Fog Mine pool in this process. All terminals complying with IPFS value will directly get IPFS or equivalent FNK, so the

fog computing capabilities can be utilized to most extent. In addition, the peripheral devices, which cannot provide value for IPFS, will become a true output terminal of the fog computing value and provide computing capability for stable operation of the fog link OS. The output pipelines of the computing capabilities generated by the equipment inside FNK and peripheral devices can be transformed according to the rule of value maximization and ensure maximal utilization rate and revenues.

We adopt the block chain technology and elements in prototype design of Fog Link OS to make generation process of the block chain contract have absolute circulation and storage value. The Fog Link OS can also be used on the mainstream devices via adaptation and porting. E.g.: when the Fog Link OS is applied in the mobile phone design, when a user connects to the network and starts the device, the system will automatically allocate the wallet address to store own earning of the computing capabilities and save assets. In addition, the contract properties include the wallet address. A user can circulate assets by using the contact book function.

For security, Fog Link OS adopts specific encryption algorithms. The text information and image information are encrypted for the mobile terminals. The FNS is used to solve the network storage problems. The SIM card is enabled/disabled and awoken under control of AI intelligent learning. Finally the practical security functions such as zero disturbance, transformation of physical positions and transmission information encryption can be implemented on the mobile devices to protect the user privacy and secure assets to most extent.

# **1. Combination of fog computing and block chain**

## **1.1. Concept and features of fog computing**

The concept of fog computing is proposed by the professor Stellford from Columbia University, New York, America, which aims to block intrusion from hackers by using "Fog". Later Cisco formally proposes this concept and assigns a new meaning to fog computing. The fog computing is a distributed computing infrastructure oriented to IoT, can extend the computing capabilities and data analysis applications to the network "edge". The fog computing enables customers to locally analyze and manage data and get real-time insights via access to the network.

In 2012, Salvador et al proposed to "hook" the "mole" stealing confidential information with the false information as the bait and further protect the true user information in one article on cloud data security. The data, data processing and applications are stored on the cloud in the cloud computing, but these are distributed to the device at the network edge in the fog computing. The network equipment (routers, mobile phones, switches, STB, proxy servers, etc.) or special equipment are used to provide computing, storage and network communication service between the cloud server and IOT equipment, so the data and computing approaches to the terminal equipment, the computing and storage consumption of the cloud servers reduce, and the response speed and the network bandwidth of the application system are improved. Compared to the cloud, the fog approaches to the ground in the "fog computing". The fog computing capability is not powerful because the fog computing capability is provided by the peripheral computers and discrete computing devices.

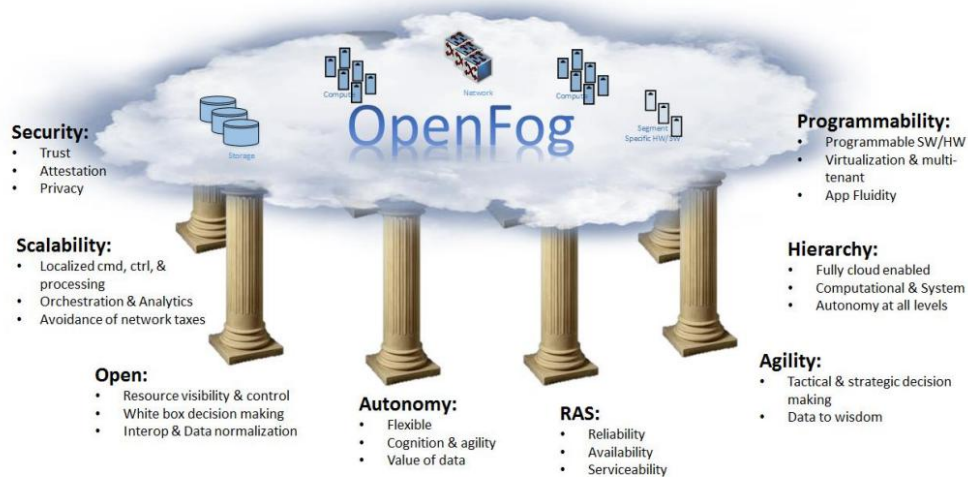


Fig. Value diagram of OpenFog open-source fog computing

The equipment at the edge network are used in the fog computing and the data transfer features extremely low delay time. The fog computing is distributed at extensively geographic places and is a large-scale sensor network composed of massive network nodes. The fog computing is very portable. The mobile phones can directly communicate with other mobile equipment. Signals need not be forwarded by the cloud and base station and high portability is supported.

The OpenFog is used in the fog computing of the FNK OS project, which features low delay time, maintains user privacies and gets resources at different levels in the transportation industry.

