# HyperConnect

The Internet of Trusted Things

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January, 2019

# Introduction

HyperConnect is an enterprise-grade, open source Internet-of-Things framework that utilizes the Elastos Blockchain and Peer-to-Peer Carrier Network.

## Purpose

The modular architecture provides a solid base for any industry vertical in the Internet-of-Things.

## Technology

Blockchain technology and the underlying peer-to-peer network allow the secure exchange of Internet-of-Things data between devices as well as value exchange for third-party services while preserving the anonymity of their users.

The exchange of data ownership or service against monetary value occurs on a decentralized and immutable ledger, based on smart contracts, while the transfer of files is carried out via the peer-to-peer network and distributed file storage.

## Licensing



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# Incentive

Most Internet-of-Things projects neglect the critical aspect that sensors produce vast amounts of data of which all have to be analyzed, but only a very small percentage of data is useful or sometimes critical - and the data analysis methods change dynamically with the network properties, which are near unpredictable.

### Solve Complexity

As multiple devices with multiple sensors are connected to form a network, users may create custom even rules that either affect one sensor, the entire network as a whole, or only certain participants in the network.

### Find Balance

Finding the balance between local processing of data, transfer and remote analytics is a complicated task.

### Fulfill Requirements

To be able to create a universal solution, the following properties have to be all fulfilled at the same time:

- No cost for communication
- Low cost for validation
- Low latency
- Cross-communication
- Secure communication
- Anonymity
- Cross-platform endpoints
- Ability to store data locally or in a distributed manner
- Ability to analyze data locally or globally
- Maintain an overview while having the same role as any other participant in the network
- Easy to understand, intuitive user interface
- Allow local integration of any service
- Modularity for easy development
- Incentive to join the network and create a sharing economy
- Allow exchange of value
- Remove middlemen

### Provide Universal Solution

The purpose of the HyperConnect project is to satisfy all the above needs with an open source, powerful and secure solution for private, commercial and enterprise use.

To be able to do so, HyperConnect combines the best properties of multiple technologies, namely blockchain, peer-to-peer communication and platform-independent software.

# Problems

## Data

- *Large amounts of generated data*

IoT devices generate large amounts of data, which must be processed to create valuable information to its users.

## Performance

- *Performance vs. cost*

Data processing can rarely be done locally due to low performance of the device. An increase in hardware performance locally would increase costs, which takes away the competitive edge of the Internet-of-Things.

## Communication

- *Communication is vital*

As a result, there is a necessity of data transfer to remote nodes as well as the possibility for bidirectional communication.

## Security

- *Secure communication requires known identities*

Although there are many widely accepted technologies available on the market for secure data transfer, they all rely on the assumption that both parties involved are known to each other and can prove their identities. Secure communication only hides the data that is transferred, but leaves the participant's identities discoverable.

## Identities

- *Known identities pose a threat to privacy*

The possibility of linking identities is the biggest threat to privacy, and the Internet-of-Things is strongly affected by this issue. Identities are much more valuable than the data exchanged between them.

### Privacy

- *Lack of privacy*

The Internet-of-Things needs a solution to allow neighbour discovery for bidirectional communication, but without the need for participant identities that can be linked to real world identities.

# Approach

### Combination

- *The combination of blockchain and peer-to-peer communication*

Contrary to popular belief, blockchain technology alone is not the key to the adoption of the Internet-of-Things. Blockchain technology solves one problem well, and that is the exchange of value, not data.

### Leveraging

Data must be sent through secure communication channels and be processed by services to create ‘valuable’ information - in exchange for monetary value, but in total anonymity.

The question of anonymity comes into play essentially when monetary value must be exchanged securely.

Currently, monetary value exchange for a service can only occur either anonymously or securely, but not both.

# Solution

### Technology

HyperConnect provides the necessary elements of the following technologies for users to connect their devices based on their IDs, receive data and present it in a visual form as well as authorize services to interact with the devices.

## Key Elements

The key to solving the problem of security and privacy is the combination of:

1. an automated and decentralized identity service
2. a peer-to-peer communication network
3. smart contracts for secure value exchange
4. decentralized application for user interaction

### - Decentralized ID Service

Each IoT Device must automatically receive a unique ID to be able to join the peer-to-peer network, connect to peers, accept or decline communication requests and store monetary value in form of tokens.

