Deploying LoRaWAN in the Enterprise

A guide to the effective roll out of LoRaWAN in IoT projects

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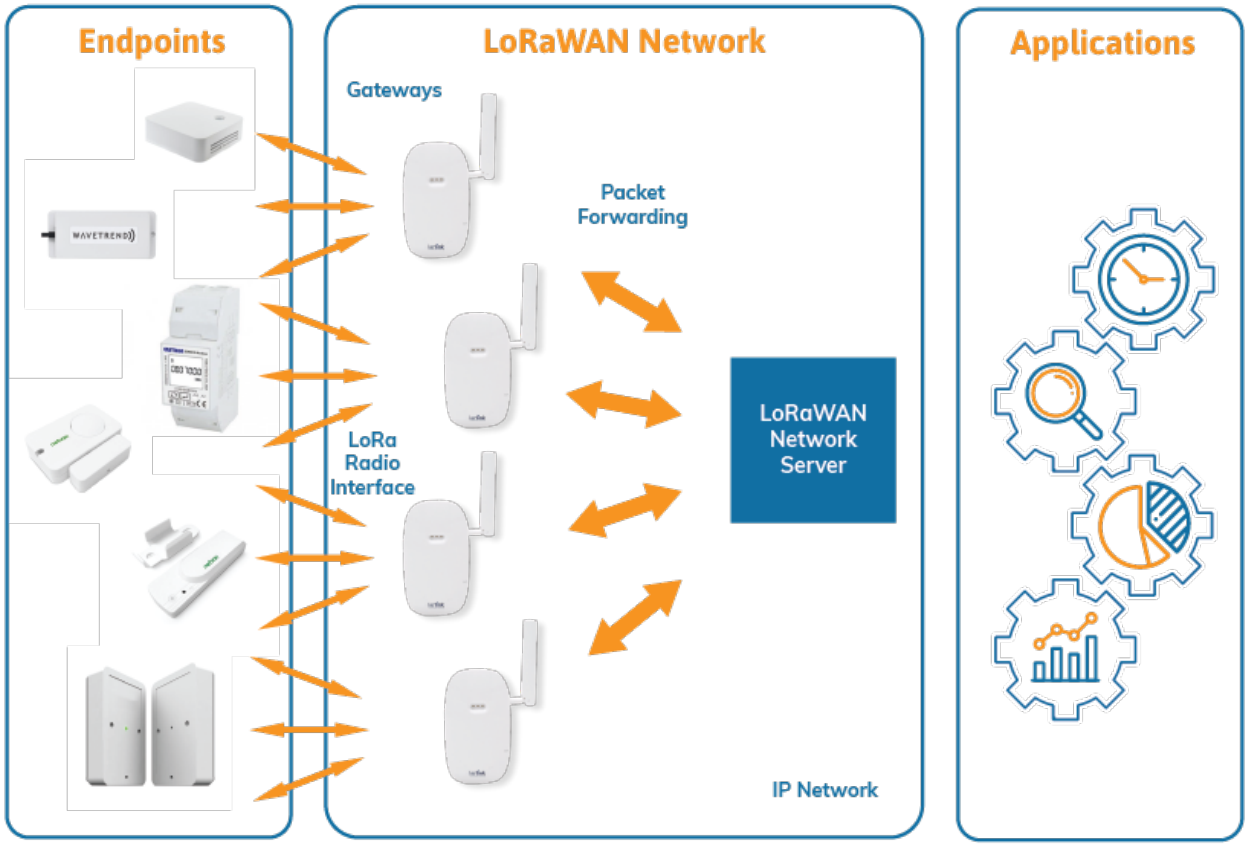
What is LoRaWAN?

LoRaWAN is an open specification for low power, wide area networks to wirelessly connect 'Internet of Things' (IoT) devices. It uses unlicensed radio spectrum to provide long range connectivity – which is where it gets the 'LoRa' abbreviation.

LoRa devices are typically battery operated, with LoRaWAN providing secure, bi-directional communication of small 'packets' of data.

Devices connect over the LoRa radio protocol to nearby gateways, which then communicate with a 'LoRa Network Server' over an IP connection.

While the technology has always been favoured by enthusiasts and hobbyists; it's now finding significant traction in the enterprise, with large scale private deployments and commercial public networks.



The LoRaWAN 'star of stars' Architecture

As an open standard, LoRaWAN offers numerous ways to design and operate an IoT network, from a private network where an organisation installs gateways connected to a private network server, to public networks covering a territory or country providing a fully managed service.

