



## TRANSFORMATIVE IoT BEYOND CONNECTIVITY

### Enabling a Marketplace for Authenticated IoT Data

#### CHINA UNICOM AND ITS PARTNERS DEVELOP SOPHISTICATED BLOCKCHAIN-BASED SOLUTION TO VERIFY IoT DATA

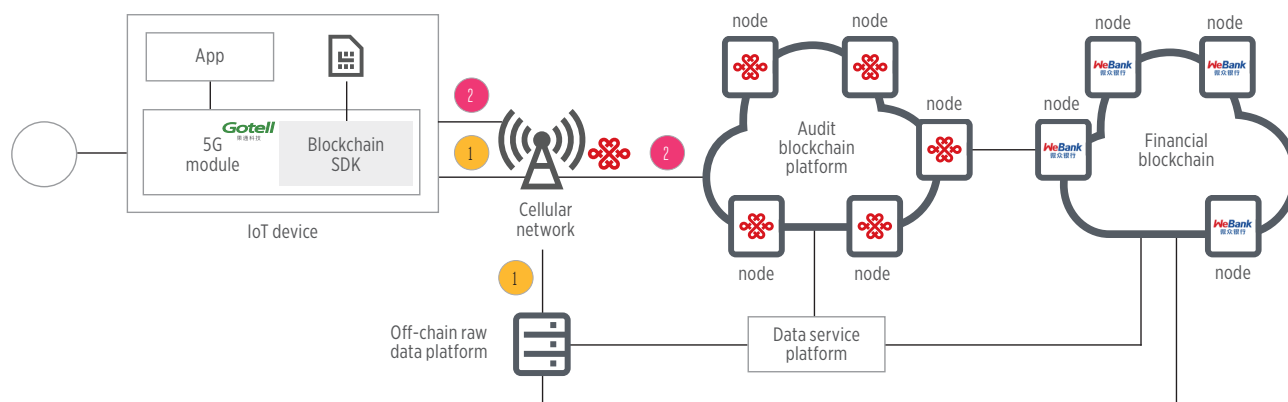
China Unicom and digital-only bank **WeBank** have developed a way to authenticate data collected by Internet of Things devices using eSIMs (a SIM card that can be remotely provisioned and programmed) and blockchain technologies. A blockchain service, provided by China Unicom, can store cryptographic hashes corresponding with data collected by IoT devices, while a financial blockchain is supported by WeBank can be used to support related payment services.

Designed to ensure stronger trust for IoT data, this new solution uses an eSIM in the IoT device to securely store blockchain-related cryptography algorithms and cryptographic keys. When the eSIM is activated the cryptographic keys are provisioned, providing the ability to uniquely identify the source of the IoT data, secure from third party access.

The cryptographic keys are used to “sign” blockchain transactions and by linking IoT data with corresponding cryptographic hashes stored on the blockchain serve to prove the integrity of the IoT data. A 5G cellular module in the IoT device, developed by tech company **Gotell**, runs blockchain SDK (software

development kit) services, which provides the protocols and the interfaces the eSIM needs to interact with China Unicom’s audit blockchain.

Through the financial blockchain supported by WeBank, the solution can also be used to reward citizens and organisations that agree to provide IoT data. A cross-chain solution supports inter-operation between China Unicom’s data audit blockchain and WeBank’s financial blockchain whilst ensuring neither supplier has direct access to the IoT data collected by application platforms.



**Figure 1** Technical components of the IoT solution

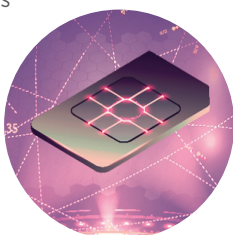
**“This loosely coupled approach means that enterprise businesses can trust their partners because no single party has excessive access to customer data,”**

**Dr. Tang Xiongyan, Chief scientist at China Unicom Network Technology Research Institute.**

## HELPING TO TRACK AIR QUALITY

China Unicom and WeBank are running a proof of concept which seeks to authenticate data on air quality crowd sourced from the country's citizens.

Launched in December 2019, the proof of concept employs IoT devices equipped with eSIMs, 5G cellular modules, 4G/5G connectivity, an “off-chain raw data” platform, China Unicom’s data audit blockchain and WeBank’s blockchain for payment and charging purposes. After receiving raw data from one or more air quality sensors, the IoT device generates a fingerprint (cryptographic hash) for this data. It then uses the mobile network to simultaneously send the raw data to the off-chain platform and the cryptographic hash to the China Unicom audit blockchain platform, where it is securely stored in an immutable blockchain.