### - Peer-to-Peer Communication Network

IoT devices create large amount of data, but without being processed, the cost of data transfer is often much larger than the value of the information that data holds. In fact, its value is often so small that the data transfer must be free to make the data transfer a reasonable decision. Peer-to-Peer networks have the benefit of both being free for data transfer and be entirely secure.

### - Smart Contracts

Smart contracts enable the secure exchange of a service or information for monetary value without the need of a third party. In terms of the internet-of-things, human interaction is not desired and smart contracts have the benefit of being secure, transparent and cannot be manipulated to benefit any party.

### - Decentralized Applications

The Internet-of-Things still requires human interaction, since at some point, the IoT network must be configured to provide valuable information to a question that the user is ultimately looking for.

# Technical Structure and Functions

## Overview

Internet-of-Things Interfaces
- Edge Client
- Remote Controller

Communication & Data Transfer
- P2P Carrier Network

Exchange of Ownership & Monetary Value
- Elastos Main Chain
- Hyper Side Chain

## Edge Client

The Edge Client is the software component that runs on the IoT device and can be used with a Graphical User Interface (GUI) or via Command Line (Terminal).

### Main features:

- Connect to peer-to-peer carrier network
- Generate own carrier address
- Connection administration (add, remove, block)
- Manage sensors (add, remove, modify)
- Manage sensor logic with built-in compiler
- Test and validate sensor logic
- Calculation of data averages (interval & frequency based)
- Manage events (add, remove, enable, disable)
- Notifications (events, connections, errors, warnings)

- Local storage of sensor reading history
- Graphs from sensor readings
- Connect multiple clients to form event groups
- Distributed file storage (Elastos Hive) or database (similar to OrbitDB)
- Offline messaging
- Update Client
- Backup / Restore
- Audio / Video file sharing
- Live streaming

### Optional:

- Elastos DittoBox (ownCloud)
- Elastos Hive (IPFS)

### Local integration possibilities:

- Machine Learning ( TensorFlow )
- Home Assistant ( MyCroft.ai )
- Other services with SDKs

## Edge Client Hosts:

- Linux (based) OS: ( Raspbian, Ubuntu Core, etc. )
- Windows OS: ( IoT Core )
- Android OS: (Android Things)

## Program Components:

- Elastos Native Carrier
- Elastos Java SDK
- JavaFX Framework (only for GUI version)
- SQLite Database

# Remote Controller

The Remote Controller is the software component that runs on the mobile phone or computer of a user and allows an overview of the connected edge clients via a graphical user interface.

## Main features:

- Connect to carrier network
- Generate own carrier address
- Connection administration (add, remove, block)
- Sensor overview
- Events overview
- Notifications (events, connections, errors, warnings)
- Local storage of sensor reading history
- Graphs from sensor readings
- Connect multiple clients to form event groups
- Distributed file storage (Elastos Hive) or database (similar to OrbitDB)
- Offline messaging
- Updates
- Backup / Restore
- Audio / Video file sharing
- Live streaming

### Optional Integrations:

#### Self Hosted

- openHAB
- Mozilla IOT
- Kodi

#### Third-Party:

- Google Home Assistant
- Amazon Alexa

## Remote Controller Hosts:

### Mobile Applications

- Android
- iOS
- Elastos Trinity

### Desktop Applications

- Windows OS
- Linux (based) OS
- MacOS

### Other (Android):

- Android Auto
- Android Wear
- Android TV

## Program Components:

### Mobile Applications

#### Android

- Elastos Native Carrier
- Elastos Android SDK
- Android Material (UI)
- Android Room (SQLite Database)

#### iOS

- Elastos Native Carrier
- Elastos iOS SDK

- Android Material (UI ported to iOS)
- Swift SQLite (Database)

#### Elastos Trinity

- Trinity Runtime
- Trinity Plugins
- SQLIte ( Database )

### Desktop Applications

#### Windows OS

- Elastos Native Carrier
- Elastos Java SDK
- JavaFX Framework (UI)
- SQLite Database

