

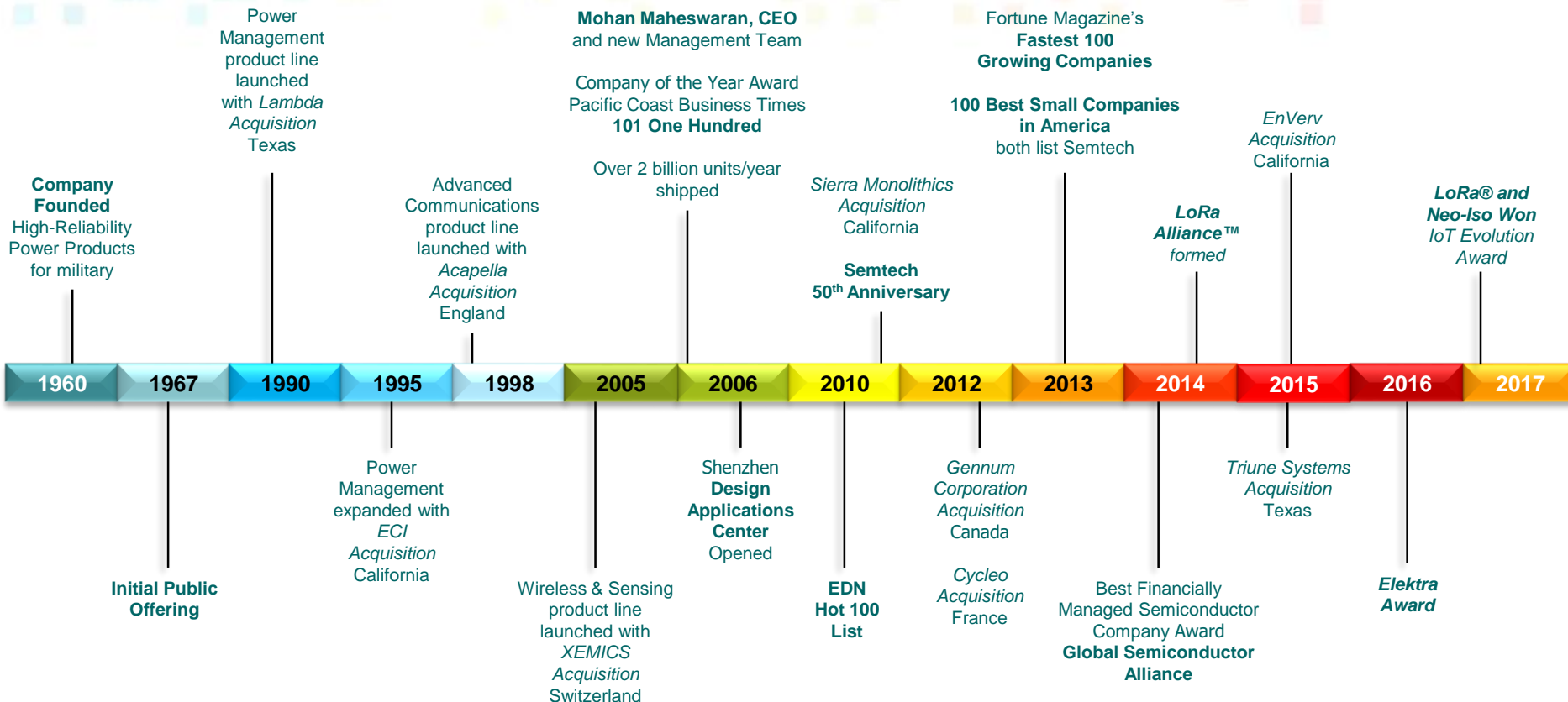


# Semtech LoRa® Overview

## Emitech IoT days

November 2017

# Semtech History & Recognition



# Semtech: Creator of LoRa Technology



- ❑ 60+ years of low-power mixed signal design
- ❑ Creator of LoRa Technology
- ❑ Founding member of the LoRa Alliance™
- ❑ Millions of LoRa® radios deployed globally
- ❑ IHS Technology – 2017 LPWAN report
  - LoRa expected to be dominant LPWAN technology
  - Over 40% of all LPWAN connections will use LoRa
- ❑ Gartner – Market Trends 2017
  - LoRa offers low risk, high reward opportunity



