NB-IoT Commercialisation Case Study

How China Mobile, China Telecom and China Unicom Enable Million More IoT Devices

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with over 350 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 industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai, Mobile World Congress Americas and the Mobile 360 Series of conferences.

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About the GSMA Internet of Things Programme

The GSMA's Internet of Things Programme is an industry initiative focused on:

- ↘ **COVERAGE** of machine friendly, cost effective networks to deliver global and universal benefits.
- ↘ **CAPABILITY** to capture higher value services beyond connectivity, at scale.
- ↘ **CYBERSECURITY** to enable a trusted IoT where security is embedded from the beginning, at every stage of the IoT value chain.

By developing key enablers, facilitating industry collaboration and supporting network optimisation, the Internet of Things Programme is enabling consumers and businesses to harness a host of rich new services, connected by intelligent and secure mobile networks.

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Summary

In China, the leading mobile operators are using Mobile IoT technologies to connect millions of devices, appliances and machines. For example, in Zhengzhou, China Mobile is using the low power wide area technology, NB-IoT, to connect three million electric bikes to a management platform designed to reduce theft and accidents. Meanwhile, China Telecom is planning to use NB-IoT to connect about 1.2 million appliances, such as air conditioners, washing machines and water purifiers in schools and apartments in Beijing, Shanghai, Guangzhou, Shenzhen and Chengdu. The connectivity enables white goods manufacturers to monitor performance, rapidly respond to faults and enable people living in shared accommodation to easily share appliances. Mobile IoT networks are also helping to improve safety. For example, China Unicom plans to deploy 170,000 NB-IoT-connected smoke detection and alarm devices in rental homes in the Yuhang district of Hangzhou in China. These Mobile IoT-enabled detectors are more cost-effective and reliable than devices using alternative wireless technologies.

In each deployment, the low cost of NB-IoT is enabling consumers and businesses to benefit from better services, while opening up new business models for mobile operators and their partners. Supporting extensive coverage and low power consumption, NB-IoT is making it feasible to securely remotely monitor and control very large volumes of everyday devices, appliance, machines and vehicles. As a result, both consumers and businesses in China are now benefitting from greater convenience, better reliability, and improved safety and security.

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Introduction

As demand for the Internet of Things grows, mobile operators are increasingly harnessing Mobile IoT networks to provide their customers with low power wide area connectivity. Employing licensed spectrum using technologies standardised by 3GPP, Mobile IoT networks can support solutions that need to be low cost, require long battery lives and operate in remote or hard-to-reach locations. Between them, the two Mobile IoT technologies – NB-IoT and LTE-M - can support a diverse range of vertical industries, applications and deployment scenarios.

Designed to connect devices with low bandwidth requirements, Narrowband-Internet of Things (NB-IoT) significantly improves the power consumption of user devices, system capacity and spectrum efficiency, compared with other wireless technologies, especially deep indoors and other hard-to-reach locations. A device battery life of more than 10 years is feasible for a wide range of use cases.

NB-IoT employs new physical layer signals and channels to enable extended coverage and ultra-low device complexity. The underlying technology is much simpler than GSM/GPRS, paving the way for the cost of modules to fall rapidly as demand rises.

Supported by all the major mobile equipment, chipset and module manufacturers, NB-IoT can co-exist with 2G, 3G, and 4G mobile networks. It also benefits from all the security and privacy features of mobile networks, such as support for user identity confidentiality, entity authentication, confidentiality, data integrity, and mobile equipment identification.

As of February 2019, 69 operators in 46 countries have deployed commercial NB-IoT networks

69 Launches **February 2019** | **46** Countries Commercial NB-IoT Networks Globally
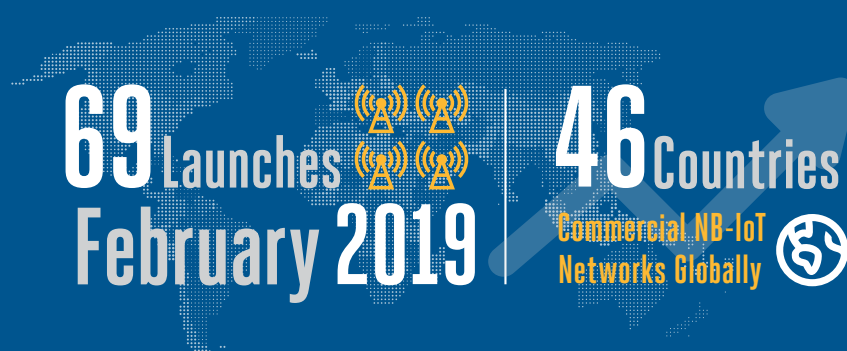
CHINA MOBILE – BETTER SECURITY AND SAFETY FOR SMART BIKES

中国移动
China Mobile

Managing the massive expansion of electric bikes

Sales of electric bicycles are rising rapidly as the performance of batteries improves. For example, there are now more than three million electric bikes in Zhengzhou, a city of about 10 million people, according to China Mobile. "Although they provide a very convenient way to travel, the sheer number of electric bicycles in the city has caused a lot of social problems, such as a high rate of theft, a high traffic accident rate, and a high proportion of fire hazards," China Mobile says.

