Will LoRaWAN's diverse ecosystem lead to private network success?

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How a network-in-a-box is powering private IoT networks

Much of the excitement around private networks, owned and operated by organisations on behalf of their businesses, rather than public networks provided by telecoms network operators that can be accessed by any customer, has been focused on the imminent arrival of 5G. However, even though private, standalone networks will lead the 5G charge, for many IoT applications the benefits aren't needed, cost is too high and configuration too complex. What's needed, writes IoT Now managing editor George Malim, is simple to buy, configure and operate wireless connectivity that can meet the needs of IoT applications in terms of cost, device density, throughput and security

There is no right answer that addresses all questions in IoT. Some applications will be utterly dependent on 5G's low latency, high connection density and enormous bandwidth. However, other applications don't need the speed or low latency and can't justify the cost of equipment and network capacity. In addition, many IoT organisations are not advanced networking users and don't have the knowledge, appetite or interest in specifying, configuring and operating private cellular networks. These organisations also have limited appetite to engage with the private network offerings of network equipment vendors, mobile network operators and systems integrators, preferring to control their own dedicated and secure connectivity. They want longevity, security and reliability plus the assurance that they are in control of their own destinies, whatever the future holds.

Aside from 5G, which has enormous attractions for large corporations that have business cases that benefit from its capabilities, there's a large established market for private networks and, arguably, an even larger still-to-mature market. The benefit of operating a private wireless network is well-understood thanks to the routine adoption of Wi-Fi within buildings and campuses and Wi-Fi itself is also set to experience a performance uplift with Wi-Fi6 coming to market,

offering greater capacity. Again, this will be the optimum solution for some IoT applications but it will be unappealing for many more.

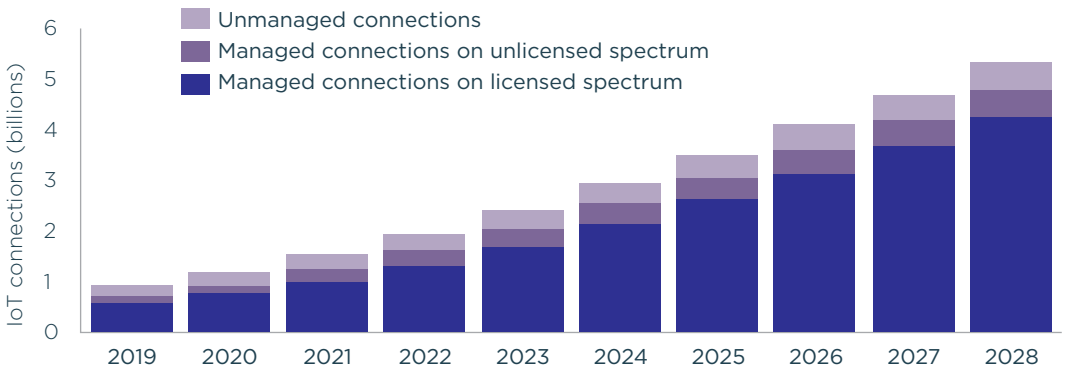
Private cellular networks are well-established and **Transforma Insights** has reported that the last few years have seen a significant increase in interest in using cellular technologies. The vast majority currently utilise LTE, gaining some of the benefits of 5G but with limited bandwidth and greater latency. Even so, the firm sees the cellular private networks market taking off substantially only with the availability of 5G. For lower end applications, with lower bandwidth requirements, the cellular industry is looking to narrowband IoT (NB-IoT) to connect IoT apps and devices and it is expected there will be many private NB-IoT networks notwithstanding set-up complexities and access to equipment.

This leaves us with a final category, the non-cellular low power wide area (LPWA) network technologies. These include technologies such as Sigfox, LoRaWAN and Zigbee. Among these, LoRaWAN and Sigfox are set to dominate, holding a leading share of LPWA networks until at least 2024 according to **ABI Research**. The firm also reports these two LPWA technologies will maintain a lead over NB-IoT and LTE-M until 2026 when cellular LPWA will account for about 60% of the 3.6 billion LPWA connections. Of the remaining 40%, LoRaWAN and Sigfox will account for more than 80% of non-cellular LPWA network connections, the firm says.

By 2026, ABI Research expects LoRaWAN to be the leading non-cellular LPWA network technology and it will account for more than a quarter of all LPWA network connections and more than half of all non-cellular LPWA. This follows hardware and connectivity module issues that have hindered NB-IoT and LTE-M market development and uncertainty regarding embedded and integrated subscriber identification module (eSIM/iSIM) technologies. These factors have delayed cellular LPWA adoption and alternative, non-cellular LPWA technologies have continued to experience growth.