Where are LoRaWAN networks most effective?

LoRaWAN plays an important role in the connectivity mix for low-power IoT. The technology is ideally suited to organisations deploying large numbers of sensors in a single building or campus, or for rural applications outside of the coverage areas for commercial networks such as NB-IoT, LTE Cat-M or Sigfox.

The bi-directional nature of LoRaWAN also lends itself to command-and-control applications, such as opening and closing valves or operating switches and relays.

By placing private gateways, an enterprise can ensure a good level of coverage throughout a building or site, where public networks may struggle with deep in-building radio penetration.

Parts of the LoRaWAN system

The device

LoRa is a well-supported protocol for IoT. In fact there's more device choice in LoRa than in any of the other low-power WAN (LPWAN) technologies today.

Battery-powered devices can operate autonomously for extended periods, in some cases up to 10 years. The network has no requirement for periodic wake-ups, it's purely down to the application.

There are three classes of LoRa device:

Class A – is the lowest power requirement, with devices initiating a communication as required, and a limited window of time the device is required to expect a downlink response.

Class B – devices are able to receive a downlink from the network at defined 'ping slots', which can be at up to 128 seconds latency. These devices use slightly more power budget than Class A, but enable bi-directional data close to real time.

Class C – devices can receive a downlink message at any time. This uses significantly more power, so is more suited to applications with continuous power such as energy metering or command and control applications.

The Gateway

The gateway is responsible for receiving data packets from the device over LoRa and forwarding them over an IP connection to the network server. The gateway does not do anything with the packet other than the network protocol conversion. In addition, the gateway delivers downlink messages to the device.

All gateways require continuous power. A wide variety of gateway hardware is available based on the network, installation and site requirements

Indoor or Outdoor?

Indoor gateways range from low-cost domestic units that connect to a broadband router to enterprise devices that cover larger indoor spaces.

The main difference with an outdoor gateway is the size of the antenna, and an IP rating suitable for external locations. Outdoor gateways are typically powered using a Power-over-Ethernet' (PoE) connection. Always ensure your outdoor gateway is installed by a suitably qualified person and is protected with an appropriate lightning arrester.

Backhaul connectivity

'Backhaul' refers to the connection from the gateway to the server. This requires an IP connection, which could either be over an existing fixed line, or over a cellular connection such as 4G. Gateways are available with in-build cellular modem with SIM slot.

One consideration is whether to connect a gateway to an existing corporate LAN or broadband connection (all gateways have an Ethernet port), or keep the IoT network completely separate. While LoRaWAN is a secure technology, there is often push-back in IT departments when mention is made of installing IoT equipment.

Multi-network LTE SIMs (such as the Daizy Gateway SIM) can provide resilient connectivity, connecting to whichever mobile network is available at a location.

The Network Server

The LoRa Network Server (LNS) is responsible for controlling access to the network, managing the equipment and publishing data to the application.

A number of cloud hosted LNS management platforms are available for Enterprises to build private LoRa networks. There are offered at various price points, and with differing levels of support. Consideration should be given to the SLA provided by the cloud vendor when using a cloud LNS in an Enterprise application.

The same is true when licensing server software for on-premise deployment. Free Open-Source platforms such as Chirpstack can be leveraged for local deployments, however a support wrapper will usually be required to support new gateway hardware and ongoing changes to the LoRaWAN specification.

Public LoRaWAN networks are being rolled out in many countries, often with regional deployments to stimulate IoT investment. These provide full management of all infrastructure,

Considerations for a LoRaWAN deployment

Management of the network

LoRaWAN introduces some additional network elements for the Enterprise to manage which aren't required with LPWAN technologies such as NB-IoT or Sigfox. These are the gateway and the LoRa Network Server. Failure of either of these elements may cause a wide outage.

- What sort of availability does my application require?
- How long could a location be offline without impact?
- What resources are required to maintain the gateways?
- How is the network server supported and maintained?
- How is connectivity between the server and gateways managed?

The availability requirement will dictate whether multiple gateways are required to provide connection redundancy at a location, and whether the gateway requires a service contract – for example a service contract with next-day swap out service. Alternatively, is there a requirement to hold spare gateways?

For hosted network servers, the ongoing support for new gateway models, updates in the LoRa specification along with an SLA around availability are a major consideration. Commercial providers offer various levels of support, ranging from community supported 'free' offerings such as The Things Network through to enterprise grade solutions such as the Daizy LoRa Network Service. If hosting the server in-house, then the burden of support and maintenance will fall to the IT group, which may have a large hidden cost.