# Low Power, Low Data Communication

**Then:** People sending messages



**Now:** Machine driven wireless



**Unlike cellular, Wi-Fi or Bluetooth,  
LoRa® is designed specifically for LPWAN applications**

# LoRa Addresses Technology Gap



## Traditional Cellular

Low battery life  
High Cost  
MNO controlled



**NB-IoT**

**Sigfox**

## LPWAN

Long Range  
Low data rates  
Long battery life



## Local Area Network

Short Range  
Low battery life

802.15.4

Short range  
Medium battery life



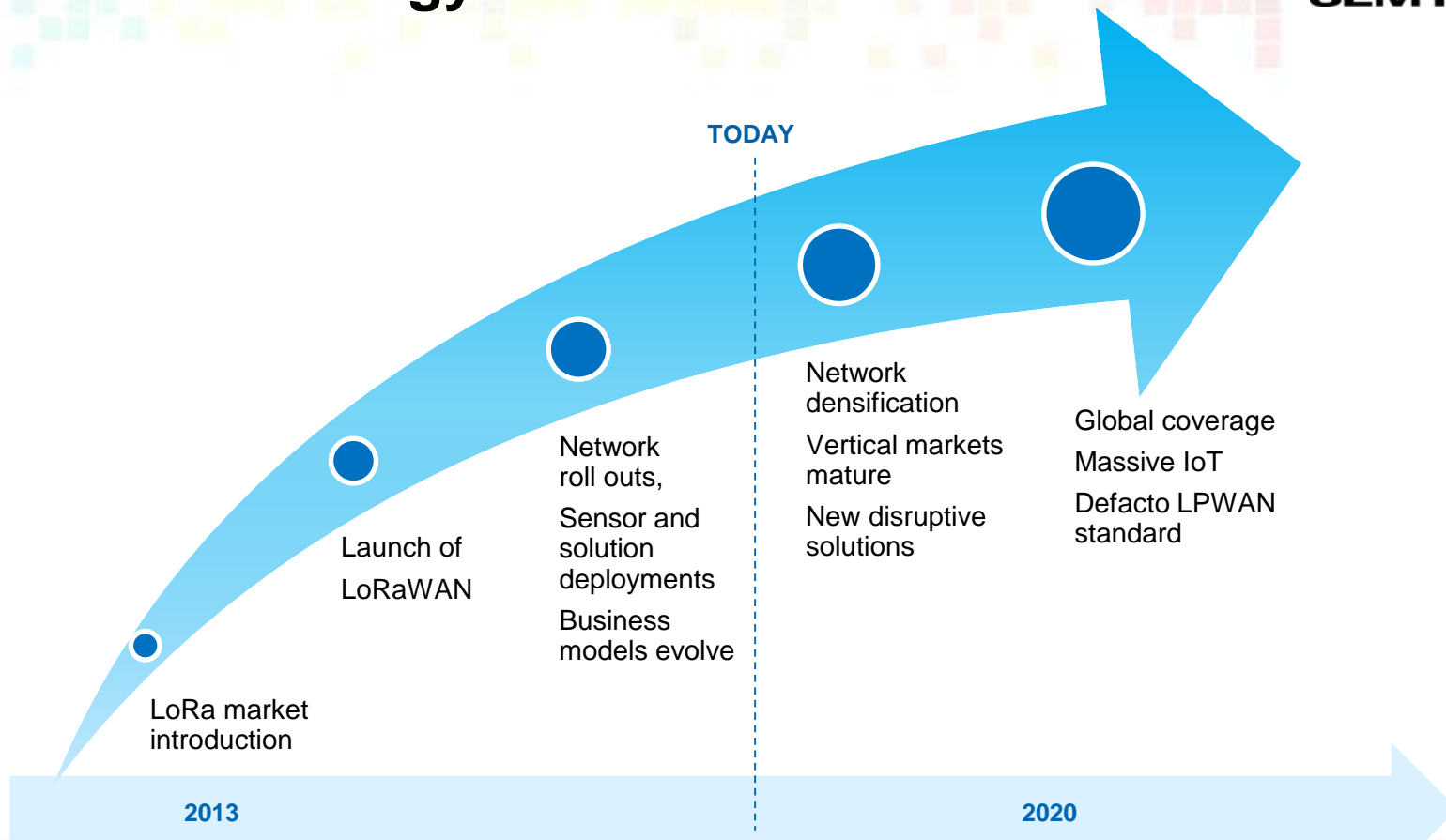
**Bluetooth**

## Personal Area Network

Short Range  
Medium battery life

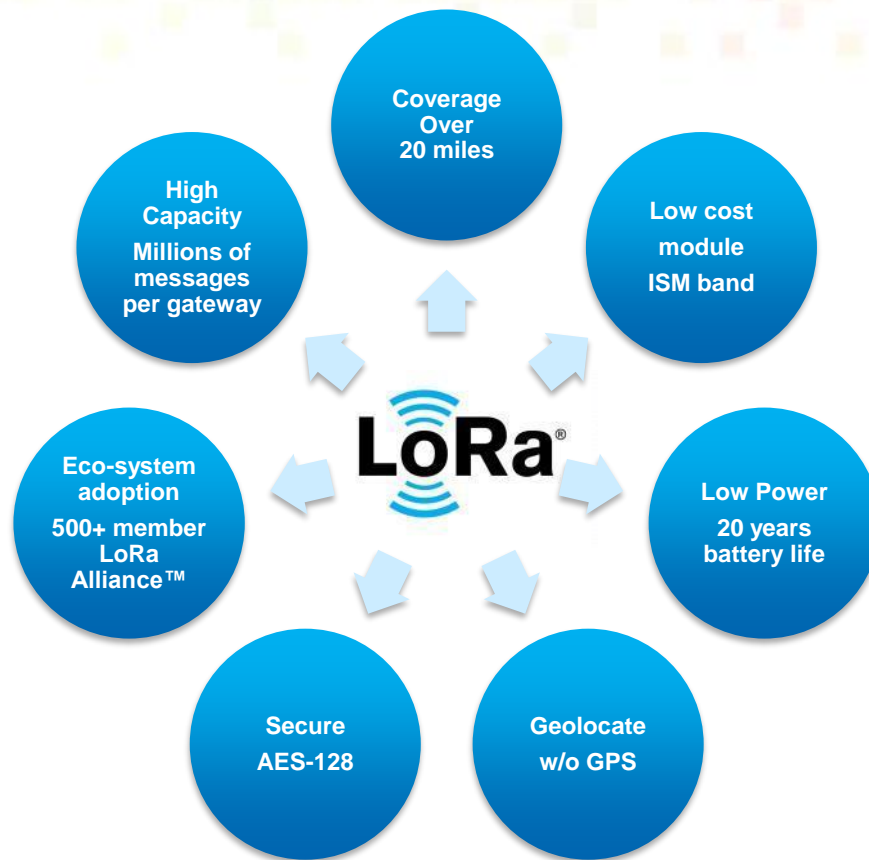


# LoRa Technology Enables Massive IoT



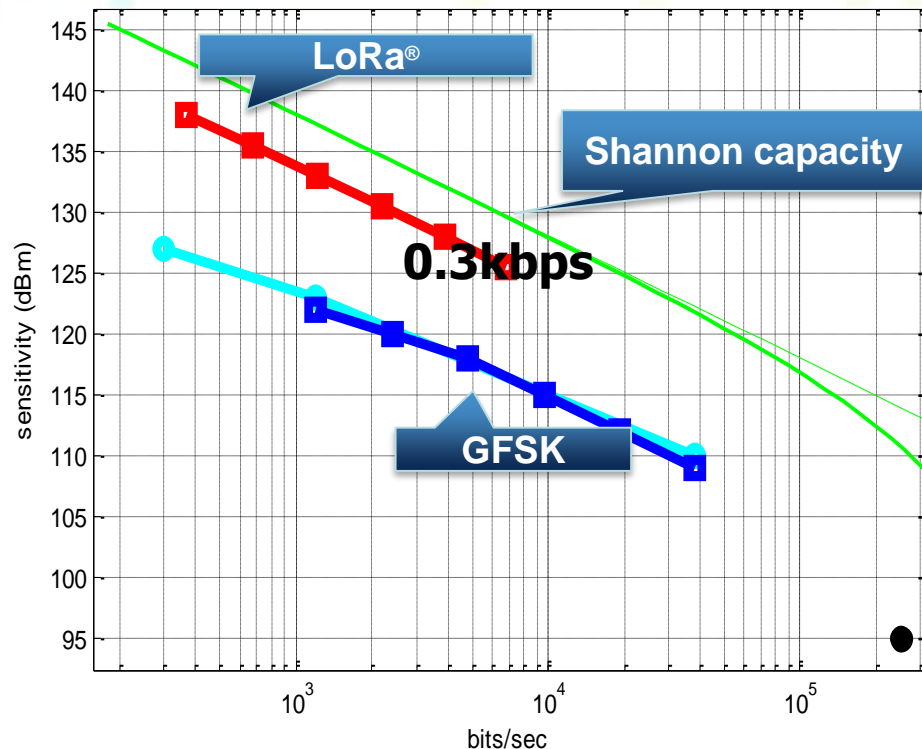


# LoRa Technology Value Proposition





# LoRa: Disruptive Technology



~30 miles field results





# Enabling true digital transformation



## Solutions

- Ease of access - Modules, SIP, LoRaWAN modem
