LoRa Network and gateway capacities

2018
About MultiTech

• 47+ years focused on Machine-to-Machine (M2M) Communications
• 80+ patents
• 25+ million devices, thousands of customers worldwide
• U.S.-based Engineering, Manufacturing, Certifications and Support
• Top 100 M2M Company
• The “Go-To” Partner for your Connected Strategy
• Product Design and Certification Services - Connected Development
Broad Family of Products

Programmable Gateways for the Internet of Things

Industrial Grade M2M Modems & Routers

Embedded Modems

Plug & Play Wireless Dongles

Developer Kits & Support
What is LoRa?

LoRa®

Long range and low power
- Not susceptible to interference from Wi-Fi, Bluetooth, GSM, LTE, etc

Robust communication
- Not susceptible to interference from Wi-Fi, Bluetooth, GSM, LTE, etc

High accuracy localization and ranging
- Modulation format permits high accuracy localization
- Not RSSI based and accounts for multi-path and fading
- Permits high volume additional features

Improved network capacity
- Connect more nodes
- Additional capacity for features

10 Mile Range*

30ft Range*

2+ Mile Range*

100ft Range*

1000ft Range*

FSK

* Approximate range

What is LoRa?
LoRaWAN™ Architecture

End Nodes
- Pet Tracking
- Smoke Alarm
- Water Meter
- Trash Container
- Vending Machine
- Gas Monitoring

Concentrator/Gateway
- LoRa RF LoRaWAN
- TCP/IP SSL LoRaWAN

LoRa Network Server
- 3G/4G Ethernet Backhaul

Application Server

Data Visualization

AES Secured Payload

TCP/IP SSL Secure Payload

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LoRaWAN™ - Edge to Gateway to Cloud

End Nodes
Dot’s

Gateway
LoRa Network Server
Application Server

LoRaWAN
Network Server

IoT Cloud & Analytics

Pet Tracking
Smoke Alarm
Water Meter
Trash Container
Vending Machine
Gas Monitoring

LoRa RF
LoRaWAN

AES Secured Payload

TCP/IP SSL
Secure Payload

AES Secured Payload
LoRaWAN™ - Conduit™ as Packet Forwarder

- **End Nodes**
  - Pet Tracking
  - Smoke Alarm
  - Water Meter
  - Trash Container
  - Vending Machine
  - Gas Monitoring

- **Gateway**
  - LoRa RF LoRaWAN
  - TCP/IP SSL LoRaWAN

- **LoRa Network Server**
  - 3G/4G Ethernet Backhaul

- **Application Server**

- **Data Visualization**

- **AES Secured Payload**
LoRa® Features

• It is secure – 128 Bit AES encryption
• Has good range – Basically ‘line of sight’ before you take into account obstructions. Technically 148dB sensitivity which put the detection below the noise floor.
• Dynamic speed vs range – nodes can be controlled from the LNS to optimise the speed when signal levels are high
• Low cost – Full private networks can have a near zero ‘OPEX’ cost. Whereas public networks have a very low ‘OPEX’ cost. – Data uplink and downlink can be via a shared gateway.
• Good penetration – Typically 10dB loss per wall you go directly through, but consider signals can also ‘bounce’ to their destination.
• Low power – By configuring nodes to go in to deep sleep extreme battery life can be achieved (3, 5 and 7 years are normally requested).
MultiConnect® Conduit™
LoRaWAN™ Gateways & Base Stations

**Industrial**
- Improved coverage in buildings & production facilities
- Connect assets using LoRa and other industrial field bus technologies
- Options for BlueTooth and Wi-Fi

**External**
- IP67 Rated
  - Macro deployment for Maximum range
  - Designed for challenging external environments
  - GNSS built in
  - PoE
  - -40 to +80 degrees

**Programmable IoT Gateway + LoRa Gateway**
- Azure, AWS, Exocite Murano, IBM Cloud, HPE, OSI Soft Pi Systems, Telit deviceWise …
- Actility, Loriot, Orbiwise, Senet, Stream, TheThingsNetwork, Talkpool, Everynet…
Capacities per gateway

