IoT Everywhere
br
Succeed with IoT

Bluetooth and LoRa: Working together to extend and simplify IoT Deployment

MULTITECH®

br | beecham research

Shaping the IoT future

The market view

A recent survey among enterprise IoT users conducted by Beecham Research confirms that the IoT market is now moving quickly from the early adopter phase to early majority. As shown in Figure 1, to the question 'roughly how many IoT devices and/or terminals are currently connected in or through your business?', 33% of respondents already had over 5000 devices connected. To the second question 'how do you expect that to change in the next 24 months?', a massive 61% of respondents also expected growth of over 10% in the next 24 months, with 22% expecting over 40% growth. As this indicates, IoT growth is set to continue at a fast rate, with current deployments also increasing substantially in size.

In addition, this expected growth is not confined to one connectivity technology. In answer to the question 'which connectivity technology will you use the most for your large scale IoT deployments?', while 42% selected cellular, LoRaWAN support was strong at 24%. Given that cellular connectivity has been a central part of IoT market development for several decades, it is perhaps surprising that LoRaWAN's first specification only came to market in January 2015. Clearly, expected use of LoRaWAN is growing very quickly in the IoT market, with strong interest for those applications where long range, low data rate and low power requirements are particularly important.

IoT is now impacting on all major sectors of our information-centric economy and each sector encompasses numerous applications, most of which will have demanding but different operational requirements. Inevitably, this means there are trade-offs required between power consumption, bandwidth and range.
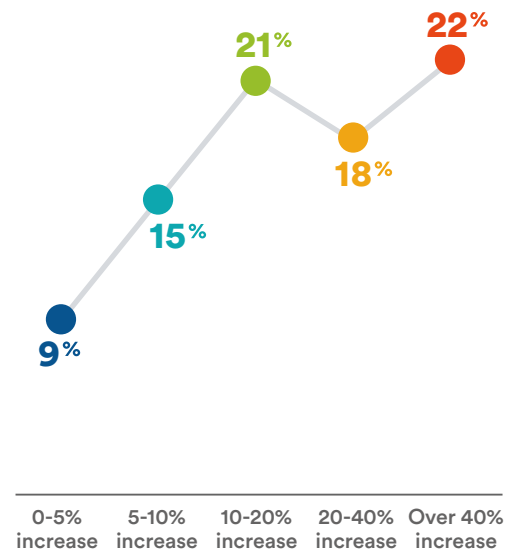
Figure 1: Enterprise IoT users expecting strong growth in their IoT deployments

How many IoT devices/terminals are connected in your business?

27% Less Than 100
13% 100 – 500
19% 500 – 5,000
7% 5,000 – 10,000
26% Over 10,000
8% Don't Know

How do you expect that to change in the next 24 months?

0-5% increase	5-10% increase	10-20% increase	20-40% increase	Over 40% increase
9%	15%	21%	18%	22%

There is no one-size-fits-all connectivity technology. Addressing the requirements of a market that is diverse and expanding rapidly cannot be realised with one connectivity type. For example, while there are many potential IoT applications with high data rate requirements, there are many more where low data rate is all that is needed and where costs need to be kept very low. The introduction of Low Power Wide Area (LPWA) connectivity addresses that and the growth of LoRaWAN in unlicensed bands has made it quite clear that cellular is not the only game in town for IoT – that there are many long range applications where unlicensed spectrum is perfect.

'IoT everywhere' is the promise, but it cannot be achieved with one connectivity type. Instead, a variety of different connectivity types is vital, with data collected through each type being utilised together. Increasingly the market will demand combinations of different connectivity technologies in order to enhance and improve their IoT solutions. Multi-protocol solutions will also be deployed because they are future proof, not limited to a single environment or data transmission format.

These diverse requirements are examined in a recent Beecham Research report titled "Deploying IoT Everywhere" and sponsored by MultiTech. This report examines where the different connectivity types are being deployed to best effect and some of the key challenges this creates.

Bluetooth and LoRa: complementary roles

Before focusing on the complementary roles of Bluetooth and LoRa and how they can meet the escalating requirements of today's complex connectivity requirements, we should first examine their individual capabilities and their respective positions in the market.