- Monetization models – embedded connectivity, new disruptive subscriber models
- Cloud, fog and edge trade offs - required for mass deployments



## Network Coverage

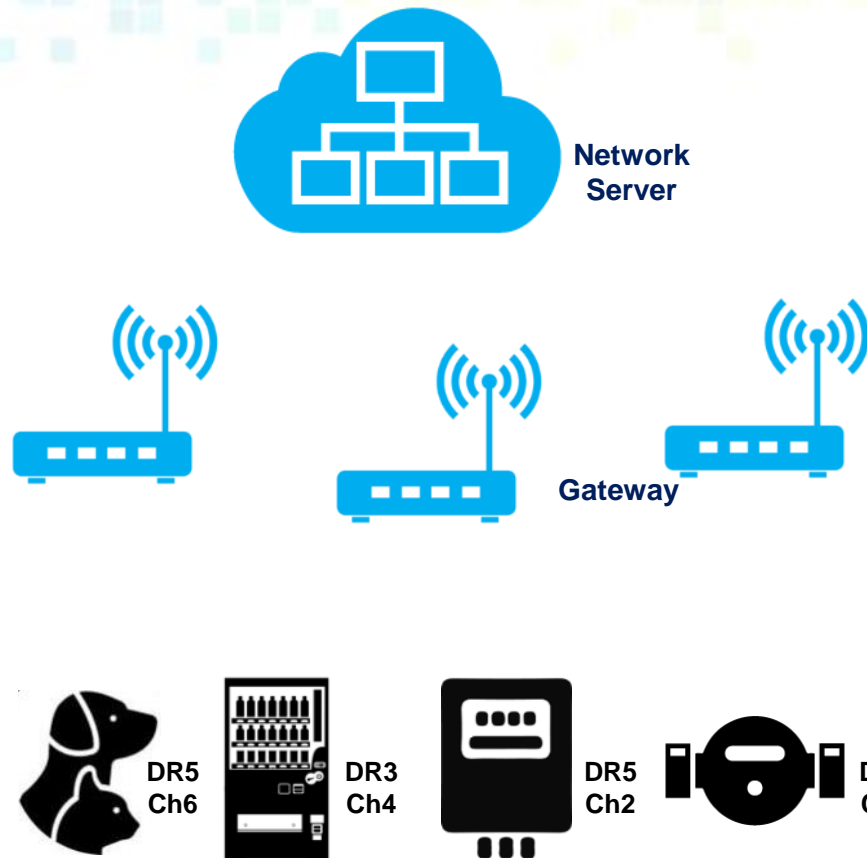
- Gateways – from Macro Outdoor to Pico Indoor connectivity
- Hybrid deployment models public, private, viral networks
- Next Gen cellular and broadband interoperability with optimal latency and throughput



