Community-led monitoring to improve water quality

UpStream

research.ncl.ac.uk/upstream

MOST 科技部
Ministry of Science and Technology

UKRI
Economic and Social Research Council

Knowledge Exchange:
Taiwan's IoT telecommunication journey

By Richard Huang, CTO AnaSystem, Taiwan (December 2021)

Overview

About five years ago, the Taiwanese government evaluated three primary low-power wide-area network (LPWAN) technologies to inform investment in the next generation of Internet of Things (IoT) telecommunication. These were **Narrowband IoT (NB-IoT)**, **long-range wide area network (LoRaWAN)** and **SigFox**.

SigFox

Operated by a private network operator, SigFox was immediately eliminated with it being a closed system. Using this option would result in a monopoly, which would contravene Taiwan's regulations.

LoRaWAN

LoRaWAN attracted the Taiwanese government's attention because it uses an unlicensed band and has no monthly fees. During the first two years of investment, the Taiwanese government built multiple LoRaWAN base stations and opened them up for citizen use. **However, they encountered various problems**. **Firstly, LoRaWAN runs on an unlicensed band, which means that radio sources may interfere with the telecommunication** - not just illegal radio sources, but also LoRaWAN modules themselves. LoRaWAN modules must follow a transmission pattern of 'Transmit-Stop-Transmit-Stop' and so on. A stop interval time is a random number. If a given module does not follow the same pattern as others, all other modules become jammed by that particular module. Furthermore, it is not easy to pinpoint the problematic modules. **Secondly, running a dedicated LoRaWAN network appeared to be costly and complex**, with the government having to set up, amongst other things, call centres to provide support to end users. **Thirdly, LoRaWAN is not a fully 'open market'**, with the server-side payload protocol usually handled by the supplier who built the network.

As a result, the Taiwanese government halted LoRaWAN plans and turned to narrow band IoT (NB-IoT).

NB-IoT

NB-IoT is operated by telecoms under licensed bands. **The service can be activated by upgrading the 4G base station software with the extra running cost for the telecoms being marginal. As a result, the government does not have to be concerned about the maintenance of the IoT network or about providing detailed customer support.** The communication protocol is based on TCP/UDP IP, so **anyone who uses the network can use their protocol without any restriction. Furthermore, if users are not satisfied with the quality of the telecommunication, they can easily switch between telecom providers.**

Newcastle University | rps | RAIN++ | ETHzürich | YorkshireWater | LASS Location Aware Sensing System | 台灣乾淨水 行動聯盟 | FondUS Technology | Friends of BRADFORD'S BECKS

Community-led monitoring to improve water quality

UpStream
research.ncl.ac.uk/upstream

Knowledge Exchange:
Taiwan's IoT telecommunication journey

By Richard Huang, CTO AnaSystem, Taiwan (December 2021)

NB-IoT (continued)

Unlike LoRaWAN, which can only have one network provider in an area due to band restrictions, **NB-IoT also has a range of other technical advantages over LoRaWAN**. For example, NB-IoT is based on TCP/UDP ethernet protocols with error check, store and forward mechanisms, and two-way communication being more mature than those of LoRaWAN. Resyncing missing data and performing remote control over NB-IoT is much more reliable than doing so over LoRaWAN. Resyncing long periods of missing data over LoRaWAN is challenging, to say the least, due to the bandwidth being too low and narrow.

For these reasons, the Taiwanese government decided to invest significantly in NB-IoT in 2018. Since then, hundreds of thousands of NB-IoT-based sensors have been deployed across our small island. At present, four major telecom companies provide NB-IoT services.

Thailand has undergone a similar journey - they were initially attracted by the open, free and unlicensed features of LoRaWAN. However, the costly and complex operation of LoRaWAN along with frequent performance issues led them to switch to NB-IoT in 2018.

AnaSystem Investment

Our company, AnaSystem, has invested massively in LoRaWAN and have since sold thousands of LoRaWAN sensors across Asia during 2016 and 2017. Sadly, **a lot of these sensors are now being abandoned**. However, many of our sensors can be upgraded to NB-IoT and we are working closely with clients to upgrade them.

LoRaWAN + 4G/NB-IoT hybrid solution

A **new hybrid LoRaWAN + 4G/NB-IoT solution has emerged in Asia**, which allows the original LoRaWAN-enabled sensors will also be utilised further. The new architecture involves deploying hybrid gateways (effectively, LoRaWAN gateways turned into 4G/ethernet-connected gateways) which collect data from short-range wireless sensor networks, usually within a 1 km radius, before transmitting it via 4G. This solution is very practical for cases with tens of sensors spread across a small area. In these types of cases, data transmission via 4G/NB-IoT can be potentially very costly for each individual sensor. This hybrid architecture effectively builds on the advantages of LoRaWAN and 4G/NB-IoT, while overcoming their drawbacks.

"This is a 5-year long story short. I hope our experience can be helpful for other IoT enthusiasts". Richard Huang, CTO AnaSystem, December 2021.

The UpStream team would like to thank Richard for his knowledge exchange contribution.