The fog computing is provided by some low-performance and distributed network equipment instead of powerful servers. The fog computing is based on half-virtualized service computing architecture model and focuses on the quantity. Any single computing node will play its role regardless of computing capabilities. Compared to the cloud computing, the fog computing architecture is distributed and approaches to the network edge. The data storage, data processing and applications will be centralized on the equipment at the network edge in the fog computing. The fog computing is a new-generation distributed computing and complies with “decentralized” features of the block chain. Since Cisco proposes the fog computing, several technology companies such as ARM, Dell, Intel and

MicroSoft and the Princeton have jointed in this concept alliance and have founded the Open Fog Alliance as a non-profit organization in order to promote and speed up popularization of the open fog computing and drive development of the IOT and block chain industry.

For FNKOS and OpenFog deployment in the Fog Link Project, the fog nodes and fog tiers can occur at FaaS from the view of the infrastructure. With FaaS, all tiers and nodes need not be deployed at single data center, but it does not mean no security. The user and fog service providers will face to security threats due to distributed data storage and network topology.

The security is based on “things” . These things shall be based on the trusted hardware. Such “trustable roots” shall be proved by the running software. The fog nodes are adjacent to end users and edges, so access control, encryption, integrity and isolation shall be provided for the fog nodes to control private and sensitive data. With generation of more complicated topology structures, the whole fog node “link” shall be trusted. Other fog nodes and cloud ends shall be secured. The fog node will be dynamically instantiated, so the software and hardware resource shall be trustworthy. Illegal components cannot be added to the fog nodes.

Security implementation may involve plentiful descriptions and properties, e.g.: privacy, anonymity, integrity, credibility, supporting evidence, trustworthy hardware root (ROT), verification and measurement.

#### **1.1.1. Scalability**

To drive users to deploy fog nodes, dynamic processing technologies and business requirements are important. The scalability in the fog network shall be implemented via a valid system and adaptation to more equipment systems.

#### **1.1.2. Openness**

The openness is the key factor to successfully apply the ecological fog computing system into the IOT platform. If the fog computing is only owned by single supplier and diversified suppliers are restricted, it will have negative influences on cost, quality and innovations of the ecological system.



### **1.1.3. Operation independence**

The deployed fog can tolerate the external failed services and can get support cross the whole level. Independence in the edge network indicates the intelligence from “Local Equipment” and data from “companions” and can fully satisfy the business requirements. The fog computing depends on the decision in the area adjacent to the devices instead of centralized decision like the cloud. The fog computing supports some column-independent functions, e.g.: programmability can bring highly adaptive deployment, make the fog nodes and tiers complete new tasks, contain dynamic operation, and realize full automation.

Independence is very important for the fog computing system to realize the quick and astute business operation decision in the fog computing system. The data generated by the FNS equipment system are different from data, knowledge and decision mode understood by the human being. Independence can ensure that the FNS system equipment can generate useful data, quickly transfer data, automatically and quickly make decisions, and automatically process them.

Data is the key in the information system and OpenFog architecture. The data generated by sensors and systems are chaotic and sudden. Sometimes data is massive. It is important that the data has no contact. The context is decided based on the operations in the FNK system. The context can be used when the data is arranged, aggregated and analyzed. The data can be analyzed at the cloud, but it increases the delay and multi-tier transfer leads to uncertainties, so all operable decisions shall be made when the data is transformed to the meaningful context. The system can make quick and better decisions.

The OpenFog computing resources can be logically divided into tiers according to the function requirements of the FNK system. The fog network shall support hierarchical structure, include the local, neighbor and area level, and can effective divide computing tasks.

The fog computing is fully different from the cloud computing. The cloud computing is based on the services of the IT operators and the social public clouds. The fog computing depends on quantity and focuses on roles of computing

capabilities of separate computing nodes. The fog computing expands the network computing mode of the cloud computing and extends the network computing from the network center to the network edge, so it can be extensively applied in different services. The fog computing features low delay, position perception, extensive geographical distribution, adaptation to portable application and support of more edge nodes. These features facilitate deployment of mobile business and satisfy connection of the extensive nodes.

