Optimising IoT-connected devices in LPWA networks over their lifetime with remote device management

Low-Power wide-area (LPWA) Internet of Things technologies allow service providers and enterprises to offer long-range Internet of Things (IoT) connectivity for battery-powered objects that consume little energy. The most popular use cases for LPWA devices involve temperature and environmental sensors, smart meters for gas, electricity and water, asset and inventory tracking, as well as industrial monitoring. One of the common attributes of almost all LPWA devices is the longevity of the device: generally a sensor or a meter is expected to operate for more than 10 years.

Device management, a critical asset to deploy and manage IoT end devices

But low-power and longevity requirements of IoT-connected endpoints make device management (DM) an essential and challenging function of IoT networks. It is vitally important for companies deploying IoT solutions to streamline their operations, adapt to changing expectations and generate new revenue streams. With billions of sensors, meters, actuators and other devices expected to be connected to the IoT, remotely managing them allows service providers and enterprises to:

- Directly manage network provisioning, including device subscription
- Launch and support new functionalities and applications
- Ensure compliance with changing telecommunication standards
- Ensure compliance with changing regional radio regulations
- Provide security management including, for example, keys management for authentication
- Manage radio performance, with dynamic LPWA network behaviour monitoring
- Optimise radio footprint to manage device power consumption.

Kerlink's Wanesy™ Device Management Centre offers mobile network operators, smart cities and enterprise customers a complete, secure and standard solution to manage and optimise all connected devices over their entire lifetime.

Device management for LPWA networks using ISM bands

LPWA networks are based on the same star network topology as 3GPP networks, including the presence of a core network and base stations, and management of radio communications, sensors/devices and their commissioning. This enables network operators to focus on high-quality security, the use of rating, billing and other operations systems, and the use of various application-server interfaces.

But there are some key differences between LPWA and other 3GPP technologies. On the radio side, LPWA networks often use unlicensed and free spectrum for transmission and reception (industrial, scientific and medical, aka ISM bands) as defined for geographical regions:

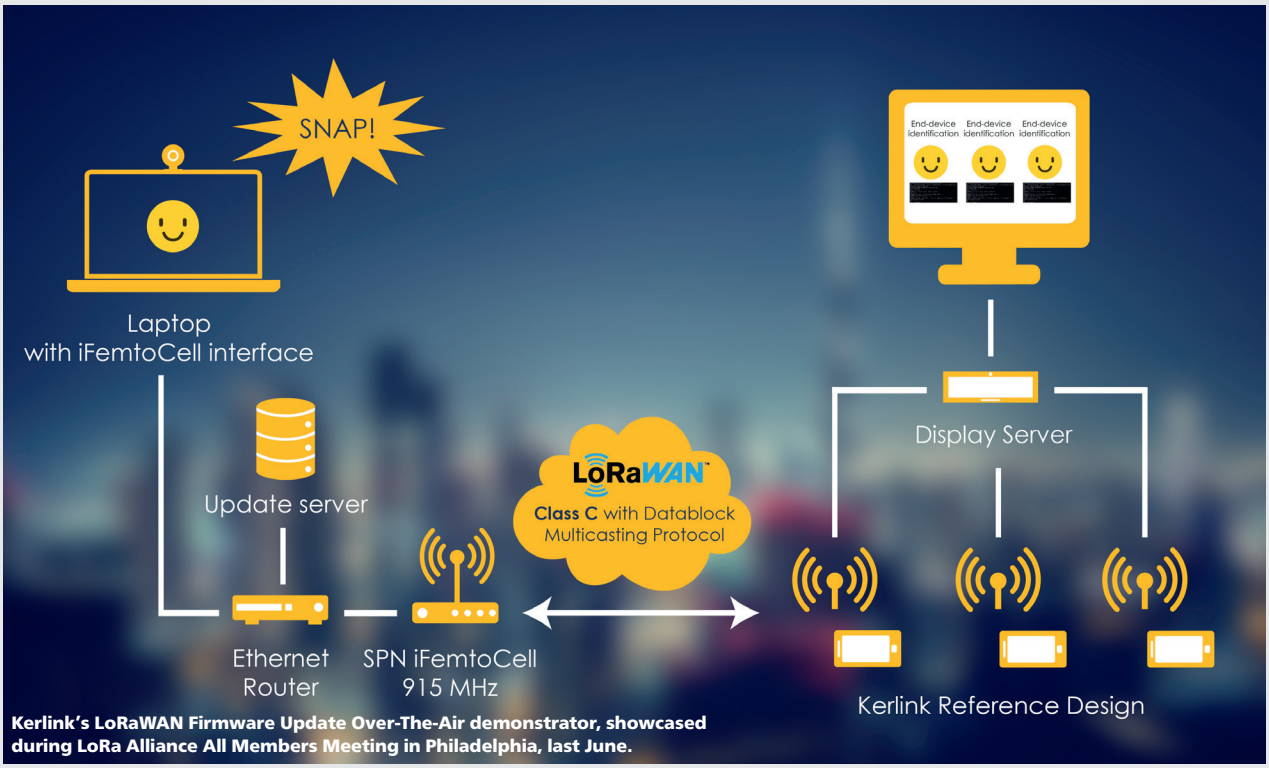
- Europe: 863-873Mhz
- North and South America: 902-928Mhz
- Asia: 915-928Mhz.