## Technology

- Features – Connectivity, Geolocation, Security, Provisioning
- Silicon – size and power efficiencies all the way to disposable solutions
- Global radio regulation compliancy and spectral efficiency

# LoRaWAN™ Network



## ❑ Multi-channel gateways

- Simultaneous reception of messages
- Scalable capacity
- Indoor or outdoor
- Adaptive data rate
- Supports geo-location

## ❑ LoRaWAN sensors

- Smart Building
- Smart City
- Agriculture
- Supply chain
- Smart Energy
- Insurance
- Smart Health



# LoRa - Brief history



**2013** • Launch of first LoRa radio by Semtech

**2014** • First mobile network operator trials

- Launch of LoRa Alliance

**2015** • Multiple sensors, gateways, modules available  
• Public, private, hybrid network deployments

**Today** • Over 500 LoRa Alliance members  
• LoRaWAN spec downloads over 20K  
• Low power geolocation introduced  
• Multi source value chain



# Ecosystem – Multi-Source Value Chain



**Chipset**



**Module**



**Device**



**Base  
Station**



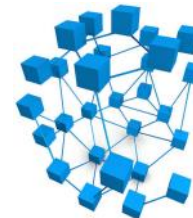
**Network  
Server**



**Application  
Server**



**Network  
Operator**

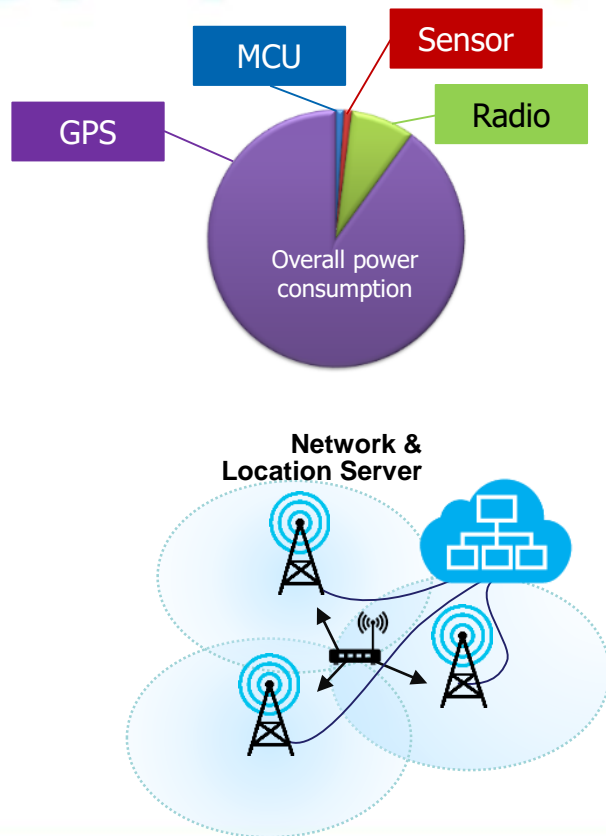


**Solution  
Provider**



## Silicon to Solutions

# LoRaWAN™ Geolocation Feature



**Low  
Power**



**GPS-free  
location**



**Optimize  
operations**

# LoRaWAN Vertical Successes: Examples



IN-GROUND

Parking sensor



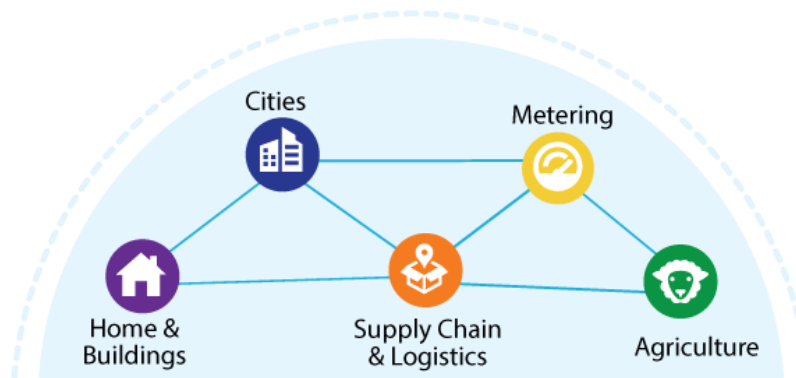
Asset tracker



Smart meter



Leak detection



- |                       |                     |
|-----------------------|---------------------|
| 1 LoRaWAN Transceiver | 3 Solar panel       |
| 2 Embedded battery    | 4 Waterproof casing |