However, this early lead, is not set to continue as cellular LPWA overcomes early challenges and 5G benefits crystallise. As an indicator, analyst firm **AnalysysMason** forecasts in **Figure 1** that ▶

Figure 1: IoT connections by spectrum type worldwide 2019–2028



Source: Analysys Mason, 2020

connections that use non-licensed spectrum, such as those for LoRa and Sigfox, will account for only 12% of all managed connections by 2028. The firm anticipates most IoT connections will run on licensed spectrum – that is, 3GPP standards – and most of these will be LTE-M and NB-IoT. This is borne out by **Figure 2** from **IHS Markit** which predicts LPWA will be a two horse race between Sigfox and LoRaWAN, at least in the short term. The long term is yet to be seen but don't forget that by then IoT connections will number in the billions so, even by this estimate, LoRaWAN will play an extremely significant part in the future IoT.

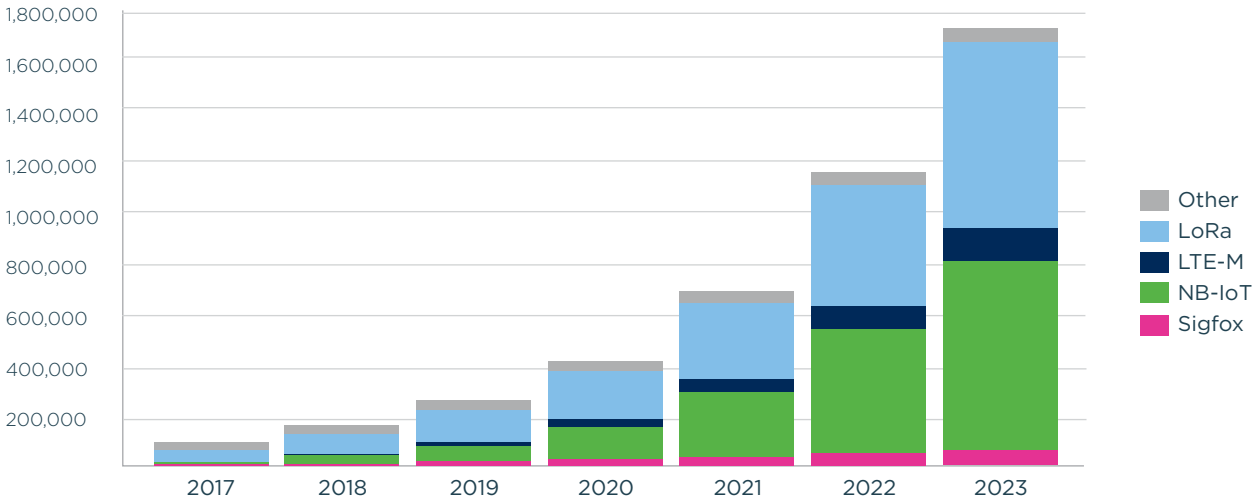
LoRaWAN as an alternative to 5G

In a recent blog published on **www.iot-now.com**, Sergiy Seletsky of **Intellias**, asserted that LoRaWAN can do most of the same tasks that 5G can do but more slowly and cheaply. No one is suggesting that LoRaWAN is the ideal solution for transmitting video or sound because with speed that ranges between 0.3Kbps and 27Kbps it would take several hours to transmit an image but for industrial sensors that need to transmit short packages of data, it's well suited.

Perhaps LoRaWAN's greatest strength is that it doesn't require complex, expensive infrastructure. It runs on small, affordable devices, with sensor costs just a few dollars in contrast to 5G-enabled sensors, which start at US$30 according to Seletsky. On the network equipment side, the cost is even more appealing. A typical outdoor LoRaWAN base station can cost less than US$,1,000 and handle thousands of connections in a 15km coverage range. In contrast a 5G base station would cost US$60,000, cover an area of 2km and support about 1,000 connections.

Seletsky's figures demonstrate the market potential for LoRaWAN as an enabler of private networks. As Analysys Mason has pointed out, traditional cellular connectivity is not able to meet the battery life and propagation requirements of applications such as smart water and gas meters. The firm has reported that NB-IoT and LoRaWAN networks are better suited to meeting these requirements but this market has entrenched relationships with service providers for its existing M-Bus networks. NB-IoT will be provided by mobile network operators who have an opportunity to gain customers in a market like this. However, LoRaWAN does not necessarily need a service provider, although national networks exist in a growing number of countries.