## **1.2. Combination of fog computing and block chain technologies**

The massive edge equipment and computing terminals are used for data storage, computing, network connection and task management in the fog computing framework. Compare to the traditional architecture, the fog computing architecture has the following features:

- (1) The fog computing equipment is deployed close to centralized users and businesses and features low-delay storage.
- (2) The equipment features small size, light weight, easy storage and portability;
- (3) The equipment is displayed in a diversified manners, has lower requirements for the running system, and is portable;
- (4) The equipment can compute close to the end users, avoid delay, and reduce the network and bandwidth consumption;
- (5) The equipment features low-delay communication and not all communications are synchronized via the backbone network routing;
- (6) The equipment can manage elements close the end nodes, including network measurement, control and configuration;
- (7) Reliability, availability and serviceability (RAS);

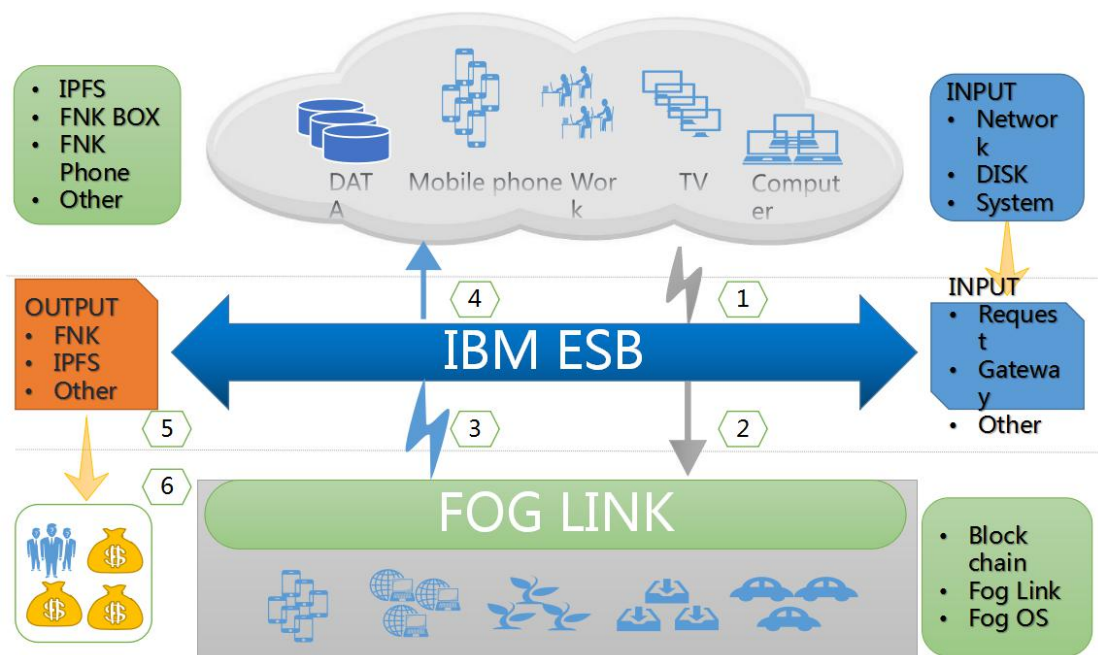


Fig. Combination of open Fog and block chain

The block chain can be understood as follows: if we imagine the database as a ledger, the database reading and writing can be regarded as accounting. The block chain technology can be used to find the quickest and best accounting person in a period, who is requested for accounting. The ledger page information is sent to all persons in the whole system. It means to change all records in the database and send them to all nodes in the whole network, so the block chain technology is also called as distributed ledger.

By combining the features of the fog computing and block chain, the users can submit specific disks and network resources by using the fog computing equipment of the FNK and get the digital assets of the FNK.

The FNK manages digital assets with the block chain contract as the asset managers. The Fog Link OS will generate fog computing miner, mobile phones based on the block chain, and private cloud disk in the FNK assets.

## 2. Design principle of fog link

### 2.1. Modular design of fog link



Fig. Module coupling of FNK system

The fog link is constructed by using some modules in the initial design, including contract management module A, contract management module B, trade module, middleware module and input and output module.

Developers can develop the software by using required modules during application implementation. The fog computing features local editing and implementation at the fog end.

