A Guide to the LoRaWAN model
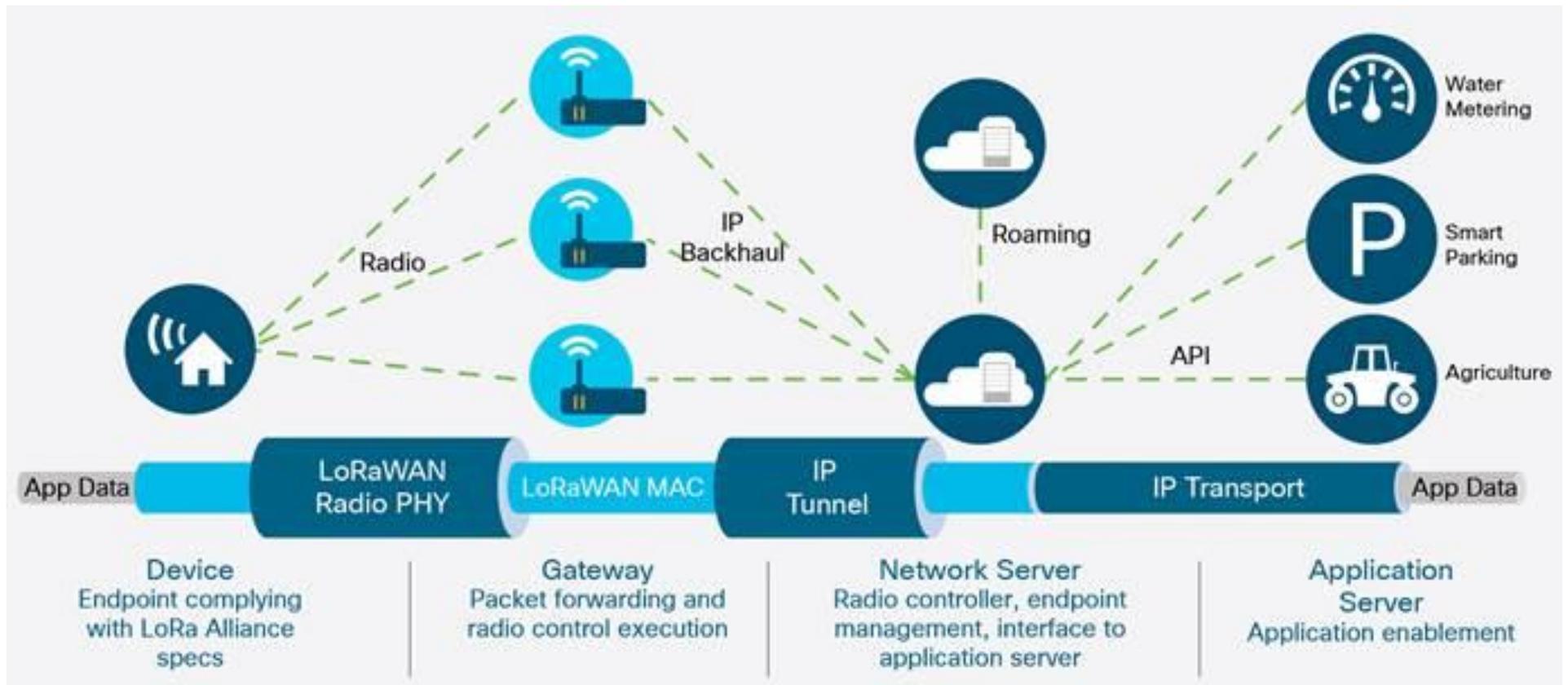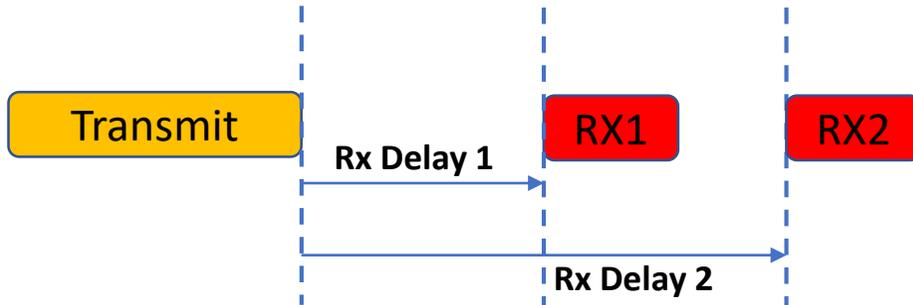
1. Architecture Overview