The EPB (Environment Protection Bureau) can then use the environmental data service platform (a relational or NoSQL database) to collect and verify the IoT raw data from the off-chain platform with the cryptographic hashes from the China Unicom audit blockchain platform. The data service platform uses the same hash function as used by the IoT device to calculate the fingerprint of the raw data received from the off-chain platform. The data service platform then compares the two cryptographic hash values to check the raw data has not been tampered with.

## COLLECTING TRUSTED AND DETAILED DATA SETS

China Unicom has employed robust and proven blockchain technologies to ensure that “gateways” or platforms often employed to collect IoT data are not involved in compromising that data. Moreover, blockchain platforms enable multiple organisations to collaboratively deliver services without requiring a central trusted agency to prove data authenticity.

For the proof of concept, data about the local temperature, humidity, PM2.5 (fine to medium particulate matter) and PM10 (larger particulate matter) is being collected by sensors every minute. This real-time environmental data is transmitted to the raw data platform via China Unicom’s 4G/5G cellular network. Where beneficial, the new 5G network could be used to also transmit high quality “real-time” video data or to enable low latency IoT ‘control’ applications.



**“A key point to highlight is that many commonly existing IoT solutions are often reliant on intermediate data collection platforms, which cannot always be trusted, but in this case using the eSIM as the root of trust provides all parties with a much greater degree of confidence around the authenticity and origin of IoT data,” adds Dr. Tang Xiongyan. “By use of the eSIM card and 4G/5G network it is possible to ensure that the input data is trustworthy, and that the IoT data stored by a business can be proven to be authentic thanks to an immutable blockchain network.”**

The new solution is designed to support the EPB’s environmental grid supervision system, which requires the deployment of a large number of air quality monitoring sensors. In practice, much of that data will need to be collected by individual citizens or local businesses. China Unicom expects this proof of concept will evolve into a pilot, depending on the market requirements and how the technologies progress.

## HOW OPERATORS CAN ADD MORE VALUE

China Unicom’s new solution can be used across multiple vertical markets where there is any form of data sharing or data marketplace associated with the IoT. The operator can generate revenue from both the provision of the 4G/5G connectivity and the blockchain services.

**“Blockchain eSIM, and blockchain-enabled modules incorporated with 5G will greatly help generating new business relationships and new business models for operators and their customers,” Dr. Tang Xiongyan says. “Mobile operators are well placed to deliver these technologies due to their reach and scale. An off-the-shelf solution from operators will be more cost effective than if enterprises build the equivalent solution for themselves, and importantly leverages key technical assets of the operator, such as data centre provision and IT security processes. The neutrality of operators is also important for cross vertical solutions, where a partner in a single vertical may otherwise prefer to retain control.”**

## About the GSMA

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators and nearly 400 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces the industry-leading MWC events held annually in Barcelona, Los Angeles and Shanghai, as well as the Mobile 360 Series of regional conferences.

For more information, please visit the GSMA corporate website at [www.gsma.com](http://www.gsma.com).

Follow the GSMA on Twitter: [@GSMA](https://twitter.com/GSMA).

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## About the GSMA Beyond Connectivity campaign

Delivering seamless IoT connectivity has been a crucial element in helping operators to launch new services such as low power wide area (LPWA) networks, using NB-IoT and LTE-M technologies and create added value and sustainable growth. Now leading IoT operators are building on this and their reputation as trusted industry partners by delivering value added services beyond connectivity.

These end-to-end solutions include services across big data, machine learning, analytics, edge computing and distributed ledger technologies. They are delivering substantial benefits to customers such as increased productivity, reduced costs and automated business processes as well as driving innovative new products and services, new lines of business and new business models.

Services beyond connectivity are transforming businesses and industries.

[www.gsma.com/BeyondConnectivity](http://www.gsma.com/BeyondConnectivity)

## About China Unicom



China United Network Communications Group Co. Ltd. ("China Unicom") was established in January 2009 with the merger of former China Netcom and former China Unicom. China Unicom, ranked in Fortune Global 500, is the only Chinese telecom operator listed in the stock exchanges of New York, Hong Kong and Shanghai.

The main businesses operated by China Unicom include fixed and mobile communications services, domestic and international communications facilities services, data communications service, network access service, value-added telecom services and system integration service related to information and communications services.

China Unicom owns a modern communications network covering entire China and linking the world. We have been actively pushing forward broadband-based fixed and mobile network development so as to provide comprehensive and high quality information and communications services to the wide users. China Unicom has officially released the brand logo for 5G - '5Gn' on April 23th 2019, focusing on the theme 'Grow into the Future'.

[www.chinaunicom.com](http://www.chinaunicom.com)