To address these issues, the mobile operator is helping the city administration to deploy a comprehensive management platform, underpinned by the advanced Beidou Navigation Positioning System and NB-IoT connectivity, allowing electric bikes to be licensed and monitored. The platform is part of a 150 million yuan (US$22 million) project to help maintain traffic order, prevent fires, improve security and reduce theft, overseen by the Public Security Bureau of Zhengzhou.

Over the course of 10 months, the Zhengzhou Branch of Henan Mobile Company developed an integrated NB-IoT-based solution, paving the way for all three million electric bicycles in Zhengzhou to be equipped with NB-IoT-enabled positioning modules. Via China Mobile's NB-IoT network, the platform can collect information on the position, speed, time, space and temperature of an electric bicycle using the Beidou satellite point technology and various on-board sensors.

The solution is being used to monitor bikes in the urban area of Zhengzhou and eight nearby counties. Electric bike owners can register for a license at business halls, communities, squares, shopping malls, supermarkets, villages, and bicycle dealers. To date, more than 923,000 bikes have been connected using NB-IoT.

The benefits of using NB-IoT

China Mobile says NB-IoT is well suited to managing electric bikes for several reasons. First of all, it can support large numbers of connections. Secondly, NB-IoT offers much greater coverage than GSM, while still benefiting from the same security capabilities, including support for two-way authentication and the strict encryption of air interface to ensure the security of user's data. Furthermore, NB-IoT is stable and reliable, supporting the carrier-class availability required by IoT applications and smart city solutions. Last, but not least, the connectivity is very cost-effective: the low bandwidth allows for low power consumption: the battery could last for up to ten years.

"The implementation of this project has set a benchmark for the comprehensive management application of NB-IoT electric bicycles in the whole province and even the whole country," says China Mobile. "The company's NB-IoT technology has taken a landmark step towards scale commercialisation, which greatly enhances the influence of this industry: the public security system throughout the country has organised study groups to go to Zhengzhou to learn from their experience."

China Mobile says the solution provides convenience for citizens, while also benefitting the police. "It will inevitably become a benchmark for the innovative application in the Ministry of Public Security and lead the innovation and development of the new generation of mobile police in the whole country," the operator concludes.

> " The implementation of this project has set a benchmark for the comprehensive management application of NB-IoT electric bicycles in the whole province and even the whole country "

CHINA TELECOM – MONITORING MORE WHITE GOODS

Using NB-IoT to manage the lifecycle of appliances

Manufacturers of home appliances, such as washing machines, air conditioners and refrigerators, are seeking cost-effective ways to monitor the distribution and usage of their products over time. As NB-IoT piggybacks on the existing cellular infrastructure, it can support a large number of connections at low cost. That is a key attribute given that in China and other large markets, each white goods vendor may need tens of millions of connections.

In China, appliance vendors are looking to use NB-IoT connectivity to help prevent unauthorised cross-region shipments of appliances, which may adversely affect the vendor's profits. An NB-IoT connected product can periodically report location data as it is being transported, whereas Wi-Fi-enabled products can only come online once they have been manually connected to a specific router.

Appliance vendors can also use NB-IoT connectivity to collect device fault data for post-purchase maintenance services, and to help improve the design of future appliances. With a smart home appliance platform, vendors could build their own ecosystems delivering a variety of online-to-offline services. For example, vendors can use the platform to monitor the real-time status of appliances, alert end-users to faults and provide rapid repair services. Moreover, vendors can analyse the data collected by the platform to deliver tailored supplementary services, such as the timely delivery of detergent.

NB-IoT has several key advantages over Wi-Fi in this market. Whereas appliances with embedded Wi-Fi need to be configured by the owner, NB-IoT-enabled appliances can connect automatically to an operator's network. As almost all white goods operate indoors, they need to be connected to a network that can penetrate walls and reach underground into basements. NB-IoT is designed to provide coverage deep indoors, while white goods in washrooms and kitchens can't always receive Wi-Fi signals.