These unlicensed bands must meet certain parameters that increase LPWA quality, but they also impose some constraints on the network, especially duty-cycle limitations of typically one percent on-air and transmission power of less than 14dBm-25mW to share radio resources. In addition, to maximise sensitivity up to -141dBm to facilitate long-range communications, the radio modulation (Ultra Narrow Band or LoRa®) uses low data rates, typically below 1kbit/s.

For Kerlink customers, **IoT device management** is powered by a set of technological tools and features for managing the lifecycle of IoT-connected equipment, including LPWA end devices. These tools allow DM users to:

- Configure applicative parameters, including logical name, application destination and wake-up behaviour
- Configure protocol parameters, such as net address or radio parameters (channel, modulation)
- Ensure device security, key management and network subscription (commissioning)
- Monitor device behaviour, including power consumption and radio footprint
- Manage network performance with over-the-air adaptive channel configuration, while managing radio footprint and cell scalability related to regional radio constraints, and
- Conduct complete or partial over-the-air firmware updates (batches or campaigns).

IoT DM is commonly used in mobile communications based on a



Kerlink's LoRaWAN Firmware Update Over-The-Air demonstrator, showcased during LoRa Alliance All Members Meeting in Philadelphia, last June.

standardised solution from the Open Mobile Alliance called OMA-DM. This standard implements the protocol for LightweightM2M (LwM2M) over CoAP (Constraint Application Protocol), which is generally well adapted to 3GPP topology networks. The Internet Engineering Task Force (IETF) is also defining a suite of protocol for LPWAN, through the CoMI package (CoAP Management Interface).

Interestingly, the very high-quality parameters of LPWA networks using ISM bands impact some features of LPWA device management. By adapting their solutions for the unique requirements of LPWA, vendors like Kerlink that offer LPWA device management can provide important LPWA-specific features. These include off-line and maintenance status without updating, multi-cast capabilities with large volumes of data (firmware binary) sent once for all targeted devices, and low-latency protocol adaptation, such as LwM2M that is supported by a large number of telecommunications service providers.

A key component in LPWA IoT network management suites

IoT remote device management is a critically important component of any IoT solution. The ability to cost-efficiently and securely manage IoT devices is relevant to all IoT deployments. Kerlink's broad experience with customers around the world over the past 12 years has identified three reasons why device management is essential in LPWA installations, and has helped guide the company's R&D for this critical feature.

1. Executing cost-efficient and scalable operations requires well-adapted tools as part of a global solution

- **Communicating with extremely high numbers of IoT LPWA devices requires automated, bulk-device lifecycle management (provision, update, deprovision).** LPWA devices are generally part of large-scale deployments and benefit from bulk provisioning processes. In addition, a quality LPWA device-management platform vendor supporting large-scale deployments should, (1) provide continuous quality assurance and patches to the platform as needed, (2) adapt the platform to the customer's evolving operational environment with firmware, hardware and software updates, and (3) offer value-rich new features to increase the functionality of the platform.
- **Bandwidth constraints require smarter, automated deployment of software and firmware to LPWA devices.** Due to bandwidth constraints, operations departments must take into account usage patterns to prevent interference with usual operational or commercial communications.
- **Revenue per device may be low,** which requires automation to keep operational costs down and ensure operations scalability in the long run.
- **Third-party systems and platforms often interact with device installations and end-devices API** for efficient bulk

operations and batch processes: interoperability and open solutions remain key for efficient deployment.