Open vs Proprietary solutions

Many IoT applications are vertically integrated, with the device, gateway and cloud service bundled. While these provide a simple way to deploy the solution, most enterprises will ultimately want to deploy multiple types of IoT sensor and application.

Vertical solutions often lock you in to a limited range of sensors, restricting choice regarding future use cases.

- Will the gateway and connectivity support sensors from other vendors?
- Can I install and manage all devices and gateways in the same way?
- Can I deliver data for all use cases through a single data set?
- Can I control all of my IoT projects through a single pane of glass?

Specifying the LoRaWAN network separately to the end devices and use cases will ensure flexibility for future use cases.

Network Coverage

The range for a LoRa connection depends upon numerous factors, the primary one being line of site. An outdoor gateway in an urban environment could typically provide 2 to 3km of coverage, where in a rural area with fewer obstructions this may extend to 7km or more, with gateways mounted in elevated positions providing considerably larger coverage areas.

Indoor coverage will be affected by the fabric of the building. Houses and small apartment blocks could be served by one indoor gateway, however taller blocks or commercial properties will likely require multiple gateways.

Each site and situation will be unique, so it is always worth considering an RF mapping of the location before devices are installed. This ensures the network plan will provide reliable coverage, reducing the number of return visits and device moves, which add considerably to the cost of a project.

While the technology is a star network rather than a mesh – with each device connecting to a local gateway, it's possible to build a level of resilience into the network by providing multiple gateways in a location, even if this isn't needed for coverage. All gateways in range will receive and forward data packets, with the network server handling the de-duplication of messages. In this way the connection will be maintained even if one gateway is unavailable.

Security

LoRa has inbuilt security between the device and the network server, with keys activated over-the-air in the field. This relies on device credentials being populated to the server in a secure way.

Many devices are deployed in unattended or unsecure locations. Care should be taken to ensure the device vendor has implemented a secure way to provide encryption keys to the application owner. Common issues include:

- The device comes with a QR code or tag containing the Appkey
- A device uses and easily guessable Appkey, for example based on a serial number
- The device vends the key via NFC

These design decisions make it easy for a bad actor to obtain keys and launch various attacks.

An additional consideration is security of the connection between the gateway and the Network Server. This is not standardised in the LoRaWAN specification, so is implemented in several ways, some of which do not offer transport-level encryption between the gateway and the server.

Network Capacity

Each LoRa gateway has a capacity limit for the number of uplink frames it may process, and this must be considered in the project design. Increasing the network diversity (the number of available gateways in range of a device) can increase capacity. In metering applications, which typically have frequent messages uplinked, tests have shown that a typical gateway can handle in excess of 1 million messages a day where devices are configured to send each message twice (for collision avoidance). Where a mix of device types are in the same area, this number can increase due to the variation in duty cycle between types of device.

Device Lifecycle Management

As with any IoT deployment, device management and field service can add considerable cost to the overall project and should be considered up front.