## 2.2. Architecture based on IBM ESB bus and FNK

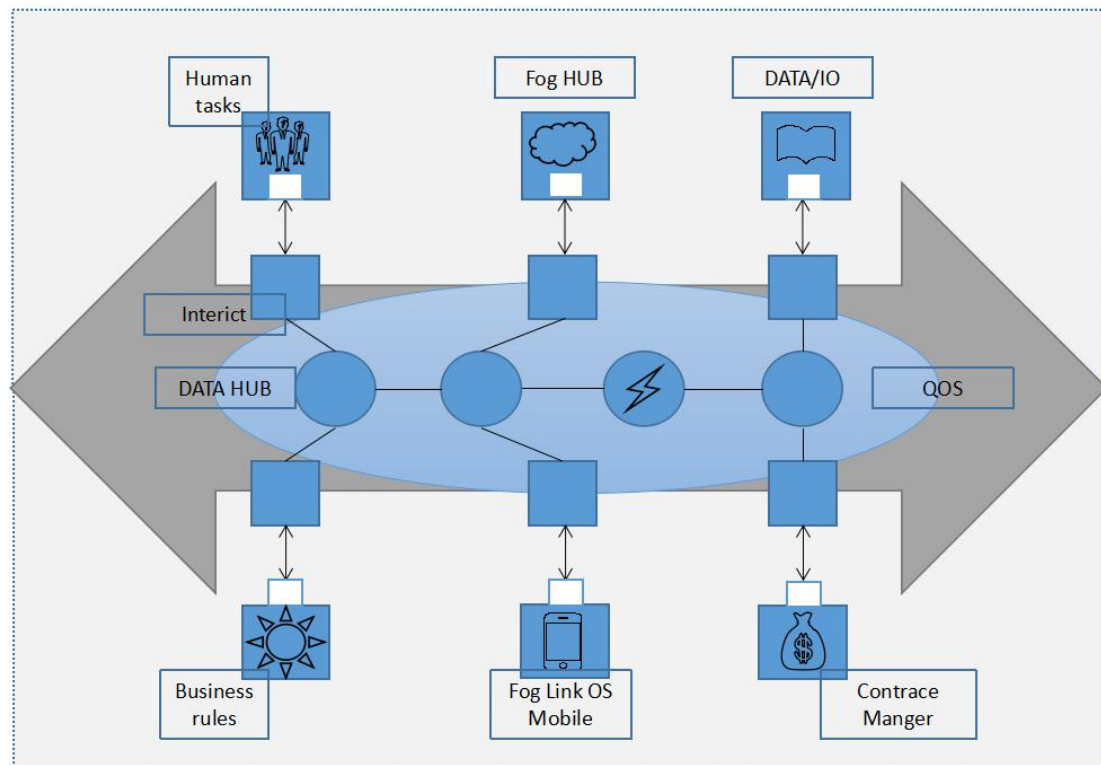


Fig Combined design of ESB and FNK

The fog link is the first decentralized and distributed network node public link, which is implemented by using IBM ESB technology in the block chain field. The IBM provides WebSphere ESB (WESB) and WebSphere Message Broker product. The WMB ESB is used in the fog link. Its powerful processing speed and seamless network resource switching enable the FNK system to be free of disturbances caused by stability of the fog computing and make the equipment realize more secure and stable computing.

Decentralized management in the decentralized ESB bus will fully depend on data storage and transmission mechanism. Although ESB is used in the fog link, we start the flow test of the ESB and decentralized mechanism on the lab phase. The fog computing nodes are standardized and the test and demonstration are completed, so interests of the miners and fog computing providers can be fully guaranteed.

After massive equipment is added to the fog chain, the ESB security and

efficiency is significant. Despite them, the system architecture of the fog link also refers to Inter Planetary File System for the persistent link of the interest network. The equipment operation efficiency and return of computing capabilities will become significant in the populous cities.

### 2.3. Network characteristics of IPFS



Fig. Change of IPFS based on the traditional network and storage protocol

The IPFS subverts the HTTP protocol and makes the value transfer comply with own protocol via the decentralized network. The FNK box keeps the computing capability system stable via the IBM ESB in the value transfer of the IPFS and outputs more regulation-compliant computing capability values for IPFS.

### 2.4. Security and performance of fog chain

The WMB provides installation at two levels. One is deployment security and the bar to Broker deployment is managed and the privileges for running WMB management commands are controlled. Another is runtime security. The privileges of sending messages to corresponding message flow and MQ resources and non MQ resources (e.g.: database system) accessed by the message flow will be controlled.

The WMB is developed by using C++ at the bottom, so its performance is improved much compared to WESB. Similarly the FNK OS is also developed by using C++ at the bottom, can collaborate with the WMB well, and can process several thousand and tens of thousand messages.

## **2.5. Systematic strategy of the fog link**

The fog link system is optimized due to the ESB middleware solution of IBM. From the standpoint of the IBM, the ESB is a middleware pattern instead of a concept. It is a brand-new integrated application and collaborative framework of the resources and operation information instead of a product.

When the fog computing is used to provide the computing capabilities for the block chain, diversified equipment types and independent determination capabilities of AI cannot deal with changes to the peripheral equipment.

The fog link is a product with ESB characteristics. For a product with ESB, management is also important. Several low-power consumption devices will be used to solve contract management, stable circulation and different application scenarios in the fog computing of FNK. The IP addresses and disks will include non-predictable unstabilities in this process. E.g.: when a service switches from one address to another address and the structures will not change, the ESB products will provide a convenient means to adapt changes. The fog link can adapt different environments and conditions and make optimal choices in the fog computing.