#### Linux (based) OS

- Elastos Native Carrier
- Elastos Java SDK
- JavaFX Framework (UI)
- SQLite Database

#### MacOS

- Elastos Native Carrier
- Elastos Java SDK
- JavaFX Framework (UI)
- SQLite Database

### Other (Android):

#### Android Auto

- Elastos Native Carrier
- Elastos Android SDK
- Android Material (UI)
- Android Room (SQLite Database)

Android Wear

- Elastos Native Carrier
- Elastos Android SDK
- Android Material (UI)
- Android Room (SQLite Database)

Android TV

- Elastos Native Carrier
- Elastos Android SDK
- Android Material (UI)
- Android Room (SQLite Database)

# Communication & Data Transfer

## P2P Carrier Network

Communication, data transfer and storage are vital elements of the Internet of Things.

HyperConnect relies on the Elastos Carrier Network to route network traffic between virtual machines and Decentralized Applications (DApps).

Reasons for a Peer-to-Peer network:

- No cost
- High scalability
- Authentication required before connection
- Contact based connections
- No central point of attack
- No man-in-the-middle

Additional features:

- File storage
- File transfer
- Streaming capabilities
- Group capabilities

# Exchange of Ownership & Monetary Value

## Elastos Main Chain

The Elastos ecosystem also contains a blockchain solution with its own native currency, called ELA. The main role of Elastos main chain is to transfer of trust over multiple chains such as side-chains and friend-chains.

The Elastos mainchain is merged mined along with Bitcoin which provides safety and reliability by the large computing power through Proof of Work (POW) of the Bitcoin network. Merge mining allows Elastos to utilize the consensus mechanism of AUXPoW.

Additionally, Elastos also provides a Delegated Proof of Stake layer (DPOS) to avoid unwanted forking of the Elastos main chain.

From a cryptocurrency perspective, the main chain's role is also to allow the trading and transferring of ELA and the exchange of tokens from Elastos sidechains.

## Hyper Side Chain (Planned)

The role of the Hyper sidechain will be to allow smart contracts to be executed securely on the Ethereum Virtual Machine (EVM) .

Ticker: HPR
Total Supply: 100.000.000
Decimals: 18

HPR will be a utility token which can be freely traded.

HPR will also serve as an incentive for developers to contribute to the HyperConnect project, either through contributions on GitHub or by selling specific modules (program codes) on the Hyper Marketplace.

- Note: Details of the HPR token are a subject to change prior to ICO.

# Use Cases

## Anonymous data collection

Manufacturers are keen to know more about their own products. How their products are being used, which elements need replacement, which ones are faulty in general or which ones are even dangerous. To this day, most of this data is collected after the product is being sent back to the manufacturer for repair. Manufacturers have to make estimations of these statistics and often risk negative feedback from customers or get involved in lawsuits. The secure collection of usage data from products without having to expose identities is the most optimal solution to this massive problem that manufacturers are currently facing.

The solution with HyperConnect is as follows:

1. During production of the devices, a modified Elastos Carrier is installed on products and a decentralized ID is generated for each device.
2. The carrier is programmed to automatically send a request to a fixed decentralized ID when first joining the network. The fixed decentralized ID belongs to the manufacturer and acts as a gateway to collect data in message form.
3. The manufacturer does not have control over the automatically generated IDs and cannot identify which product has which decentralized ID.
4. When a product is delivered to the consumer, the product accesses the internet and starts sending data to the decentralized ID that belongs to the manufacturer.
5. The received messages through the modified Elastos Carrier can then be exported by the manufacturer for creating statistics and other purposes.

The benefit of this process is that IDs are generated for each product and are programmed to contact only one DID in the network, and that DID belongs to the manufacturer.

The manufacturer has no possibility of matching the device DIDs with their customers by default as the IDs were generated in a ‘black box’ environment from a viewpoint of the manufacturer.

Privacy of the consumers is fully preserved. The peer-to-peer network used for communication is secure by its nature.

An additional benefit to this solution is that if the customer, for any reason, wants to make the link between his or her identity as a customer and the device’s identity, the customer can provide the DID of the product to the manufacturer and the manufacturer can trace back all the information even from the past about the product. This enables an improved, professional service for the manufacturer without requiring excessive input from the customer side.