Bluetooth technology is capable of sending data continuously over a short distance, usually less than 10 meters. Bluetooth was originally intended for point-to-point or point-to-multipoint data exchange among consumer devices. Optimized for power consumption, Bluetooth Low-Energy (BLE) was introduced to small-scale consumer IoT applications, including fitness and medical wearables, and smart home devices, replacing cables and wires when streaming audio files or small video files. That said, BLE is ideal for short-range business communication that require a high throughput such as a short-range, proximity-based sensing. Applications in this sector include asset tracing, access control and indoor navigation.

LoRa (Long Range), which proves a low power, terrestrial wireless platform for IoT, is based on semiconductor technology developed by Semtech. It operates on unlicensed frequency bands. LoRaWAN® is a standard for interoperability managed by the LoRa Alliance®, that is recognised as an International Telecommunication Union (ITU). It is non-profit technology alliance of which Semtech is a founder member and board sponsor. The technology is employed in public, private and hybrid networks and deployments are easy to integrate into existing infrastructures.

It enables low-cost, battery-operated IoT applications, which are the fastest growing sector of IoT. LoRa technology's low power consumption requirement is a key feature since it allows LoRa battery-powered devices to last up to 10 or more years. According to Semtech LoRaWAN consumes at three to five times less power than an NB-IoT network.

Bluetooth Low Energy (BLE) addresses low-power short-range connectivity, while LoRa addresses low-power long-range connectivity. Both technologies employ unlicensed, spread spectrum technology. Bluetooth can send data continuously over a short distance, usually less than 10 meters. LoRa has an urban range of connectivity between 2-5 kilometers, while in a rural setting it can reach up to 15 kilometers. Figure 2 shows other key parameter comparisons.

When integrated with BLE, LoRaWAN leverages Bluetooth's strengths while combining those with its long range. The result is the ability to enable massive, affordable scaling that introduces new capabilities such as the ability of field operators to use applications on their phones to connect to individual remote meters.

Enhancing a legacy BLE short-range sensing network with low power, long range LoRaWAN connectivity has many advantages. Industrial IoT applications may already have some installed wireless sensors that use BLE. Now, with the installation of a hybrid LoRa and a BLE module, there is a BLE resource that can uplink consolidated information into the Cloud automatically.

Hybrid solutions bring what once were considered competing technologies into a holistic offering that combines the strengths of combined connectivity protocols. In this case it's the low-power combination of BLR short-range connectivity and LoRaWAN long-range connectivity.

Figure 2: The table indicates the complementary functionality of these two low-power technologies.

Feature	Bluetooth	LoRaWAN
Widely understood by non-technical users	●	
User-friendly via app-based management	●	
Low latency	●	
Supports high bandwidth needed for configuration & application	●	
Able to withstand RF interference	●	●
Secure	●	●
Long-range		●
Low capital expense		●
Low operational expense		●

Expanding the market

The IoT business proposition is very simple. Deploy sensors and devices that generate parameter and event data. Process and analyse the data into insightful intelligence. Employ the intelligence in the applications and services of the corporate ecosystem in order to boost productivity, enhance efficiency and have a positive, lasting impact on a company's bottom line. Markets expand when this objective is realised. This results in a virtuous circle.

Right now IoT networks operate in an increasingly complex environment comprising different communications technologies, hybrid networks, different frequency bands and spectrums that must accommodate huge network traffic flows and a plethora of connected devices. Ironically this issue reflects the rapid success of IoT.

LoRa was specifically designed for low-power devices. It employs a proprietary radio technology that is based on Chirp Spread Spectrum

(CSS) modulation technology, as employed for sonar and radar. Use of this spectrum is free. Low-low-cost, battery-operated devices can be deployed in remote locations where they operate for 10 years or more. This capability has expanded the market. ABI Research estimates that by 2026 LoRa will be the leading non-cellular LPWAN technology and it will be employed in more than 50% of all non-cellular LPWA network connections.