LoRaWAN deployments comprise:

1. **A collection of mobile devices**

2. **A collection of gateways**

3. **One or more layers of network servers, depending on the network**

4. **An application server, where the data eventually ends up – e.g. Telematics Guru**

From Cisco's IXM Gateway Datasheet

2. The LoRaWAN Mobile Device

- LoRaWAN class A devices use a simple 'client talks first' protocol

- At start-up, the device sends a network join request, and receives a response from a nearby gateway

- After that the device periodically sends a message (uplink) , and waits for a response (downlink)

- So, communication between the device and server is initiated by the end device

2. The LoRaWAN Mobile Device

- In Australia, transmissions are in the unlicensed 915-928MHz band, and are subject to interference from other users

- You need to make sure your devices aren't transmitting too often, or they will interfere with each other

- Around 1 message per second per gateway is about the upper limit on an 8 – channel gateway
  - For 300 units, that's one message every 5 minutes
  - If you purchase a high end gateway with more channels, you can send proportionally more often.
  - You can configure the units to transmit faster, to increase capacity. A 4x increase in speed will give a 4x increase in capacity, at the cost of a 50% reduction in range.
  - In the EU and many countries outside Australia, the law imposes a 1% duty cycle restriction, preventing transmission more than once every 2 minutes, and making acknowledgment by the gateway impractical.

- Simply purchase the device, and register it with your network using the information on the printed label, and turn it on.

- In Australia, you may need to configure its network channels using a USB cable

- Any further configuration can be done over the air

- Future firmware updates must be done via USB

- All messages are encrypted with a device specific pre-shared key, and identified by the device serial number

3. The Gateway

- Gateways receive messages in a 10 to 20km radius, and forward them to the network

- Gateways start at about $300 for a commodity 8 channel gateway with ethernet backhaul

- The gateway is a dumb packet forwarding device, it doesn't understand the packet contents, or decide what to send back, this is handled by the server

3. The Gateway

- Almost all gateways support the [Semtech Packet Forwarder](#) protocol , which is usually operated on UDP port 1700

  - It isn't encrypted, and the gateways aren't authenticated, but all mobile device data is encrypted with pre-shared keys

  - Locking down the IP addresses and port numbers between the gateway and the network server should provide sufficient security

- Network servers will often support their own proprietary packet forwarding protocol as well

- You buy the gateway, put it on a mast, connect it to the backhaul and configure it to point to your network server

4. The Network Server

- The network server is responsible for receiving multiple copies of the transmitted packets, decrypting and deduplicating them, and then forwarding the payloads to whatever application server the end user requires.

- When you provision a device onto the network, you register its serial number and pre-shared encryption key with the network server

- In future versions of LoRaWAN, you will be able to use a second encryption key to prevent the network server from understanding the data it sends to the application server, but this is not practical in LoRaWAN 1.0. So, the network server must be trusted by the end user.

- You can either host your own network server (commercial or open source), or use a public network server such as The Things Network.

5. The Application Server

- This is final destination of the data. Most networks will push data to your application server in their own proprietary JSON format, as either an HTTP POST, or an MQTT topic.

