



INTERNET OF SERVICES PRIMER



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Introduction

“The secret of the Internet's success has been its openness to new services.”

—— Edward Felton

Background

Information leakages, commission fees, privacy violations are not rare issues during our daily usage of services provided by centralized online service providers. Since the conception of Bitcoin in 2008, developers have tried to develop many blockchain technologies to adapt to various scenarios. Most blockchain technologies, however, are limited by their technical designs. In general, large fees and limited computational capacity prevent widespread blockchain adoption.

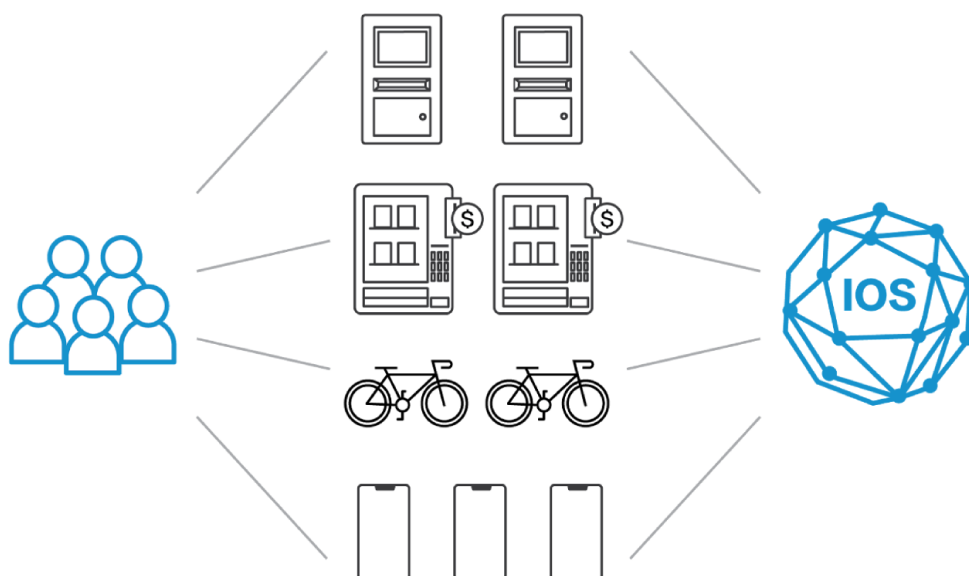
What is IOS

The IOS (Internet of Services) provides a next-generation, decentralized ecosystem for online service providers and users with safeguarded and fast transactions based on blockchain technology. The IOS offers a solid infrastructure for all kinds of online service providers. Its openness, ultra-high TPS, low latency, privacy protection, scalable and secure blockchain, and adoption of many pioneer and innovative technologies like: HUDS (Hyper Universe Distributed System), FTFS (Fair & Transparent Feedback System), EDS (Efficient Distributed Sharding) and PoB (Proof-of-Believability) system will provide infinitely new possibilities for online service providers to serve their customer base. Online service providers can easily deploy independent DAPPs to realize sophisticated applications, including but not limited to decentralized virtual goods/services marketplace, cloud computing, file storage, e-commerce, online gaming, gambling, prediction markets, virtual assistant service, online advertising and more. Using the innovative IOS infrastructure, the underlying IOS network comprises crypto-economic constructions that facilitate online services of all kinds.

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To create a network fast and stable enough to process large volumes of payment transactions, we used IOS Blockchain's secure and scalable architecture. Using our innovative Efficient Distributed Sharding (EDS) system and Proof-of-Believability (PoB) consensus mechanism, our network is capable of processing millions of transactions of goods and services, and optimizes the speed of block generation and the validation process.

In the meantime, users within the network are able to provide/receive services and exchange values safely without counterparty risk. Our users and service providers will all benefit from the network design that is aligned with the essence of transactions and human nature.



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Additionally, the overly complicated access to cryptocurrencies is a large impediment to mass adoption. In order to resolve this issue, the IOS Foundation is actively seeking opportunities for cooperation in the areas of shared economy, the Internet of Things, smart devices, and so on. At the time of writing, the IOS Foundation is actively communicating with leading players in the industry, including the Dora Blockchain Lab, a smart IoT software and hardware service provider that serves millions of customers every day, in an effort to grow the IOS league.