Cattle monitor



# Semtech LoRa® Roadmap

2017 and beyond



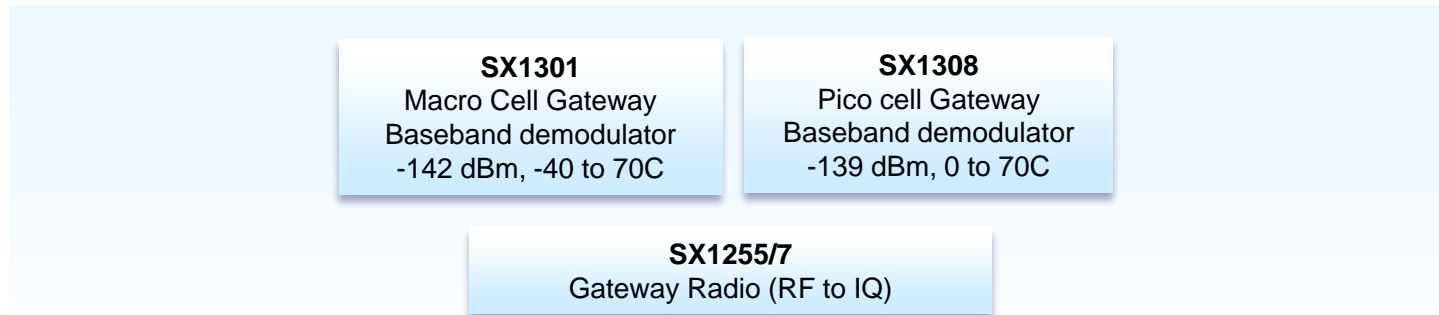
# Semtech LoRa® IC Products



## Sensor Radio IC

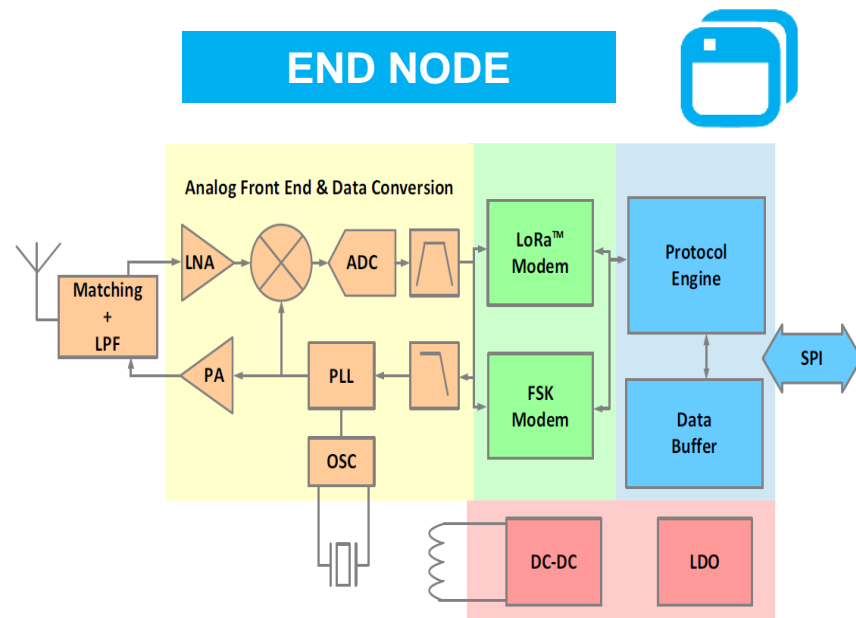
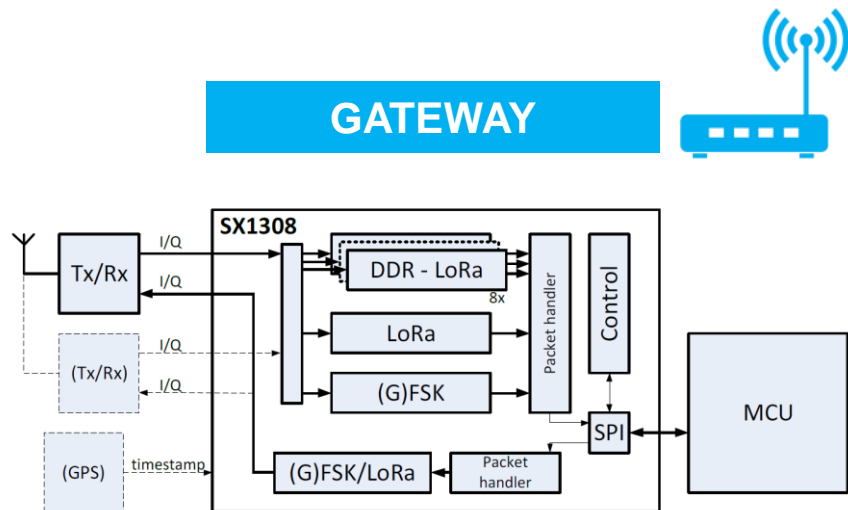


## Gateway ICs



LoRa Alliance™ members offer complete LoRaWAN based products and solutions today

# Functional Block Diagram



# End Node Reference Designs

Part	Design	Band	Region	P <sub>OUT</sub>	Platform
SX1272	SX1272MB1DCS	868MHz	EU	14dBm	Mbed
	SX1272MB2DAS	868MHz/915MHz	EU/US	14dBm	Mbed
	SX1272RF1xAS	868MHz/915MHz	EU/US	20dBm	Eiger, Prototype
SX1276	SX1276MB1JCS	433MHz/868MHz	EU/US	14dBm	Mbed
	SX1276MB1MAS	433MHz/868MHz	EU/US	14dBm	Mbed
	SX1276MB1LAS	433MHz/915MHz	US	14dBm/20dBm	Mbed
	SX1276RF1IAS	169MHz/868MHz	EU	20dBm/14dBm	Eiger, Prototype
	SX1276RF1JAS	433/868/915MHz	EU/US	14dBm/20dBm	Eiger, Prototype
	SX1276RF1KAS	490MHz/915MHz	China/US	20dBm/14dBm	Eiger, Prototype

*Design Files are available under Docs & Resources of Semtech's LoRa Product Page*

# LoRaWAN™ for sensor nodes

- ❑ LoRaWAN specification defined by the LoRa Alliance
- ❑ Open source stack for ARM Cortex-M MCUs
- ❑ Portable to other MCU or CPU architectures
  
- ❑ Option 1: GitHub
  - <https://github.com/Lora-net/LoRaMac-node> (*Master & develop branches*)
  - <http://stackforce.github.io/LoRaMac-doc/> (*Documentation*)
  