In addition, combining technologies such as Bluetooth and LoRa create more opportunities for new applications. There are use cases that cannot be supported by an individual technology. When technologies work together, they expand the number of IoT use cases possible. Moreover there is a clear requirement for a worldwide, interoperable, single frequency. Application developers and network providers require a technology that provides long-range, low-power connectivity within a uniform frequency.

Enabling Bluetooth-LoRa networks

Integrating BLE's short-range functionality with LoRaWANs long-range capability is a core MultiTech capability. Figure 3 shows the topology of a typical network. Although it might appear to be complex the concept is straightforward. Bluetooth beacons are hardware transmitters, a class of BLE devices that broadcast their identifier to nearby portable products such as smartphones and tablets that are used perform actions when they are in a zone that is close to a beacon. However, when there are numerous devices and therefore multiple zones, as shown in Figure 3, then the

network would employ BLE-LoRaWAN bridges and gateways that concentrate the traffic and transmit it to a LoRaWAN.

MultiTech's Conduit® gateways extend and expand this capability by enabling the creation of private LoRaWAN networks connect thousands of end nodes directly to a business platform. The architecture is ideal for enterprises who want to cost-effectively connect sensors and actuators clustered in a commercial or industrial facility using a private network

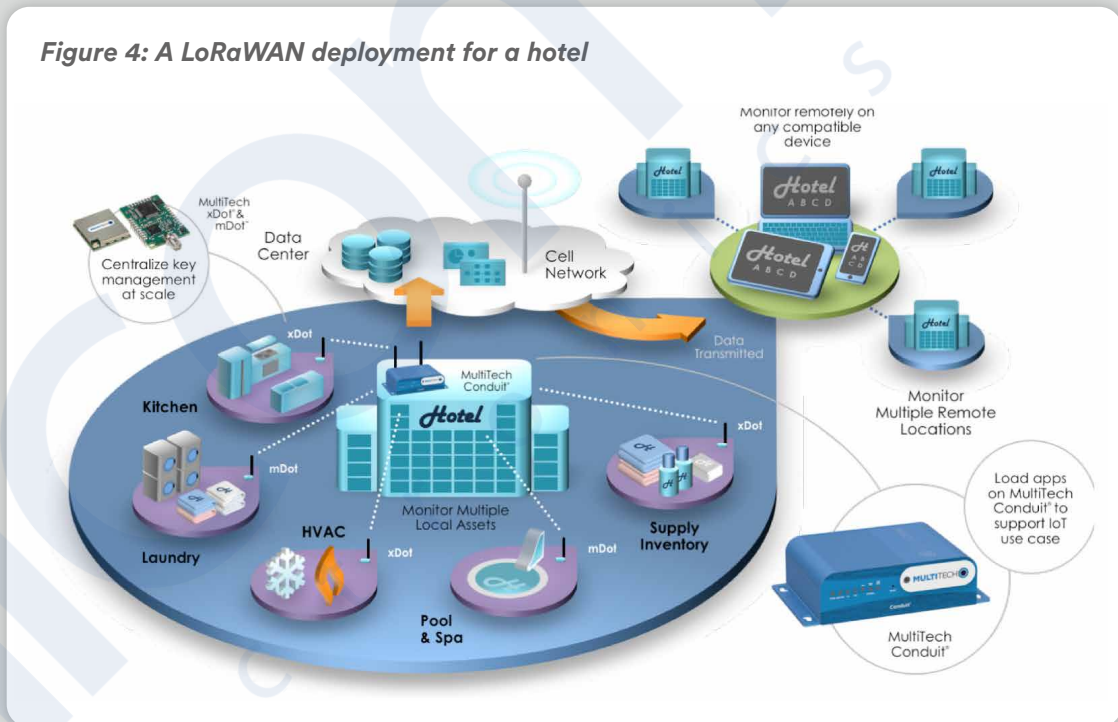*Figure 3: A typical hybrid Bluetooth-LoRaWAN network*
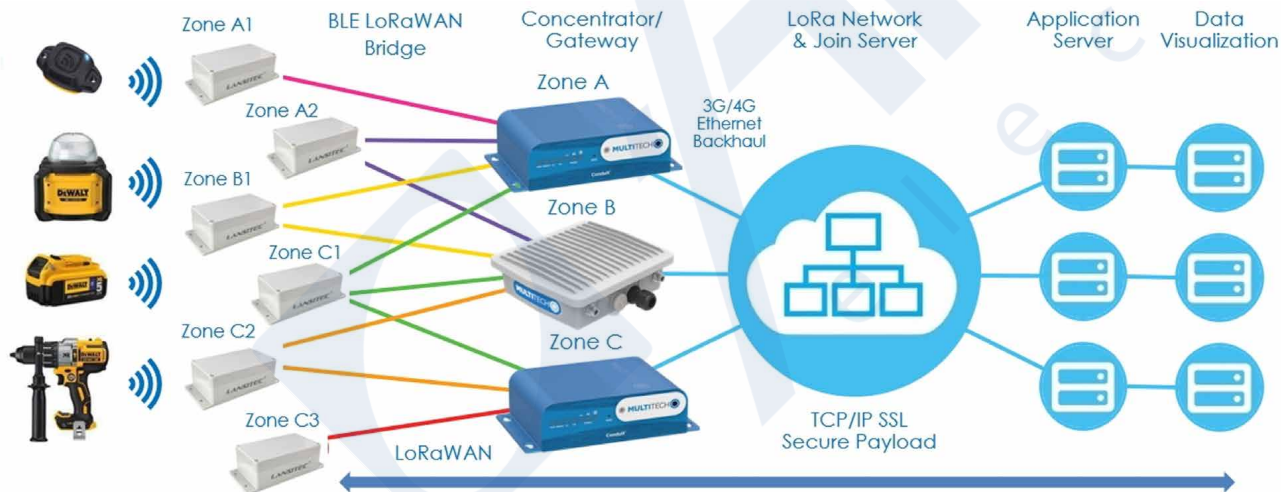
and enable secure management of those networks across multiple sites. In addition the solution enables operational resiliency by processing real-time data and making decisions locally even during a network outage.

