01-30

As the foundation for connecting the real world with the virtual world, the Internet of Things (IoT) has always attracted much attention. Whether in the artificial intelligence revolution or blockchain technology, IoT will always remain an underlying architecture, providing valuable and usable digital recourses. Nonetheless, tons of issues yet to be addressed still exist in IoT at present.

The first issue is fragmentation. Since the day of its birth, IoT is in fragmentation. The omnipresent sharing bikes on the streets are networked, but different types of bikes require different apps to unlock them; moreover, as for those similarly networked sensor doors, infrared lamps, smoke detectors and coffee vending machines, their networks are also separated and closed, so that even products of the same type are fragmented, not to mention those of different types.

Then, can the issue of fragmentation be addressed? The answer is yes. One way of eliminating fragmentation is to introduce a unified operating system and the concept of middleware, compatible with fragmented hardware devices and providing a unified programming interface.

Apart from the fragmentation issue, standardization is a central issue that has plagued and hindered the widespread application of the Internet of Things. IT technologies are standardized. Personal computers interact with the server through the HTTP protocol, presented on the browser, which is a kind of standardization. The all-network broadcast among bitcoin nodes is also standardized. In terms of standardization, the entire IoT industry has tried for over two decades. There are physical layer standards such as WiFi, BLE and ZigBee as well as those for industrial networks such as Modbus, Profibus and Industrial Ethernet. Although different standards are incompatible, no standard at the application layer has been promoted; when Equipment B is successfully connected with Equipment B, Equipment A knows nothing about the operation or the instruction for requesting Equipment B. Even worse, different drivers and different protocols of different software suppliers for the same type of equipment are incompatible, difficult to interact.

Finally, there also exist many difficulties in the large-scale application and safe application of IoT. Firstly, chips, modules, equipment, networks, platforms, applications, data and services etc are a rather long industrial chain in itself, involving numerous and jumbled hardware equipment technologies and software service technologies, with no fully opened market channel, leading to slow value transmission effect. Secondly, the cooperation, trust and value systems among various users, physical objects, sensor control equipment, service platforms, supervision platforms and third party resource systems etc in the industry are not sound, causing great difficulty for IoT to integrating into industries. Lastly, most centralized IoT platforms held by manufacturers or service providers possess the power to collect and analyze users’ data and control users’ equipment without their authorization, posing a great threat to users’ privacy and security.

Well, based on the issues of fragmentation and standardization, Ruff offers a brand new solution, namely, Ruff OS — an IoT operating system that enables operation of hardware by abstracting hardware and calling program libraries. It employs JavaScript, which has numerous developers, as the programming language, enabling the same application code to be operated on different boards, without the need for cross compiling or board programming; it can be tested on PC and deployed for IoT application with one click, so that IoT fragmentation and standardization issues are addressed at the application layer.

Next, programming languages are applied for hardware development to eliminate the gap between hardware and software. By December 2017, 13521 engineers had registered at the Ruff community globally, and over half of them had purchased Ruff development boards and deployed codes.

In terms of the security of large-scale IoT application, Ruff, as an architecture combining IoT with blockchain, includes a distributed operating system and an open main chain so that the peer-to-peer network and consensus mechanism of virtual world are extended offline to enable the information flow to drive the atomic flow.

To put it simply, the blockchain-based distributed ledger may provide Ruff-platform IoT applications with support of trust, ownership records, transparency and communications. Besides, in addition to public chains, private chains will be developed in Ruff to store transaction information in a highly secured way. With centralized server cell phones and data-storing IoT architecture, information may be written into local ledgers and keep synchronized with other local ledgers, guaranteeing the security and uniqueness of facts.

All the IoT transactions on the blockchain will be added with time stamps to guarantee their availability for future generations. Additionally, blockchain digital protocols or smart contracts can be applied to blockchain data, to implement commercial clauses in IoT communications, guaranteeing the effectiveness and security of IoT in large-scale applications. Lastly, blockchains with high-end encryption technologies can help the public chains of Ruff IoT, when used, to reach the highest security standard.

Established in 2014, with edge calculations as its core, Ruff has replaced the original embedded operating system. It currently has over ten thousand developers and is the most common IoT operating system in the industry. Its team members are all from well-known tech companies, such as Nokia, Alipay and Intel, as well as thirty 2017 Forbes China under-30 elite members.