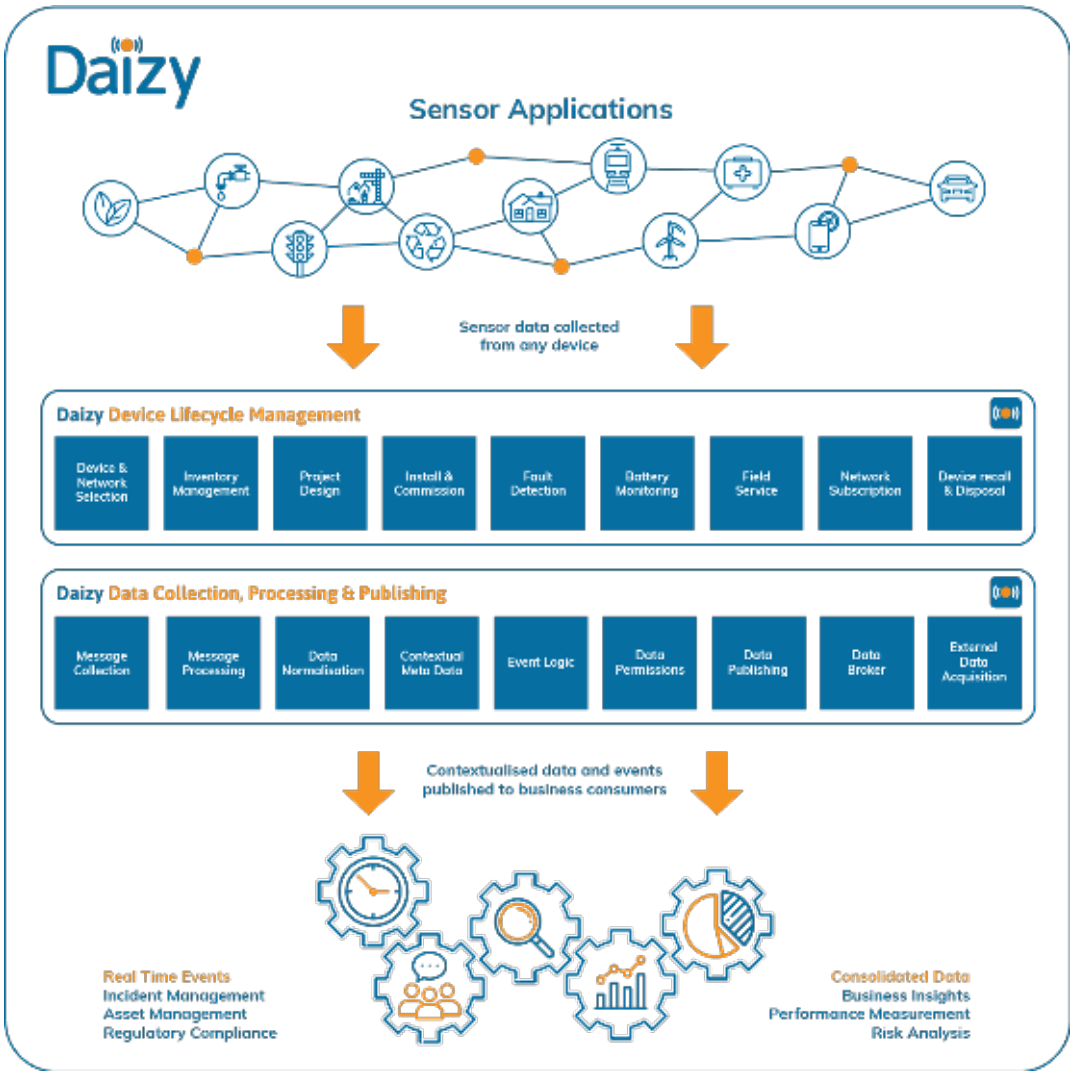
- How are devices securely enrolled in the project?
- Who is responsible for installation and field service?
- What training is required?
- How does this work at scale?

Mission Criticality

LoRaWAN is a good technology to drive insights and trigger business events from previously unseen data. Care should be taken when using LoRaWAN for mission critical activities, such as process control within manufacturing or in critical safety systems. The nature of the technology and the reliance on radio and IP connectivity mean that it should not be relied upon to be 100% available and trusted as a mission critical connectivity fabric.

LoRaWAN and Daizy

Daizy is the open IoT platform for Enterprise. We help you unlock the smartest version of your organisation, now and in the future. Our platform is horizontal and open, so it grows with you – no device, network or application lock-in.



Daizy provides native support for LoRaWAN through our global network service. This allows an organisation to quickly deploy LoRa devices without the burden of managing the LoRa Network Server. All communication between the device and the Daizy platform is encrypted, and key are managed in a secure way.

The Daizy LoRa Network Service

- Simple Installation and activation of LoRa devices using the Daizy Mobile App to reduce the training cost for field service personnel.
- Incorporate LoRa devices alongside other network technologies in the same project
- Support for a wide range of LoRa gateways. Maintain the flexibility to purchase the right gateway for your project or bring existing gateways to the Daizy platform.
- Optionally purchase from a range of fully configured 'plug and play' gateways with managed support from our hardware distribution partner AllIoT
- Secure packet-forwarding from the gateway to the Daizy platform
- Optional Daizy Gateway SIM for 4G connectivity, with network roaming to ensure the widest coverage in each country.
- Fully managed device configuration using the LoRaWAN downlink.

Daizy is also available to organisations with existing LoRa network server deployments with flexible integration to major LoRaWAN platforms, including The Things Network, Loriot, Chirpstack, Kerlink Wanesy, Iot Scotland, Orange and Things Industries.

For organisations that want to run (and grow) smart initiatives or create smart applications using insights from large volumes of sensor data. Daizy takes the pain out of deploying, managing and scaling smart IoT projects.

For more information, please visit us at daizy.io or contact us.

LinkedIn: Daizy
Twitter: @DaizyIoT