Figure 2: LoRaWAN and Sigfox are leading LPWA uptake



Source: IHS Market (now Omdia) 2019

The attraction here is that organisations can build their own networks if they want to. One of the advantages of LoRaWAN is that you don't have to be an enormous multinational corporation with vast resources and networking experience in order to have a private network and the LoRa community has latched on to this prospect with enthusiasm.

Lora Alliance chief executive and chairwoman, Donna Moore, has said she expects private industrial networks could account for around 50% of all LoRaWAN deployments and she sees industrial IoT (IIoT) as a particularly fertile ground for the technology. She cites deployments at major US retailers and at Schipol Airport in The Netherlands as indicators that the future of private networks is not only industrial.

"Platform advances and edge computing will also contribute to the digital transformation of industry," she said. "In their own ways, both areas contribute to advancing manufacturing safely and productively. The LoRaWAN ecosystem is collaborating on platforms that can facilitate highly deployable, cost-effective approaches to IoT, covering a huge number of applications such as safety, tracking, predictive maintenance, stock or parts, and many others."

Open ecosystem

An advantage of LoRaWAN is that it has established an expansive ecosystem of developers and product manufacturers that brings choice to the market. Many of these are now easy to purchase and give IoT customers confidence that this is a vibrant ecosystem with more innovation to come.

Among the vendors, **MultiTech** offers its Conduit, LoRa gateway for industrial applications. Network engineers can remotely configure and optimise their Conduit performance through DeviceHQ, MultiTech's IoT Application Store and Device Management platform. The Conduit features Wi-Fi, Bluetooth. Bluetooth Low Energy (BT/BLE), GNSS and two accessory card slots that enable users to plug in MultiTech mCard accessory cards supporting their preferred wired or wireless interface to connect to a wide range of assets locally to the gateway. Available options include a LoRaWAN mCard capable of supporting thousands of MultiTech mDot and xDot long range RF modules connected to remote sensors or appliances.

Kerlink's Wirnet iStation is an evolution of the Wirnet Station and provides a LoRaWAN

gateway to smart projects, combining simplicity of installation with coverage. The Wirnet iStation comes with features for remote monitoring, advanced radio network configuration and backhaul management with Kerlink's Wanesy Management Center (WMC), which make it easy to operate a LoRaWAN network even for non-telecoms users. The Wirnet iStation is also compatible with the Wanesy Small Private Network solution to deploy a standalone and self-operating LoRaWAN private network.

Tektelic's KONA Micro IoT Gateway is another LoRa gateway designed for enterprise and lightweight industrial applications that require always-on connectivity. Configured with an internal 3G/4G modem and a built-in battery backup, the KONA Micro IoT gateway continues to operate and transmits sensor data to the network even when the main site has lost power. Simple to configure and cost effective, it is targeted at private networks where the operator requires unfettered access to the gateways regardless of their deployment location.

The three gateways listed above are just a small snapshot of the marketplace with many more LoRaWAN gateways and devices available across a broad ecosystem. Significantly, products from all three of the vendors above – and others – are available from **Amazon**'s AWS Partner Device Catalog. This catalogue enables IoT developers to select AWS-qualified gateways and an array of certified LoRaWAN devices from the LoRa Alliance website. Then, they can utilise the AWS Management Console to register gateways with the AWS IoT Core for LoRaWAN.

AWS IoT Core for LoRaWAN is a fully managed feature that enables customers to connect wireless devices that use LoRaWAN with the AWS cloud. Using AWS IoT Core, customers can setup a private LoRaWAN network by connecting their own LoRaWAN devices and gateways to the AWS cloud – without developing or operating a LoRaWAN network server (LNS).

This radically streamlines set up of LoRaWAN and AWS IoT Core for LoRaWAN supports the open source gateway-LNS protocol software called LoRa Basics Station. This creates a plug-and-play experience that reduces the device on-boarding friction. In fact, customer can even buy specific kits in boxes. Semtech, the owner of LoRa, has collaborated with AWS and **TensorIoT** to simplify IoT solutions development and is offering kits for the asset tracking and smart building sectors that integrate LoRa devices and the LoRaWAN protocol with AWS' IoT services.

Amazon is not the only possibility and several vendors have productised LoRaWAN in a variety of ways to make it simpler to specify, deploy and operate private networks. **Actility**'s ThingPark Market is one example that also offers solutions that have been put together to meet the needs of specific deployment types. Distributors, such as **Digi-Key**, also have extensive portfolios of LoRa-

related products that are readily available, enabling customers to buy the hardware they need.