If required, manufacturers may also utilize the distributed file storage IPFS for secure software updates on products.

HyperConnect extends the capabilities of the Elastos Carrier, introduces the manufacturing process and the node implementation for the Carrier on the manufacturer side.

### Anonymous third-party service usage

The exchange of data while preserving privacy becomes more complex when an additional monetary layer is required . Monetary value in exchange for a service is an essential real world process that in terms of the Internet-of-Things must follow the same process. The complexity is amplified by the need of total automation, security and preservation of privacy.

As an example, a third party service needs to be used to extend the capabilities of a an Internet-of-Things device. Let us assume that a device transforms speech (audio) into text locally, but there is a need to have the text translated into another language by a third-party service as our device does not have the capability for the translation.

The general idea is that devices will be able to hold small amounts of tokens themselves that can be managed and monitored via the HyperConnect Dapp, and the services. When a service is selected to be used by a device, the device sends the required amount of tokens to the service provider address, which in return accepts the invitation of the device to connect for a fixed time frame, depending on the value of the tokens transferred. Because the transfer of tokens involves costs, the optimal time frames may be days, weeks or months to use the service.

The HyperConnect Dapp will provide the Marketplace for third-party services to allow device subscriptions in return of HyperConnect tokens.

# Our Company

## Background

**XKI - Internet of Things Development and Consulting**
Website: https://x.ki/

We are focusing on Internet-of-Things and Blockchain solutions.

**Origin of the name XKI**

*“XKI represents the idea of “(**X**)Cross-Platform **K**nowledge **I**ntegration” and translates to a large network of connected devices in which every participant is aware of its surrounding. Participants of the network exchange information and react to changes individually or as a group.”*

## Our Vision

The creation of an evolving ecosystem of interconnected devices may be reached by combining the Internet of Things (IoT), Blockchain technology and Machine Learning.

Our company’s belief is that the next stage in the evolution of technology is the right combination and seamless interaction of such technologies to solve large scale and global issues.

## Our Core Values

“People First, Things Second.”

“ Without a doubt, the rapid growth of technology has made an immensely positive impact on our society. However, a large proportion of our community has been left behind, unable to keep up with the technology and use it to their advantage.

We want to provide these tools in a form that is intuitive, ready to use and very powerful.”

## Current Products

**XKI.Cloud** ( https://xki.cloud/ ) - Beta Closed recently

XKI.Cloud is a cloud hosted, IoT Management Platform for Device, Event and User Management.

The solution is a Software-as-a-Service Product with multi-tenant and clustered database, a separate messaging and analytics infrastructure that can handle up to 4 million messages per second.

The IoT devices can be authenticated via a Graphical User Interface (GUI) edge client and has a built-in Python compiler. The authentication requires no coding and the Python compiler allows a simple, low level manipulation of data for sensor readings.
In addition, the edge client has built-in remote update capabilities.

**Smart Home Hardware**

We have been working with a Smart Home hardware manufacturer and have integrated both the XKI.Cloud solution as well as the Elastos Carrier.

The solution is fully compatible with HyperConnect through the Elastos Carrier network.

## Involvement in Elastos

We have been actively contributing to the Elastos Ecosystem because we believe in the vision of Elastos and because we have been searching for a solution that combines peer-to-peer communication with blockchain.

Our contributions were:

- Updated, corrected and extended documentation for multiple Elastos GitHub repositories such as the Elastos Native Carrier and Elastos Android SDK.
- Created and open sources the Elastos Carrier Java SDK, created the documentation, project roadmap and status overview, as well as a Desktop Messenger using the Elastos Carrier and SDK
- Built Hyper.im, a mobile messenger using the Elastos Carrier and Android SDK. More than 230 beta testers are actively using it since the initial release in the middle of January 2019.
- (not released, MVP) integrated Elastos Carrier into a Smart Home solution

We have also been actively following Elastos news and have invested in ELA.

## Team

***Peter Strauss***

- Co-Founder at XKI
- Previously worked at SAP in Vienna for more than 3 years.

Studies: Business Informatics at the University of Vienna
Technical Focus: Network architectures and web technologies

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