- Multiple variable to consider:
  - Concurrency – 8 channels per gateway (8 nodes at a time)
  - Time on air / Duty cycle – How long is a transmission?
  - Acknowledged data – Comes from the 1% transmission time
  - How often does a node transmit? – Small data
  - The Join sequence – Requires responses!
  - Range and speed – 5 Speeds
  - Interference – Spread spectrum technology
  - Adaptive data rate – Increases speed and capacity
  - By directionality – Limited by duty cycle
MultiConnect® Conduit™ AP
Access Point for LoRa® Technology

Commercial
• 4G-LTE, Wi-Fi or Ethernet Backhaul
• Ideal for in-building coverage and enhanced SLAs within commercial facilities
• Use cases include Residential & Office Building Automation, Retail, Exhibition Centers & Smart Cities
MultiConnect® Conduit™
IoT Starter Kit for LoRa® Technology

MultiConnect® Conduit™ + mDot™
- Everything you need to prove your Lora Application
- Conduit Gateway with your choice of 868 or 915MHz
- Choice of IP backhaul, Ethernet or Cellular 4G-LTE
- Two mDot’s and developer boards
- Site Survey mDot Box tool

MultiTech Website
http://www.multitech.com/brands/multiconnect-conduit-lora-starter-kits

Information on MultiTech Conduit IoT Starter Kit for LoRa Technology
## Recommended Accessories

<table>
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<tr>
<th></th>
<th>Macro</th>
<th>Nano</th>
<th>Pico</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product</strong></td>
<td>MultiConnect® Conduit™ IP67 Base Station</td>
<td>MultiConnect® Conduit™</td>
<td>MultiConnect® Conduit™ AP</td>
</tr>
<tr>
<td><strong>Included Antennas</strong></td>
<td>All Antennas</td>
<td>All Antennas (model dependent)</td>
<td>Built in</td>
</tr>
<tr>
<td><strong>Included Mounting</strong></td>
<td>Mounting Brackets</td>
<td>Mounting 'wings'</td>
<td>Mounting Bracket</td>
</tr>
<tr>
<td><strong>Included Cables</strong></td>
<td>Optional LoRa extension cable</td>
<td>Ethernet cable</td>
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</tr>
<tr>
<td><strong>Power</strong></td>
<td>Optional PoE injector</td>
<td>Switched Mode PSU (model dependent)</td>
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</tr>
<tr>
<td><strong>Protection</strong></td>
<td>Optional Lightning Arrestor</td>
<td></td>
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</tbody>
</table>
LoRa® Network Management

Embedded NS - Private
• Complete embedded solution for local management of the network
• Support ABP, OTAA, ADR,
• Configurable streaming API based on Node-Red
• Complementary platform DeviceHQ® for gateways management
• Free of change with documentation, community and support included
• Recommended for POC, test, small and/or decentralized networks
• Master/Slave private networks

External NS (packet forwarder) - Public
• Third party solution for complete management of the network
• Cloud based solution or on-premise solution
• Support ABP, OTAA, ADR, streaming API…
• Prices conditions depends on the provider
• Recommended for large scale networks
• Compatible with all the network server providers

Integration of embedded NS gateways - Hybrid
• The Synox platform, and Microsoft Azure can be used to manage the local network
DeviceHQ® for Gateway Management Tool

Efficiently Deploy, Manage & Scale Remote Connectivity

Reduce cost & complexity of remote device management

• Simplify field deployment of communication assets with goal of zero-touch provisioning
• Real Time alarms and warnings

Secure Provisioning and personalization

• Authenticate communication assets
• Enable secure connectivity & SW updates
• Custom applications deployment & management

Scale network deployment

• Go from a single unit to many quickly & easily
• Tight integration to IoT data platforms
What is coming

- Geo Location – Semtech reference 2.X
- Update to NodeRed
- Upgradeable LoRa concentrator cards
- Upgraded LNS
- Enhanced Class C support
- Multicast support
- More defined regions (channel plans) – Following LoRaWAN™ specifications
- Dual LoRa® card support – 16 channel or dual 8 channel
- Greater range in AP variants
- Higher specification base gateways
Changes – 1.4.14 AEP firmware and underlying mLinux updates

- The LNS is to be updated to version 2.0.13 (Semtech reference definition)
- LNS (Local) default configuration will see the default change to ‘Public’
- The public mode ‘RX’ window default will now be 5 seconds
- Private mode updated,
- Channel mask added to enable channel plan differences
- Local data base of node definitions now limited to 2000 nodes (without external storage)
- Database back up interval now set to 1 hour
- New version of NodeRed installed
- LoRa-Query command (command line) updated
- LoRa config change no longer requires a full gateway reboot
Full GUI
Easy to use configuration