Much of this is thanks to the inclusive attitude Semtech has taken. Rather than confining LoRa to being a proprietary system for connecting industrial sensor networks, the company has focused on creating a robust radio standard and is now looking to continue to grow the ecosystem. This is demonstrated by Semtech's recently unveiled LoRa Edge platform, which enables location to be calculated using Wi-Fi or GPS at a fraction of the cost of current solutions. LoRa Edge comes with Semtech's LoRa Basics Modem-E software which means developers don't have to worry about the underlying radio functions. The LoRa Basics platform has been designed with low power usage and low cost in mind, making it applicable to a raft of IoT applications. In common with much of Semtech's activities, LoRa Basics have been launched in partnership with the ecosystem.

Conclusion

Private networks are a seductive proposition. Once you've set up your network you're no longer subject to the vagaries of a mobile network operator, a systems integrator or another form of connectivity service provider. You own the hardware and know how to operate the system, keeping it secure and well-maintained.

In previous generations these benefits were the preserve of the largest corporations who could establish their own cellular, wired or radio networks or turn to specialised providers to do it for them. What LoRaWAN is achieving is the democratisation of private networking. Admittedly, it won't achieve the ultimate throughput of 4G or 5G and there are considerations to address in terms of security, but the extensive ecosystem provides huge choice and options to address specific use cases and concerns.

If you don't need very high speed and low latency but operate over a relatively large area and need a large number of sensors and devices connected, LoRaWAN offers a simple means to run your own private network. After all, you can buy it in a box from a mainstream retailer and watch videos on YouTube to learn how to set it up quickly and simply. For farmers, factory supervisors, facilities managers and many others, networking has never been so simple to enable.

Why LoRaWAN is providing geolocation for every IoT device

Wouldn't it be nice to have geolocation as a native service on any type of connected device? Wouldn't it be even better if there were a solution with up to ten-times the extended battery life of existing cellular solutions. How about allowing customers to pay for their geolocation services only when needed? The future of geolocation has arrived, writes Marc Pégulu, the vice president of IoT product marketing and strategy for Semtech's Wireless and Sensing Products Group

Geolocation is one of the most compelling and fastest growing Internet of Things (IoT) applications. A variety of industries such as transportation, logistics, healthcare, and food services are looking to replace inefficient and burdensome manual processes with geolocation asset management solutions. Geolocation-equipped devices automatically locate, track and monitor physical assets such as equipment, product, vehicles and people. However, traditional GPS technologies are expensive, have technical boundaries that prevent successful deployments and require extensive power to operate.

Track and trace

Geolocation is frequently used in track and trace asset management applications with a mobility aspect. This segment, however, remains penalised by a lack of low-power and cost-effective solutions, resulting in a low volume of adoption. It is difficult and expensive to scale deployments of conventional GPS trackers that require batteries to be replaced several times per year, especially if there are thousands in the field.

Installation and maintenance

When deploying IoT, it is easy to make mistakes. For instance, during installation or maintenance of your IoT devices, every device must be logged for its location. The manual registration process when installing sensors in a building, for example, is subject to human error. If you don't have the location correct, the data you receive from the device is meaningless.