System Overview

Node

In the ecosystem of the IOS, all intelligent IoT devices (such as computing devices, self-driving vehicles, drones, unmanned terminals, and cluster storage devices) are considered nodes in the network. In the IOS system design, we have “first class nodes” that support all technical functionalities and serve as network maintainers, service providers or rule enforcers. The idea of a “first class node” is similar to that of the “first class citizen” in Java, which supports all operations available to all other entities. For devices unable to function as “first class nodes” due to their own resource constraints, it can run a IOS light client using SPV (Simplified Payment Verification) method to verify transactions. Every node in the system would have its unique identity hash in order to ensure that it can be effectively registered, discovered and processed.



Account

An Account is necessary for each user to interact within the IOS blockchain. All personal information, including a user's digital assets and other related information (such as the user's

address, private key, public key, wallet balance and smart contract) is stored in the account. In the IOS ecosystem, all accounts are capable of hosting a smart contract. It is up to the owner of the



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account to decide whether the account shall function as a private account or a multi-signature account. This design not only allows us to create a more dynamic ecosystem, but also enables each user to selectively execute their own functions upon receiving the service or transactions. In the meantime, the sender is responsible for paying any fees generated during a transaction or the execution of a smart contract.

Service Automaton Ecosystem

One of the innovations of the IOS is Service Automaton Ecosystem, a new concept based upon existing smart contracts and the blockchain technology. In short, we can consider the concept of service automaton as the blockchain abstraction for smartphone applications in the App Store. With this technology, online service providers can easily build their own independent Dapps based on IOS technology and integrate them seamlessly into the IOS ecosystem, where users will be able to search and discover new DApps.

Transaction and Service

Like any other ecosystem or marketplace, value-information exchanging between accounts is the most critical activity in the IOS network. According to our design, there are two types of objects, transaction and service, handling such value-information exchange. In the architecture of the IOS, a transaction is defined as a message that signed by a user's signature and explicitly recorded in the blockchain. Typically, transactions will contain the followings: information about the send and the recipient, amount of IOS token to transfer, an optional data section and the commission fee paid by the sender. On the other hand, we define that all messages sent via smart contract as *Service*. Similar to a transaction, a *service* can be used for transmission of data or triggering other smart contracts. However, unlike a transaction, as the deterministic result of a smart contract, a *service* exist only in a **IOS Virtual Machine (IOSVM)** execution environment. This setting helps the network avoid storing huge amounts of service requests (in lieu of critical transactional information) in the IOS network in the future.

Fair & Transparent Feedback System (FTFS)

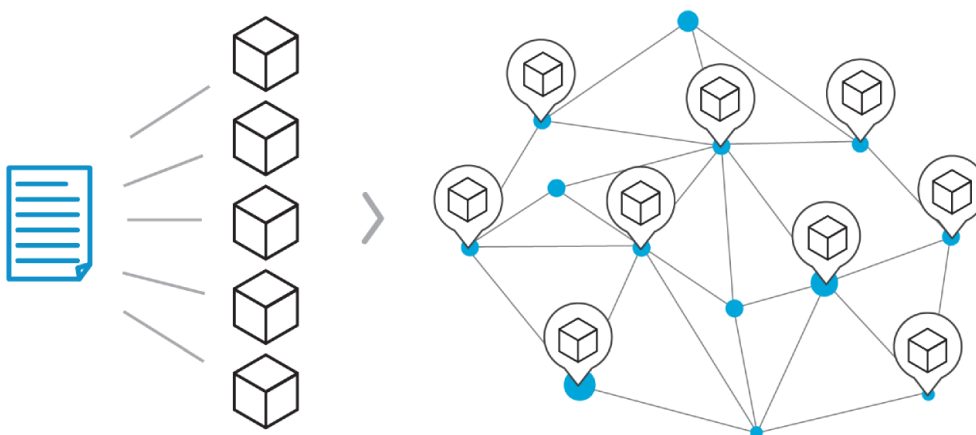
Unlike other centralized service platforms, where reviews can be purposely altered, public

comments on the IOS network can never be deleted or modified. Upon the completion of any transaction, the user will have the right to evaluate the service or product, and the result will be permanently stored in transaction records. Also, the IOS Blockchain allows service providers to

continuously receive feedback from their customers, which in turn can help business owners improve their services and gain believability. In order to incentivize users to give feedback, IOS rewards users by giving believability scores to those who contribute honest and quality feedback.