Moreover, Wi-Fi-based appliances can be disconnected due to password or router changes, while a limit on the number of simultaneous connections means white goods may not be able to transmit information because the maximum number of household connections has been reached. Huawei says that the online availability of Wi-Fi-enabled white goods drops to less than 5% in three years, which is too low to meet the requirements of white goods manufacturers. There is also a risk that Wi-Fi router passwords can be hacked, leading to unsecure appliance connections. By contrast, NB-IoT connectivity is provided over secure networks run by mobile operators.

In summary, NB-IoT connectivity makes it feasible for manufacturers to manage the entire lifecycle of household appliances, from manufacturing, logistics, warehousing, and retailing to application and maintenance.

Enabling the sharing economy

The cost-effectiveness and coverage of NB-IoT is enabling appliance manufacturers to explore new business models, such as the deployment of machines that can be rented on a per use basis. China Telecom first began testing this kind of proposition in 2017. Together with a leading white goods maker and Huawei, the operator launched the Commercial Laundry Room at the Beijing University of Chemical Technology. Equipped with NB-IoT, 40 smart washing machines are being used by tens of thousands of teachers and students.
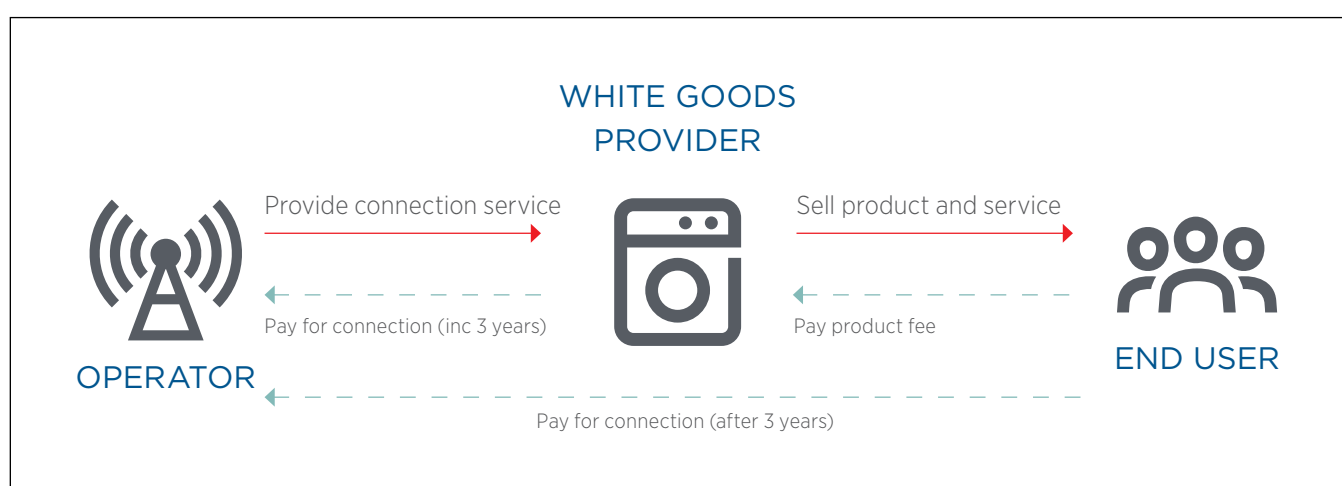
After registering using a QR code via WeChat, an end-user can make a laundry service reservation, pay, and then remotely follow the laundry cycle through an app. After all the service tasks are completed, the cloud platform automatically notifies the user. "The whole laundry service process is highly intelligent, completely overturning the previous campus self-service laundry service mode," says China Telecom[1].

The Commercial Laundry Room service uses the white goods maker's NB-UHomeKit solution, which incorporates a compression algorithm, information security and a variety of network protocols, as well as NB-IoT. The vendor is seeking to deploy its NB-UHomeKit much more widely, rolling out an NB-IoT smart air conditioner and smart door lock application.

To support this emerging sharing economy, China Telecom is aiming to use NB-IoT to connect about 1.2 million appliances, such as air conditioners, washing machines and water purifiers in schools and apartments in Beijing, Shanghai, Guangzhou, Shenzhen and Chengdu. The NB-IoT connectivity can be used to collect data from on-board sensors, such as a gyroscope, an accelerometer and temperature and humidity monitors. This data enables the manufacturer to monitor the appliance's operational status, the environment in which it is located and track fault information.

A similar concept could be applied in the business market. For example, China Telecom believes printer manufacturers could use NB-IoT to monitor the status and performance of their equipment in commercial buildings.