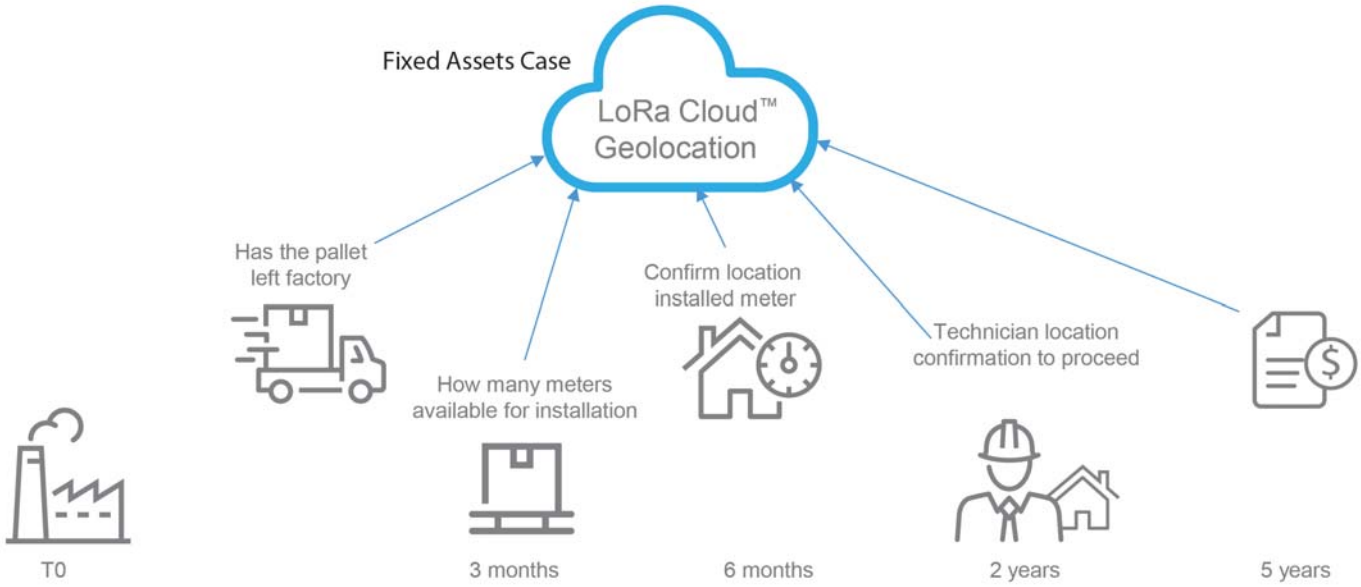
Data analytics

Diversity of information, such as rich geolocation data, enables smarter analytics with artificial intelligence (AI) engines. This helps organisations optimise operational processes and verify authenticity of a device and its data. If the location does not match the registered location in your database, then it means something is wrong or there is a potential for fraud.

The future of geolocation

Semtech has been working hard to make geolocation technology as low power and low touch as possible. We have ▶

Figure 1: Geolocation applications for fixed assets



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addressed common IoT challenges such as diversity of sensor data, cost of ownership and ease of use. Our innovative efforts to solve these issues have made geolocation one of the key drivers for the mass adoption of LoRa devices and the LoRaWAN protocol.

Expanding the availability and use cases for geolocation has opened the door for new business models. For instance, **Helium** is using proof of location with automatic mapping as a major feature for its cryptocurrency mining. Another example, **Volvo**, offers a parking management system for its factory yards to track thousands of cars and trucks. When vehicles have been moved, alerts are triggered, letting operations know the exact coordinates of the new location – saving time and preventing loss.

Now, geolocation capabilities have the potential to be in every IoT device, even fixed assets. Many of our geolocation uses cases involve devices that don't move or that rarely move. Imagine geolocation as a feature which is so affordable that you would use it for a very limited time of the IoT device's life, maybe several times a year, perhaps just once a year, or why not, just once in the device's lifetime.

Low power geolocation for fixed assets

This new paradigm is best explained by taking a look at the device journey of a fixed asset. For instance, let's take a water meter sensor. At first sight, why would you need geolocation for a meter which by its nature is fixed? Well, let's follow its journey.

First, it is manufactured and then transported, most likely on a pallet with other meters. Obviously, you want to know when the pallet left the factory and when it is due to arrive in the warehouse, and geolocation is the best way to get this information. Once in the warehouse, you may be interested in easily verifying that the given meter is actually there or, by means of geolocation, how many devices are in stock and available to utility customers for sale and installation.

As mentioned before, when installing the meter, you have to log the location. Being able to ensure that the actual sensor location matches the plan is a critical task. It allows the utility company to correct mistakes before they become a big issue. And over time, such assets require maintenance. Sometimes these services are outsourced to a third party, and the precise database of locations of the meters may not be up to date or properly communicated with the third party. But what if the technician, when arriving on site, could self-interrogate and verify the actual location of the asset to service? This would provide flexibility, efficiency and cost-savings for everybody.

Last, for assets which are deployed for many years, being the case for most of the IoT devices, it is not uncommon that the ownership is transferred over time. So, being able to verify the actual location of the assets you are selling, or that you are buying is important for due diligence purposes and for valuation.

There are many other examples, but this one illustrates well why your fixed asset should have a geolocation capability.

How is this possible?

Semtech developed the LoRa Edge platform that includes a combination, modular offering. The first is LoRaWAN with Wi-Fi and GNSS location scanning on a single chip. Next, a device management and geolocation cloud service with both subscription-based and consumption-based models for pay as you need cost. And last, a tracker reference design for application developers focused on cloud application development.

We released a modular approach because we acknowledge the diversity within the ecosystem. Some require a chip only, and they will build on top of that. They may have all of the components in-house in order to build a software path, whether it's firmware or cloud software. Some want the device-to-cloud component, maybe because they want to have a faster time to market. Others may desire a complete system.

We believe every IoT device should have the low power geolocation ready feature – whether it's a mobile asset or a fixed asset. This is possible, thanks to the low power aspect of LoRa and LoRaWAN and the new LoRa Edge platform, which delivers one of the IoT industry's lowest power and most affordable geolocation capabilities. ■

Marc Pégulu
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www.semtech.com

A modular offering for every developer profile