MultiTech's Conduit® gateways enable the creation of private LoRaWAN networks capable of connecting thousands of end nodes directly to a business platform. The architecture is ideal for enterprises who want to cost-effectively connect sensors and actuators clustered in a commercial or industrial facility using a private network and enable secure management of those networks across multiple sites. In addition the solution enables operational resiliency by processing real-time data and making decisions locally even during a network outage.

Figure 4 visualises a LoRaWAN deployed for a hotel. Local areas such as the Kitchen, Laundry, Pool & Spa are BLE zones that communicate with a Conduit® gateway, which in turn enables remote monitoring and connectivity with cellular networks.

Applications aplenty

LoRa and the LoRa-Bluetooth combination addresses a vast, expanding range of use cases such as track and trace, building automation, construction monitoring, mining, farming, telemetry, and remote data logging. Figure 5 highlights eleven IoT applications for smart buildings. This topic is covered in a 53-page eBook. It items numerous smart building applications and similar detailed information is available for the energy, transport & logistics, agriculture and healthcare sectors.

Figure 4: A LoRaWAN deployment for a hotel

The smart building eBook indicates that the market is growing rapidly, poised to reach USD265.37 billion by 2028 (Fortune Business Insights). Applications focus on the occupants' well-being, analytics, saving money, environmental concerns, contactless technology and remote management tools. Smart building technologies include wireless sensors, gateways and analytics.

Like Smart Buildings, IoT technologies are growing rapidly. Their adoption rate is increasing from 13% in 2014 to about 25% today, with the worldwide number of IoT-connected devices projected to increase to 43 billion by 2023 (McKinsey and Company).

About MultiTech

MultiTech products connect companies to their assets. They leverage proven, standards-based sensor and communications technologies and open architectures to bring systems and processes into the future. The company provides expert technical support and partner with customers to overcome the IoT integration challenges with off-the-shelf and custom products tailored to meet individual corporate needs.

Figure 5: Smart buildings are packed with numerous innovative IoT applications