- ❑ Option 2: ARM mbed
  - <https://developer.mbed.org/teams/Semtech/code/>
  - Many sample applications on mbed™ platform



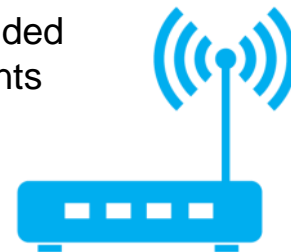


## LoRa Gateway Reference Designs

# LoRa Gateway Reference Designs

	DATA ONLY (V1.X) MACRO & PICO	DATA + GEOLOCATION (V2.X)
<b>Baseband IC</b>	<b>SX1301 / SX1308</b>	<b>SX1301</b>
TX Channels	1	2
RX Channels	8	16 to 64
Antennas	1	2
Duplex	Half	Half / Full
Power Output	up to 23dbm	up to 30dbm
<b>ARCHITECTURE</b>		
Modems	1	2 to 8
DSPs	0	2
FPGA	-	1
Radio FE	Yes	Yes

- LoRaWAN gateway products available from multiple suppliers
- Reference design and SW available from Semtech
- Macro cell for outdoor, data and geolocation
- Pico cell design intended for indoor environments



*\*Base-band extender for GW v2.1*

Gateway hardware reference design	Pico 1.0	V1.0	V1.5	V2.1
License agreement	No	No	No	Yes
Environment	Indoor	Indoor / outdoor	Indoor / outdoor	Outdoor
RX Channels	8	8	8	16-64 (No Diversity) 8-32 (with Diversity)
Region	All except JP and Korea	All except JP and Korea	JP , Korea EU (above 20 dBm) (LBT required)	All
Packet Forwarder	No	No	No	No
HAL	No	No	No	No
Interface	USB / UART	SPI	SPI	SPI
TX power	20dBm	27dBm	27dBm	27dBm
RX Sensitivity	Down to -140dBm	Down to -140dBm	Down to -140dBm	Down to -140dBm
RF Frequency	<1GHz ISM Bands 470-928MHz	<1GHz ISM Bands 470-928MHz	<1GHz ISM Bands 470-928MHz	<1GHz ISM Bands 470-928MHz
LoRa GeoLoc Capable	No	No	No	Yes
MCU/FPGA Function	MCU (USB-SPI, Power Consumption)	No	FPGA (TX filtering for EU, LBT for JP / KR)	FPGA + DSP (fine time stamping, freq conversion, Tx filtering)
Full Duplex	No	No	No	Yes



# Additional Resources

## ❑ Pico Cell gateway information

- <http://www.semtech.com/wireless-rf/rf-transceivers/sx1308/>
- SX1308 datasheet
- SX1257/55 datasheet
- Picocell gateway ref design user guide
- Ref design files (schematic, layout, BOM)
- HAL and packet forwarder are on github

## ❑ All other gateway reference designs

- HAL and packet forwarder for v1.x are on github
- <https://github.com/Lora-net>
- Contact Semtech for GW v2.1



# LoRaWAN Roadmap

## TODAY

**LoRaWAN 1.0.0**  
Initial Spec Release  
Released

**LoRaWAN 1.0.2**  
APAC Updated  
Regional Requirements  
Available to Alliance Members  
Released

## 2017

**LoRaWAN 1.1**  
Roaming, Join Server ,  
Class Switching  
In IPR review



# LoRa Community

- ☐ **One stop resource for suppliers and customers**
- ☐ **Promote your products and find products**
  - Over 200 LoRa based products and solutions
  - Eco-system partners and alliance members are active users
- ☐ **Learn what the market needs**
  - New use case announcements from the eco-system
  - Idea exchanges and support forums tell you what your customers experience on the ground
- ☐ **Get support**
  - Experts in the community including Semtech provide technical support
- ☐ **Education**
  - Many videos, training material, application briefs, white papers available



<http://www.semtech.com/iot>



**Thank You**