- You can write your own application server and store the data in your own database, or you can use an existing server with a web frontend such as Telematics Guru.
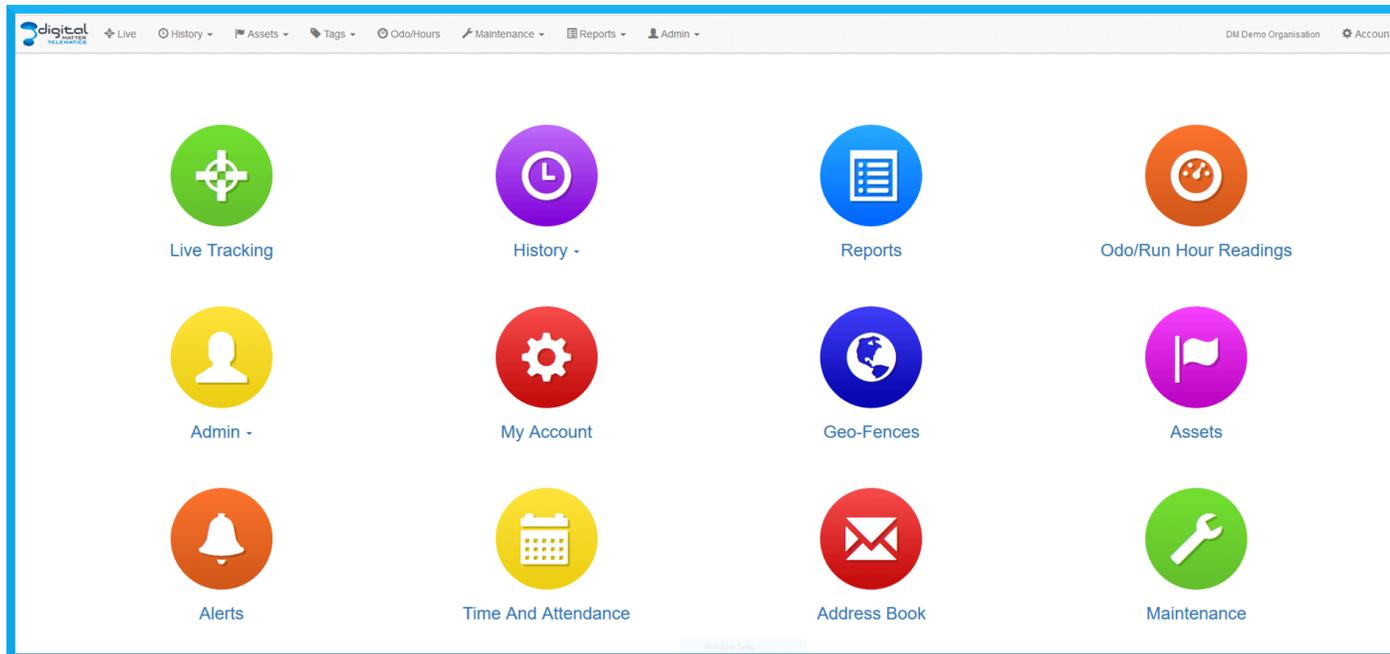
6. What frequencies in what territories?

- LoRaWAN defines several regions

  - AS 923MHz (Used in Australia and New Zealand, Japan, and many Asian countries)

  - South Korea 920-923MHz

  - Australia 915-928MHz (Useable in Australia and New Zealand – alternative to AS923)

  - US 902-928MHz

  - EU 863-870MHz (used in Europe, Russia, Africa and Middle East)

  - India 865-867 MHz

  - China 779-787MHz

  - China 470-510MHz

  - EU 433MHz

- Digital Matter only support frequencies in the 800's and 900's (so no China or EU 433 support)

  - Clients select either the 800 or 900 series when placing orders with Digital Matter

  - If not pre-configured at factory, the region must be set with a USB config cable before deploying to the end-user

Certain network servers (such as [Actility's](#)) offer Geo-Location.

This allows LoRaWAN devices / sensors in the field to be geo-located by triangulation to a degree of accuracy determined by the number of **Geo-location enabled gateways.**

All LoRaWAN end-devices support geolocation, but to use this feature the gateway must be geo-location enabled.

Not as accurate or real-time as GPS, but with good infrastructure, fairly accurate.

- There are 4 components that will vary between vendors in the supply chain
  - Devices – the client will need a LoRaWAN device, like the ones offered by Digital Matter for example
  - Gateways – the client will need a gateway such as the ones supplied by Multi-Tech, or subscribe to a gateway infrastructure such as Senet
  - Network Server – the client will need a back end to process the data, an example is The Things Network (TTN) or Actility.   However, the gateway provider may already include this in their offering, and vice versa.
  - Application – the client will want to see / monitor / track / manage their assets and devices via a web app of sorts.   An example is Telematics Guru provided by Digital Matter. This would be a monthly or annual fee for access to a platform / app.

- There may be a 5th cost to consider which would be custom design / integration of sensors to devices. And representing these on a dashboard could incur design costs too.

Further Resources

PRODUCTS, DATASHEETS & INTEGRATION INFO

- Digital Matter Support - LoRaWAN information

LORA ALLIANCE

- LoRa Alliance - Technology
- LoRaWAN 101 - Technical Overview

THE THINGS NETWORK

- The Things Network - Devices/Gateways/Network/Applications Information
- TTN List of Commercial Gateways

For further info, please contact Digital Matter as per details on website

www.digitalmatter.com