The WMB is an advanced version of the ESB and provides plentiful powerful built-in nodes to support message routing, e.g.: Filter nodes, Label nodes. The Router nodes are introduced to the new WMB version. This node is nearly same as the Router node in WESB. For dynamic routing, the WSRR can store the service. The WMB can be integrated with WSRR well. We can realize dynamic routing in the message flow via RegistryLookup and EndpointLookup.

## **3. Fog link OS solution**

### **3.1. Fog link system architecture**

The system architecture of the fog link OS is designed according to the rule of the practicability and portability. The FNK super nodes, IPFS (Inter Planetary File

System) and the fog computing nodes will be configured best in the Fog Link OS. The C++ language is programmed for match between ARM and Native in the Fog Link OS system to optimize the user blocking experiences during operation of the Android system. The C++ languages are used in the whole engine, so its execution efficiency is much higher than it of the JAVA.

Different terminal equipment can be independently adapted in the Fog Link OS. Although adaptation workload is heavy, the supported terminal types and programmability are also required for the mobile phone OS based on the block chain.

The C++ codes are used to maximize optimization of the CPU calculation efficiency of the equipment in the Fog Link OS system, so the input and output flow can comply with the physical value transmission system. The IBM ESB bus plays a powerful coordination role as the middleware and makes the system more smooth and efficient.

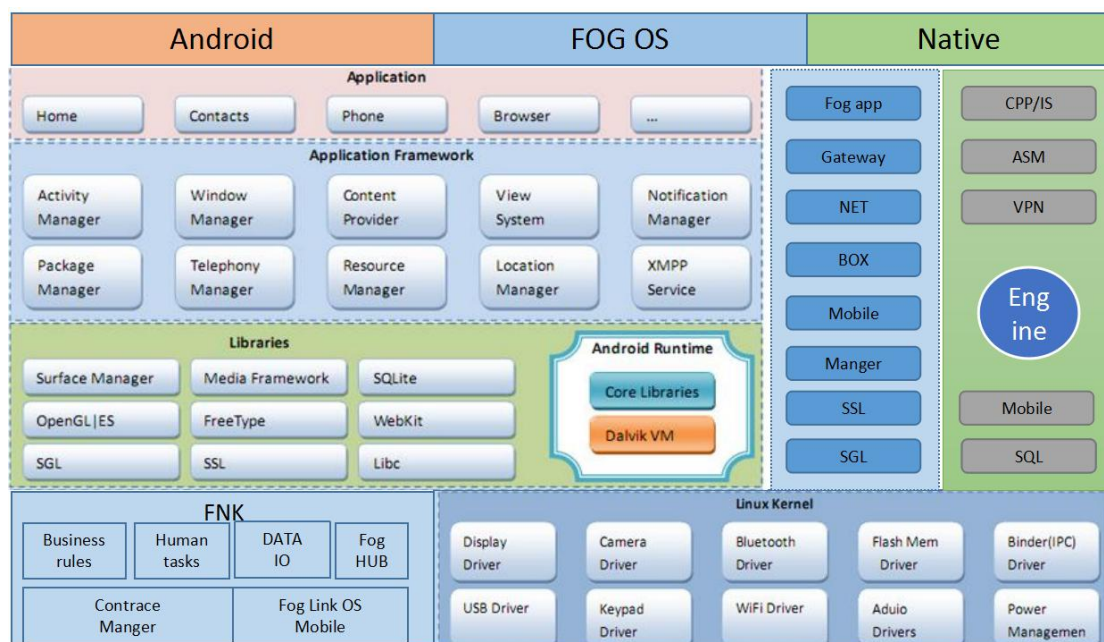


Fig. FNK OS system architecture

The above diagram shows the system architecture of the fog link. The modular design in this diagram can realize high compatibility to Android via the common bottom with LINUX, improve the calculation efficiency of the mobile phones, and



make more equipment and chip involved.

## **3.2. FNK OS application scenarios**

The Fog Link OS system supports ARM and X86 architecture. Several irregular nodes in distributed computing (different networks and IO capabilities) will form a huge fog computing network, which can realize data transfer and distributed storage. The Fnk OS in the application scenario is described as follows:

Now no true block chain mobile phone is available on the market. With investigation, users will also think that the block chain mobile phone shall include functions not provided by the traditional mobile phone. These functions are difficult and practicable. According to our designed proposal of the block chain mobile phone, the block chain mobile phone can satisfy 80% user requirements in the early period. The requirements are described as follows:

### **3.2.1. Block chain mobile phone based on fog computing**

It can improve the start speed and operation efficiency of Android mobile phone. Based on this requirement, C++ is used to reconstruct the start part in the Fnk OS and improve the start speed. We manage App operation efficiency and security by using the state defense-class sandbox container.