2. Longevity of LPWA devices requires unique features to support long-term operation and security of end devices

- **Connected devices have an expected lifetime of 10 years or more without physical access to the devices, in many cases.** This requires that they be monitored and updated by configuration or firmware switching to prevent overconsumption of power and bandwidth on the radio network.
- **Intelligent device management** maximises the efficiency of power used for transmission, so that a device's battery life is not unnecessarily diminished.
- **Device management must allow the rollout of security updates** that will be inevitable due to LPWA devices' longevity.
- **Devices require end-device radio configuration and firmware updates** to stay up to date with the latest developments and changes in regulations.
- **Devices must be monitored** to identify faults and prevent major problems upstream, before they occur.

3. Lack of LPWA IoT device accessibility requires zero-touch, remote device management

- **Devices must be easy to install, manage and diagnose remotely.** Installation and maintenance crews will frequently lack deep technical knowledge or adequate tools to triage the connectivity elements of these LPWA devices on the spot.
- **Many IoT devices are deployed in areas that are difficult or costly to access physically.** Device management must provide capabilities to configure and maintain a device remotely once installed to allow easy troubleshooting and operation.
- **Fast, simple provisioning** allows solutions to be deployed quickly to ensure the solution is replicable in a cost-effective way.

Operator and enterprise benefits of LPWA device management

LPWA device management has several financial and operating benefits for a service provider or enterprise. These include:

- **Optimising the total cost of ownership (TCO) and return on investment (ROI) of LPWA network deployment.** By using remote, automated device lifecycle management, a service provider or enterprise can minimise manual device management procedures and lower ongoing operations costs, while guaranteeing a constant high level of quality.
- **Adapting the embedded application during the lifetime of the device.** Using over-the-air updates, a service provider or enterprise can update embedded applications to keep up with market or connected services evolution to meet evolving end-customer expectations.
- **Increasing the ability to leverage predictive and preventative maintenance** to orchestrate multicast update or configuration campaigns.
- **Addressing maintenance operations and trouble resolution with high efficiency**. Using the real-time monitoring and alerting features of an IoT DM platform, a service provider or enterprise can provide enhanced maintenance to quickly find and repair troubles with devices or the underlying LPWA network.
- **Managing the device fleet in a consistent way.** LPWA device management allows a service provider or enterprise to manage its IoT devices with the same tools as it would manage a fleet of mobile phones. And some of these tools might be based on OMA-DM standards for LwM2M to provide a standards-based solution.
- **Reconfiguring devices to optimise network use.** IoT device management allows a service provider or vendor to reconfigure devices on an LPWA network to maximize network efficiencies and ensure global quality of service (QoS) across the network.

Kerlink's device management solution

By providing its Wanesy™ Device Management Platform on top of its existing core network Wanesy™ RAN Management Center, Kerlink now offers a full suite for public or private service providers or enterprises to remotely and securely operate their connected devices. Combining state-of-the-art LPWA network stations, core network management solutions and end-device remote monitoring and configuration tools, Kerlink enables existing players and new entrants to quickly roll out and operate a highly reliable connectivity network to streamline their operations and generate new revenue streams. Focused on leveraging industry-proven open solutions and promoting interoperability, Kerlink is dedicated to building a vibrant ecosystem around its solutions to boost the IoT growth in verticals where use cases can be efficiently supported by LPWA connectivity. These include smart-city, industry, agriculture, transport and asset-management applications.

The company is a founder and board member of the LoRa Alliance™ and a world leading LoRaWAN™ IoT equipment and solutions provider. It has installed more than 70,000 Kerlink stations and other equipment in Europe, South Asia and South America for more than 260 clients. For more information, visit us at **www.kerlink.com**, email us at contact@kerlink.com or follow us on Twitter @kerlink_news.