In future, Ruff will be a brand new IoT-based underlying architecture platform, characterized by decentralization, openness, open source and high efficiency. In ecosystem, different participants may provide resources to acquire token returns or consume tokens to acquire resources and share resources to form an economically-driven autonomy.

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作为连接现实世界与虚拟世界的基础，物联网（IoT）一直备受关注。无论是人工智能革命还是区块链技术，物联网都将永远是一个底层架构，提供有价值和可用的数字资源。尽管如此，目前物联网仍然存在大量有待解决的问题。

第一个问题是碎片化。从诞生之日起，物联网就处于碎片化状态。街头随处可见的共享单车联网，但不同类型的单车需要不同的APP解锁；而且，对于那些类似联网的感应门、红外灯、烟雾探测器和咖啡自动售货机，它们的网络也是分离和封闭的，以至于即使是同类型的产品也是碎片化的，更不用说不同类型的产品了。

那么，碎片化的问题可以解决吗？答案是肯定的。消除碎片的一种方法是引入统一的操作系统和中间件的概念，兼容碎片化的硬件设备，提供统一的编程接口。

除了碎片化问题，标准化是困扰和阻碍物联网广泛应用的核心问题。IT 技术是标准化的。个人电脑通过HTTP协议与服务器交互，呈现在浏览器上，是一种标准化。比特币节点之间的全网广播也是标准化的。在标准化方面，整个物联网行业已经尝试了二十多年。有 WiFi、BLE 和 ZigBee 等物理层标准，以及 Modbus、Profibus 和工业以太网等工业网络标准。虽然不同的标准互不兼容，但应用层的标准一直没有推广；当设备B与设备B成功连接时，

最后，物联网的大规模应用和安全应用也存在不少困难。首先，芯片、模组、设备、网络、平台、应用、数据和服务等本身就是一个较长的产业链，涉及的硬件设备技术和软件服务技术众多，杂乱无章，市场渠道不畅通，导致价值缓慢传输效果。其次，行业内各类用户、实物、传感控制设备、服务平台、监管平台、第三方资源系统等之间的合作、信任和价值体系不健全，给物联网融入行业带来很大困难。最后，

那么，基于碎片化和标准化的问题，Ruff提供了一个全新的解决方案，即Ruff OS——一个物联网操作系统，通过对硬件的抽象和调用程序库来实现硬件的操作。它采用拥有众多开发者的JavaScript作为编程语言，使相同的应用程序代码可以在不同的板子上运行，无需交叉编译或板子编程；可在PC端测试，一键部署物联网应用，解决应用层的物联网碎片化和标准化问题。

接下来，将编程语言应用于硬件开发，以消除硬件和软件之间的差距。截至 2017 年 12 月，全球 Ruff 社区注册工程师 13521 人，其中一半以上购买了 Ruff 开发板并部署了代码。

在大规模物联网应用的安全性方面，Ruff作为物联网与区块链相结合的架构，包含分布式操作系统和开放的主链，使虚拟世界的点对点网络和共识机制得以离线扩展使信息流驱动原子流。

简而言之，基于区块链的分布式账本可以为 Ruff 平台的物联网应用程序提供信任、所有权记录、透明度和通信支持。此外，除了公链，Ruff 还将开发私有链，以高度安全的方式存储交易信息。通过集中服务器手机和数据存储物联网架构，信息可以写入本地账本并与其他本地账本保持同步，保证事实的安全性和唯一性。

区块链上的所有物联网交易都将添加时间戳，以保证它们对后代的可用性。此外，区块链数字协议或智能合约可应用于区块链数据，实现物联网通信中的商业条款，保障物联网在大规模应用中的有效性和安全性。最后，采用高端加密技术的区块链可以帮助 Ruff IoT 的公链在使用时达到最高的安全标准。

Ruff成立于2014年，以边缘计算为核心，取代了原有的嵌入式操作系统。目前拥有上万名开发者，是业界最常见的物联网操作系统。其团队成员均来自诺基亚、支付宝、英特尔等知名科技公司，以及30名2017福布斯中国30岁以下精英成员。

未来，Ruff将是一个全新的基于物联网的底层架构平台，具有去中心化、开放、开源、高效的特点。在生态系统中，不同的参与者可以通过提供资源来获取代币收益，也可以通过消耗代币来获取资源并共享资源，形成经济驱动的自治。

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