### **3.2.2. Fnk BOX**

The private dedicated cloud disk (Fnk Box) can provide the evidences of the fog computing capability workload and work efficiency for the enthusiasts, including POW evidence in bandwidth, storage, efficiency and difficulty based on user-provided computing capabilities. The Fnk BOX prototype supports video playing and cloud disk function. The cloud disk can encrypt and transfer stored user' s private data by using the backbone network and fog computing nodes.

Other user equipment are called in data transfer of the Fnk BOX, so other users participate in collaborative and distributed computing, which prove workload (POW).

### **3.2.3. Sand box of block chain mobile phone**

This sand box function is the core of the block chain mobile phone system and is one integral part. The sand box can provide users with comprehensive and

integrated products and services such as mobile security evaluation, security detection, security reinforcement, security sand box and security management platform of “end, management and fog” by using different strategies, can effectively protect rights and interests of developers, effectively guarantee reliability of the mobile office of enterprises, and finally secure data of individual users, so the product can be applied in Internet finance, E-commerce, E-government, smart city and smart medical treatment.

With backup and recovery mechanism of the sand box data, users can realize seamless migration, data backup and data recovery at the fog computing terminals. Even the system environment can be uniform at different terminals to avoid data asymmetry in case of equipment switching.

The sand box desktop can independently run. The basic sand box setting and application management is supported. The sandbox application of the terminal also supports the sandbox of the APP SDK and Wrapping mobile application. The sandbox desktop supports application distribution, built-in sandbox application and sandbox management function. The management platform can control the sandbox desktop. The functions such as general platform, user management, data management, application management, device management, strategy management, key management and backup recovery can be implemented for the sandbox desktop and sandbox application.

### **3.3. Example of fog link codes**

The start codes of the fog link are compared with Android in this code fragment. The start part of Android and FNK OS includes the process initialization and system framework start.

The following code fragment shows different start parts in two systems and how FNK OS replaces the Android.

## Start part of Android system

### ① Linux init process initialization

```
1 service udevd /sbin/udev
2 service logd /system/bin/logd
3 service logd-reinit /system/bin/logd --reinit
4 service healthd /sbin/healthd
5 service console /system/bin/sh
6 service adbd /sbin/adbd --root_seclabel=u:r:su:s0
7 service servicemanager /system/bin/servicemanager
8 service zygote /system/bin/app_process -Xzygote /
system/bin --zygote --start-system-server
9 service vold /system/bin/vold
10 service netd /system/bin/netd
11 service ril-daemon /system/bin/rild
12 service surfaceflinger /system/bin/surfaceflinger
13 service drm /system/bin/drmserver
14 service media /system/bin/mediaserver
15 service defaultcrypto /system/bin/vdc --wait crypt
tfs mountdefaultencrypted
16 service encrypt /system/bin/vdc --wait crypttfs en
ablecrypto inplace default
17 service gatekeeper /system/bin/gatekeeper /data
/misc/gatekeeper
18 service installd /system/bin/installd
19 service flash_recovery /system/bin/install-recove
ry.sh
20 service racoon /system/bin/racoon
21 service mtpd /system/bin/mtpd
22 service keystore /system/bin/keystore /data/misc/
keystore
23 service dumpstate /system/bin/dumpstate -s
24 service mndsd /system/bin/mdnsd
25 service afm_server /system/bin/afm_server
26 service uncrpt /system/bin/uncrpt >
```

## Start process of FogLink OS

### ② Linux init process initialization

```
1 ...
2 service foglink /system/bin/foglink
```

### ③ Android framework start

```
1 int main() {
2     AppRuntime runtime;
3     if (zygote) {
4         runtime.start("com.android.internal.o
s.ZygoteInit",
5             startSystemServer ? "start-system-s
erver" : "");
6     }
7 }
8 // 在这里加载 Android dalvik/art 虚拟机, 并加载运行 java
代码, java 接管整个UI
9 void AppRuntime::start(const char* className, const
char* options) {
10
11     // start the virtual machine Java
12     JNIEnv* env;
13     if (startVm(&mJavaVM, &env) != 0) {
14         return;
15     }
16
17     if (startReg(env) < 0) {
18         return;
19     }
20
21     jmethodID startMeth = env->GetStaticMethodID(
startClass,
22         "main", "(Ljava/lang/String;)V");
23
24     jclass startClass = env->FindClass(className
);
25
26     env->CallStaticVoidMethod(startClass, startM
eth, strArray);
27 }
```

### @Fog Link OS start process

```
1 int main() {
2     load_config_file();
3     FogFramework fogos;
4     fogos.start();
5 }
6 // 为提高CPU/内存使用效率, FKN OS 完全由C++处理所有UI, 不加
载 dalvik/art虚拟
7 //机, 这是 FKN OS 与Android 最大的不同
8 void FogFramework::start() {
9     start_fog_service_manager();
10    start_fog_framework();
11    start_fog_ipc();
12    binding_scripts();
13    dispatch_system_events();
14 }
15 // 在FKN OS 中运行 Android 应用时由于系统化的 Android 框
架执行
16 void FogAndroidSubSystem::startApplication(int argc
, char* argv[]) {
17
18 }
```

### 3.4. Fog link system equipment

#### 3.4.1. Fog link box

The FNK box can satisfy the requirements in the IPFS transmission system protocol, is configured with 1000M network adapter and USB3.1 interface, and supports 1-5 disk positions. The power consumption is not more than 45W under full load.