Hyper Universe Distributed System (HUDS)

The IOS aims to provide a blockchain capable of hosting a wide range of services providers, from independent small business owners to enterprises like Amazon or Alibaba. With that in mind, an efficient way to distribute content and hosting data is critical. The IOS provides a reliable distributed storage and subscription mechanism on P2P networks - **Hyper Universe Distributed System (HUDS)**. Both users and service providers can store files or metadata on multiple nodes in the network, without downtime and censorship. Besides, the IOS has created a distributed index so that service messages can be broadcasted to subscribers. With the help of HUDS, users are able to search for a specific service or application within the IOS ecosystem. The ability to distribute information and data is an important feature the IOS ecosystem supports.



Privacy Protection

For any commercial-oriented ecosystem, it is obvious users do not want their information exposed. IOS builds on anonymous payment systems, trustless ledger-based consensus protocols, and various cryptographic primitives to present a globally consistent view of the

protocols, and various cryptographic primitives to present a globally consistent view of the network to all of its users without sacrificing anonymity. Thus, every piece of information within our ecosystem, regardless of its form, is strictly encrypted. At the same time, the IOS provides zero-knowledge protocols by implementing a new form of zk-SNARKs (zero-knowledge Succinct

Non-interactive Arguments of Knowledge) to shield all data in an asymptotically efficient way. Any third party must obtain user consent to gain data access.

Tokens in the IOS Ecosystem

As a service-centric ecosystem, the IOS blockchain adopts IOS Tokens (IOS) as the medium of exchange for all transactions, commission fees, etc. All IOS tokens will be generated in the Genesis Block. In the IOS ecosystem, IOS tokens can be used for:

- **Payment:** Payments for services and goods provided by merchants or other community members.
- **Commission:** Payment to validators as compensation for running smart contracts, processing messages and transactions, and using resources shared by the general ecosystem including but not limited to storage space, computing power, etc. The commission fee exists to incentivize the validators and prevent malicious users from damaging the interests of the community through excessive deployment of smart contracts.
- **Believability:** IOS tokens will be used in the calculation of a user's believability (explained in the following section).

In addition, as a member of the IOS ecosystem, each user can acquire IOS tokens through:

- **Block Validation:** the process of validating transactions;
- **Community Service:** contributing resources, i.e. running smart contracts, providing storage space, etc;
- **Exchange / Third-party Integration:** Users can obtain IOS tokens easily via exchanges or IOS League partners' integrations (i.e. mobile apps, websites, and even intelligent vending machines).

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In the IOS ecosystem, we will also introduce Servi as a measurement of users' contributions. Servi is a token designed to encourage members to contribute to the continued development of the IOS community. It has the following attributes:

- **Non-tradable:** Since Servi is not designed as a medium of exchange, Servi can not be traded or exchanged in any way.
- **Self-destructive:** After validating a block, the system will automatically clear the Servi balance owned by the validator, so that nodes with high believability can take turns in validating blocks, thus ensuring a fair block generation process.
- **Self-issuance:** Servi will be generated and deposited to user's account automatically after certain contributions, such as providing community services, evaluating services provided by another party, or making other special contributions.



Community Consensus

In order to ensure the sustainable development of the IOS community, we have set up a series of consensus protocols, including but not limited to:

- The IOS network can set a threshold for transaction costs by voting, and only charge for transactions exceeding this threshold.
- The IOS agreement also includes a mechanism that allows validators to vote collectively on the upper fee cap on smart contracts. During network congestions, the system will automatically arrange all transactions according to commission fees, commission limit, and believability of users (this is explained in the next section).



IOS Blockchain Architecture

The IOS blockchain is a scalable and secure blockchain architecture. We have solved four key challenges, making the IOS a sustainable network that connects millions of services around the world.



Proof-of-Believability

We proposed Proof-of-Believability - a randomized Proof-of-Stake consensus protocol. Believability factors include IOS token balance, Servi balance, reviews, and user behaviors, and its range is $(-1, +1)$. We use a faster graded Byzantine Fault Tolerance mechanism, that allows for a set of nodes to decide on the next block. A key aspect of Proof-of-Believability is that these nodes are selected randomly using algorithmic randomness based on input from previously generated blocks. By design, accounts with higher *servi*, more IOS tokens, and better reviews are more likely to be selected as the next validators and beneficiaries of the newly generated blocks.



Efficient Distributed Sharding (EDS)

Our EDS benefits the underlying blockchain networks by reducing the transaction processing load on each validator, and increasing the total processing capacity proportionally with the number of new users.