Huawei says mobile operators in China are using a conventional B2B2C business model: the mobile operators provide SIM cards to white goods manufacturers, which then sell the smart white goods to the end customers. The white goods providers pay the first three years of communication data traffic fees to the operators when they sell these products (see diagram). Three years later, if the end customers stills want to use the NB-IoT connectivity, they will be able to pay for the subsequent data traffic fees via a smartphone application.

WHITE GOODS PROVIDER

Provide connection service

Pay for connection (inc 3 years)

OPERATOR

Sell product and service

Pay product fee

END USER

Pay for connection (after 3 years)

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[1] http://jiaju.sina.com.cn/zixun/20171117/6337220545725399074.shtml

CHINA UNICOM – ENABLING SMOKE AND TOXIC GAS DETECTION

The case for smart smoke and gas detectors

As toxic gases and fires can kill people and ruin homes and workplaces, householders and businesses are increasingly looking to use specialist detection equipment to minimise losses and damage. Connected smoke detectors can act as automated sentries, able to detect smoke or gas leaks in real time and alert people in the building and elsewhere. If the density of smoke or a gas exceeds a predetermined threshold, a smart smoke detector will notify a backend management platform and activate related devices, such as alarm bells. The platform can also alert the building owner or manager, as well as emergency services, via voice messages or SMS. With real-time information supplied by smart smoke detectors, fire fighters can make critical decisions about where to deploy their resources to save lives and reduce property losses.

NB-IoT cuts the cost of connectivity

The risk of damaging fires is particularly high in the old areas of cities where buildings can be densely packed. In such properties, it can be hard to install smoke detectors using cables. As they don't need wiring, cellular-connected smoke detectors can overcome these challenges. With support for extended coverage, NB-IoT detectors can also connect to a base station in basements and closets where conventional network coverage is weak or non-existent.

As NB-IoT is a low power technology, detectors with 3000mAh batteries can run for three to five years, according to Huawei. By contrast, power-hungry traditional smoke detectors require frequent battery replacements, making them more expensive to maintain.

A NB-IoT-enabled smoke or gas detector can be configured to send a "heartbeat message" at regular intervals, such as every hour, in addition to an alarm message, when smoke reaches a certain threshold. These messages can be less than 100 bytes per time, meaning they can be comfortably carried by a NB-IoT connection. In case of a message delivery failure, the message is re-sent automatically. Moreover, Huawei says the firmware of the smoke or gas detector can be updated over-the-air using NB-IoT, as the update will typically require less than 30kb of data.

Commercial deployments underway

Following successful pilot tests, China Unicom plans to deploy 170,000 NB-IoT connected smoke detection and alarm devices in rental homes in the Yuhang district of Hangzhou in China. Generally installed in the ceiling, the units will monitor smoke levels in 170,000 rented rooms. The detectors will transmit data on smoke levels, power consumption and network signal strength to a backend platform.

China Unicom is working with Taihe Ann, a smoke sensing terminal and application platform provider, Lierda, a manufacturer of transmission communication modules, and systems integrator Dabang, which is responsible for installation and maintenance. During a two month on-site network test, the partners optimised the NB-IoT detector's key parameters, such as time delay, sensitivity and power consumption.

The deployment should reduce the cost of fire monitoring and fire fighting and increase response times in the event of a fire. Following the deployment in Yuhang, the partners intend to extend the deployment across the whole of Hangzhou.

Huawei says China's mobile operators are employing two different business models (see diagram). One model involves simply providing the connectivity and SIM cards to suppliers of smoke detectors, whereas the other model involves the operator purchasing detectors from suppliers and then providing the full package to the building owners for a monthly rental fee.

SALE MODEL:

OPERATOR → Provide connection → **Device Sim connectivity** + **Annual service** → Provide device and service → **USER** / **BUYER**: Regional government and apartment or store owner

Pay connection fee to operator ← Pay device & service fee

RENTAL MODEL:

Device + **Annual service** → Provide device and service → **OPERATOR** → Rent device and offer service → **USER** / **BUYER**: Regional government and apartment or store owner

Pay device & service fee ← Pay rental fee to Operator

Conclusion

The rollout of NB-IoT connectivity across China's emerging sharing economy highlights how this Mobile IoT technology is being widely adopted by both enterprises and consumers. With the number of active NB-IoT connections now rising into the millions, economies of scale are increasing, creating a virtuous circle that will drive wider deployments.

An integral part of operators' 5G IoT proposition, NB-IoT is fully future-proof. For applications with low bandwidth requirements, Mobile IoT networks are likely to remain the most cost-effective way to monitor large numbers of assets and support related service propositions.

For more information please visit:
www.gsma.com/IoT