To satisfy the requirements of the big disk array, we design the DEMO FNK box according to the appearance of the disk array and embed FNK OS. The hardware can support different disks.

From the view of practicability, design of the FNK disk array can save plentiful maintenance cost for users in future. The mobile haddisks need not be separately purchased in case of installation and operation. After the system starts, the system will enter the predefined RAID capacity logic.

The fog link box is an equipment with the IPFS transmission function, which can provide the box owners with the cloud disk and media center functions and can also provide the IPFS with partial capability output and network resources required in operation of the Fog Link OS. Now the FNK box includes the system and hardware. The following figure shows partial industrial design and effect diagrams of the FNK box.



Fig. DEMO of FNK fog computing miner

### 3.4.2. Block chain mobile phone

After the Fog Link OS is adapted and optimized, it can be directly written into the mobile phone system. Our system could run on the mobile phones such as HTC and Motorola and was highly compatible with the Google Android in 2014 during our mobile phone project plan.

We will continue perfecting UI and user experiences, make great efforts to release the first block chain mobile phone in the world, and take a substantial step for decentralized industry layout.

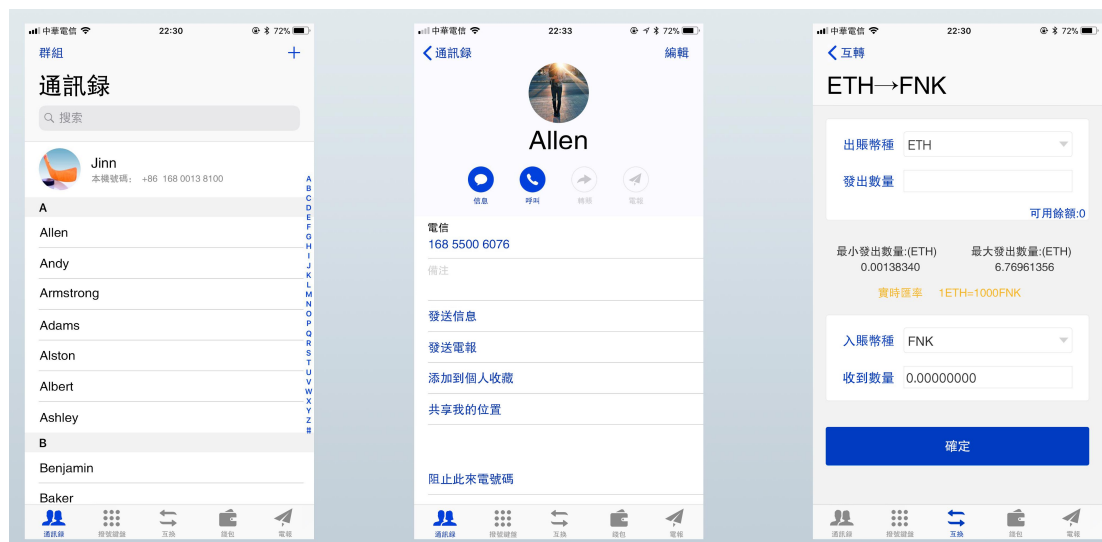


Fig. Fog Link OS UI design

The above diagram shows the snapshot of the mobile applications for the Fog Link OS. It is the first deeply migrated mobile OS in the world, so its UI design is imagined, please refer to final R&D effect.

### 3.5. Open source plan of fog link

The decentralized block chain industry is open and harmonious. We expect to directly open source codes after the FNK puts into operation, including FNK OS.

The developers can easily participate in FNK construction and perfect. For

software developers, game developers, equipment manufacturers and fog computing contributors, we provide massive supporting Tokens. All participants can get FNK sugar by their contributions.

### **3.6. Fog link community**

We will establish the fog link community for lovers. The fog link community will also support potential developer community. Now the free terminals are plentiful on the market and OSs are diversified. We expect to reuse the free equipment, divide their capabilities according to the specification, and make the free equipment show their values.

### **3.7. Alliance**

The ecological system of the fog computing is created by plentiful roles. We have contacted IPFS officers and will promote and cooperate with IPFS technical agreement.