• Dedicated LoRaWAN™ tab
• Local Diagnostics
• Local Firewall
• WAN Fail over
• Quick status review
• Advanced ‘Keep alive’ features
• Local and remote firmware updates
• Application development and deployment
Multiple LoRa® Network Server options to enable easy scalability

- Public cloud LNS support – Known as Packet Forwarder option. Supporting both local configuration files & Provider installation applications
- Local Network server – Fully configurable via the local GUI, and remotely via a free of charge management tools – www.devicehq.com
- Hybrid network server. Enables ‘Non LoRa platform’ providers with a Lora platform with Edge processing. Can be via either discrete standalone LoRa services and industry standard uplink technologies or fully integrated with the providers SDK
NEW - Master Slave Capability

Management (out of the box)
- Simplifies the management. One Master can support up to 2 Slaves gateways
- Increases the coverage of a private network / campus to cover all ‘dark areas’
- Can be used to ‘circumvent’ duty cycle restrictions for class C solutions
- Enables effective load balancing to increase Lora node capacity
- Enables roaming of nodes in private networks
- Easy viewing of ISM band usage
NEW-Local Node GUI

- Used with Local LNS
- Add and modify your nodes and define their class with an easy to use GUI
- Manufacturer of nodes independent
- Supports up to 2000 per gateway / Master slave configuration (100 out of the box)
Network Reliability

• Advanced keep alive functions. Including OS, IP layer, Carrier tracking, timed reboot, remote reboot, time of day reboot.

• Wan failover – Can use cellular, Ethernet and Wi-Fi in any order of priority

• Poly-Packet forwarder – Use of dual supply of LoRaWAN carriers

• Roaming SIMS – MultiTech Gateways are not locked to any one carrier. As a rule MVNO and secure SIM providers can use multiple carriers.

• ‘FOG’ or remote LoRaWAN servers ( LoRaWAN server in the gateways ) has no single point of failure for the LoRa server. The LoRa server resides in every gateway.
## Recommended Part Codes (EU) Including accessories

<table>
<thead>
<tr>
<th>Gateway</th>
<th>Part Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro (IP67)</td>
<td>MTCDTIP-LEU1-266A-868</td>
</tr>
<tr>
<td>Pico</td>
<td>MTCDT-LEU1-246A-868-EU-GB</td>
</tr>
<tr>
<td>Nano</td>
<td>MTCAP-LEU1-868-001A</td>
</tr>
<tr>
<td>Starter Kit</td>
<td>MTCDT-LEU1-247A-STARTERKIT-868</td>
</tr>
</tbody>
</table>

Note – There are over 60 different general configurations available so the above is a good starting point.
Little known feature support

- Poly-packet Forwarder – Used to run the gateway in packet forwarder mode from two ‘non related’ cloud (or cloud and local) LNS
- Fully supports class A and C end devices
- Fully configurable local queue for downlink packets (Main use is class C)
- Support for Multicast – One packet to many nodes at the same time (see notes)
- Support for FoTA – Supports firmware upgrade of nodes (see notes)
- Application upload – Build your Nodered flow locally and upload to DeviceHQ®
- Open embedded linux environment – Supports local ‘native Linux applications’
- Expansion – Add more usable storage space with SD cards
Things to Consider

- **WAN data cost (SIM)** – 500 nodes send 200 bytes data per day. This totals 100Kbyte of data or 3Meg data per month. Add more nodes (could be any ones nodes in packet forward format) and you could use a lot more data – Note does not include IP overhead, LoRa® Packet over head of ‘MQTT’ over head. This could be 300 additional bytes per packet.

- **Placements of antennas** – Range can be impacted if you mount your antenna in parallel to a mounting pole (like a magnet for RF)

- **Lift shafts and risers in buildings**. Great for hidden space but often lined with metal so can act as a faraday cage!

- **Duty cycle!!!** – Duty cycle also applies to the gateway so in class A and C can limit the number of nodes you can acknowledge.
Useful resources

- www.multitech.com - Standard commercial site for generic product information
- www.multitech.net - MultiTech developers web site for all things ‘technical’
- http://lora.multitech.com - MultiTech dedicated LoRa web pages
- www.youtube.com – MultiTech and third part training videos
Thank You!

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