The IBM and Open Fog will provide us with plentiful help. Later will expect more enterprises and individuals to join in the FNK alliance.

## 4. Team Introduction

### 4.1. Members of project team

#### Bruce Song

- Doctor from Chinese Academy of Sciences in the network security;
- Senior system architecture from IBM;
- Senior architecture and big data expert from the State Key Lab;
- Deep theoretical research and rich practice experiences in technical fields such as distributed computing, parallel processing, image recognition, language recognition, natural language understanding, deep learning and data mining and rich big data development experiences in business fields such as telecommunication, E-commerce, finance, military and aerospace;

#### Job

- Senior hardware engineers of the former Sony Ericsson;
- Founder of Ruimei as a mobile new media;
- Honest partner of the Telecommunication operator;
- Be dedicated to mobile phone products and technical fields and have multi-year operation and promotion experiences in fields such as mobile game, mobile ads and mobile payment;

#### Fed Wu

- Founder of Fog Link OS;
- Senior architect of Fota business;
- Senior engineer of the mobile business department of China InterActive Corp;
- Software engineer of Mobby as an America media
- Be dedicated to fields such as mobile ads, new media operation, third-party payment, OS and mobile equipment upgrade;

#### Brook Yang

- National Information Institute of India and Beijing University of Aeronautics and Astronautics
- Deputy president of Internet business department of Coolpad
- Senior software engineer of China InterActive Corp;
- Manager of China Mobile base project;
- Deep theoretical research and rich practice experiences in technical fields such as technical application of block chain, consensus algorithm and general technical framework and rich big data development experiences in business fields such as telecommunication, E-commerce, finance and block chain;

## 4.2. Adviser team

### Guo Hongcai

Be Famous in digital coin field, a famous angel investor of Bitcoin and Ethereum company and multi-year research and exploration experiences in virtual coin and block chain industry.

### Dr. Likai LI

Hawk Eye Angel for Crossborder Hi-tech Investment ( China/Israel/US )

Chairman of Enno Tech, managing Partner of Enno Ventures, vice president of Zhongguancun Association Private Equity and Venture Capital, founding partner of Guansheng & Partners (PRC lawyers), guest professor for executive courses at Peking and Tsinghua University EMBA programmes. Dr. Likai Li obtained his PH.D. from Queens University Canada. Dr. Li served as government legal counsel in the PRC Ministry of Commerce for many years. He became a limited partner of Sequoia Capital (China) in 2007. Dr. Li published two books on innovation and startup management:

《Open Innovation》 (May, 2016.) & 《The Anti Fragile Game》 (May, 2017).

Investment Cases:

- Newsight: Israeli startup, 3 D computer vision chip design
- Growing IO: digital marketing and analysis on consumer behavior
- INK : blockchain startup, digital verification and transaction platform and eco-system for IP properties worldwide
- Heils Tech (AITA): blockchain + AI + IOT (human facial recognition)
- Ding+: SAAS platform for massive C to M orders application ( first garments and jewelry)
- Greenlive : AI device and platform that watches dust spread of construction sites
- SuccessChannel: future China version of Salesforce
- SQU Ltd: Big data + AI platform for education and HR



## Tao Peng

- Johns Hopkins University ;
- A doctor from Johns Hopkins University in statistic pattern recognition specialty
- Master degree of mathematical statistics science and computer science.
- Kernel algorithm engineer of multiple pioneer companies in Silicon Valley; (AcculImage /Merge Health care and Symphony)
- Be dedicated to jurisprudence, image recognition, big data analysis, finance, Internet media and prospection;

### 4.3. Early investors

#### Julia

Julia VCPE Capital Founder/chairman of board

Has the bachelor degree from Shanghai Jiaotong University in application chemistry specialty, the MBA degree of Renmin University of China in business administration specialty and EMBA of Cheung Kong Graduate School of Business, founded several industrial companies from 1995 to 2004, has rich experiences in entity business and management, successfully founded a management consultancy company and multiple private equity investment funds from 2004 to 2015, has deep understanding on the capital market in China and rich practice experiences, has invested multiple companies listed in China and Hongkong, and is one of the influential professional investors on the capital market.

## 5. About this whitepaper

This whitepaper is only for communication. The included information or analysis contents cannot compose the acquisition proposal or persuasions. This whitepaper shall not be understood as the provided technical guidance and buying/selling behavior and shall not be any form of contract or promise.

For technology discussion, please contact us via the following email.

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*Telegram group:*

<http://t.me/fnkofficial>

*References:*

<https://foglink.io/>

<https://ipfs.io/>

<https://www.ibm.com/developerworks/cn>

<http://www.openfogconsortium.cn/>

《OpenFog Architecture Overview》

*Thank the following copartners:*

