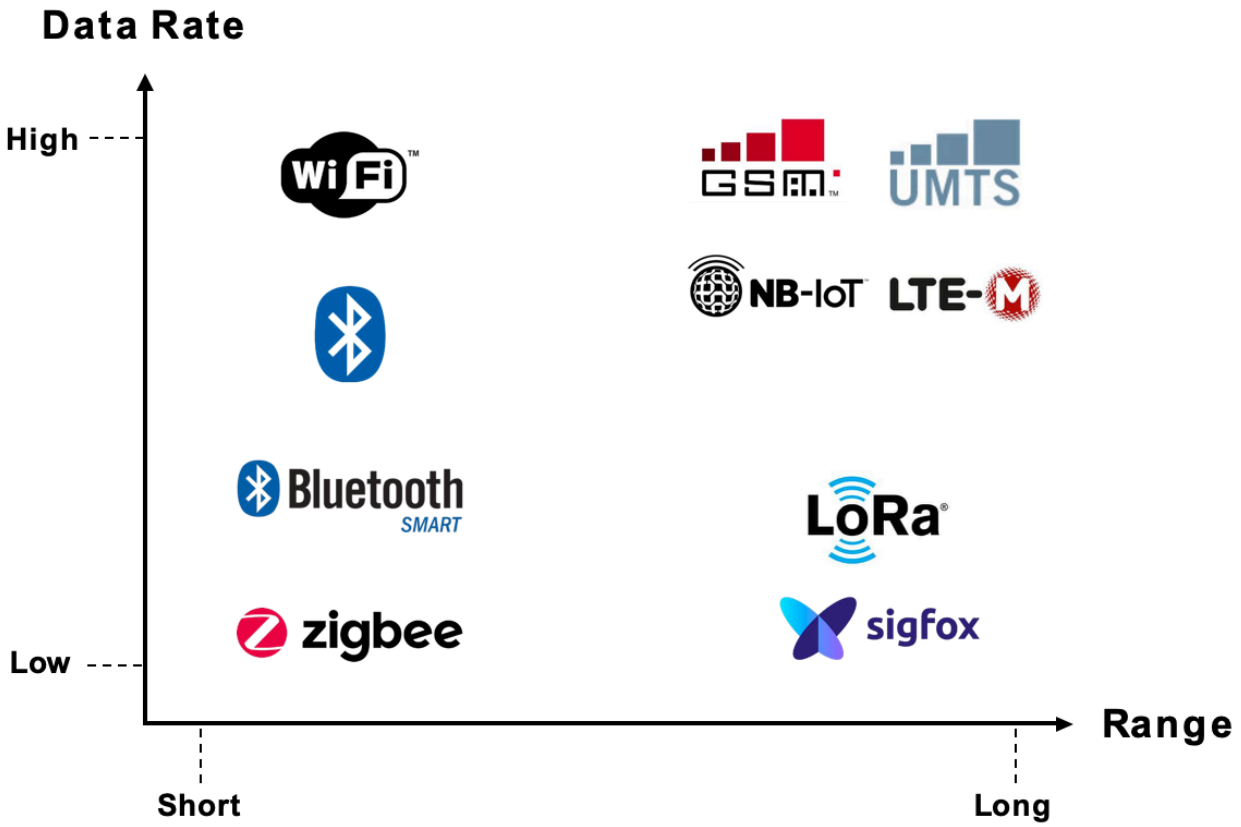
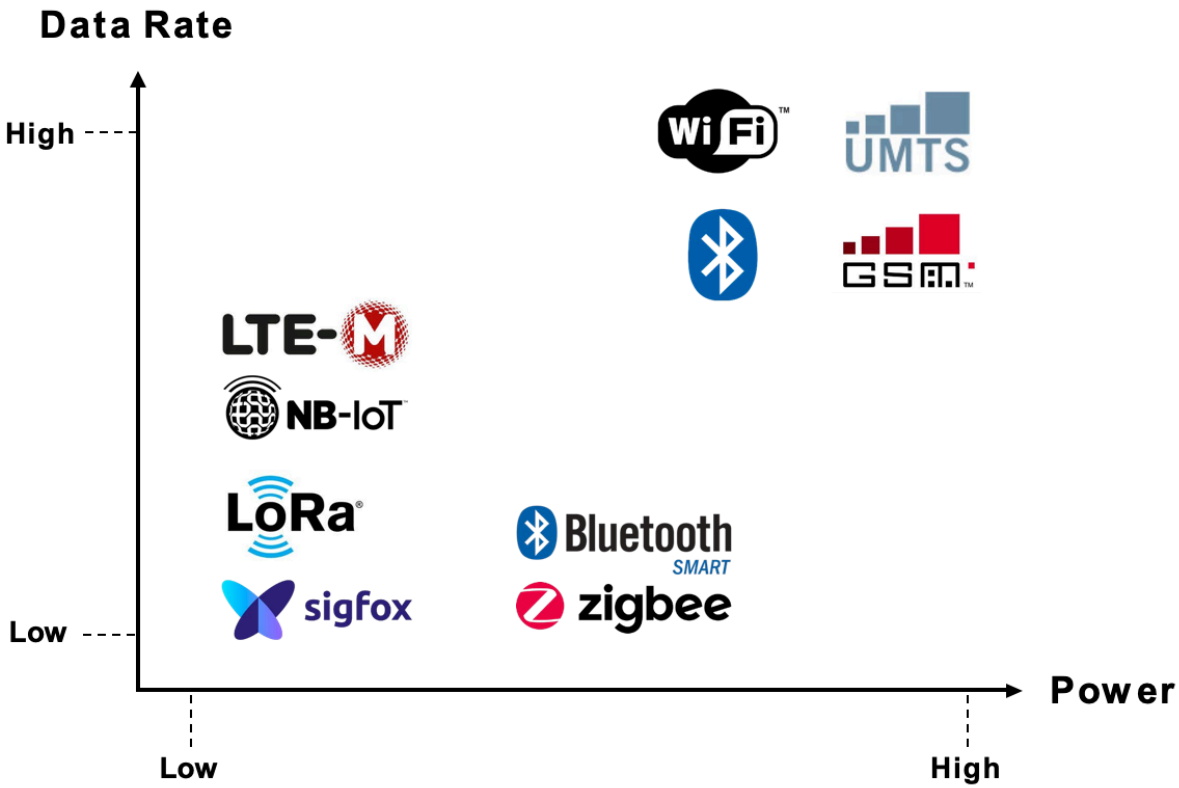
LoRa as a flexible LPWAN technology for IoT

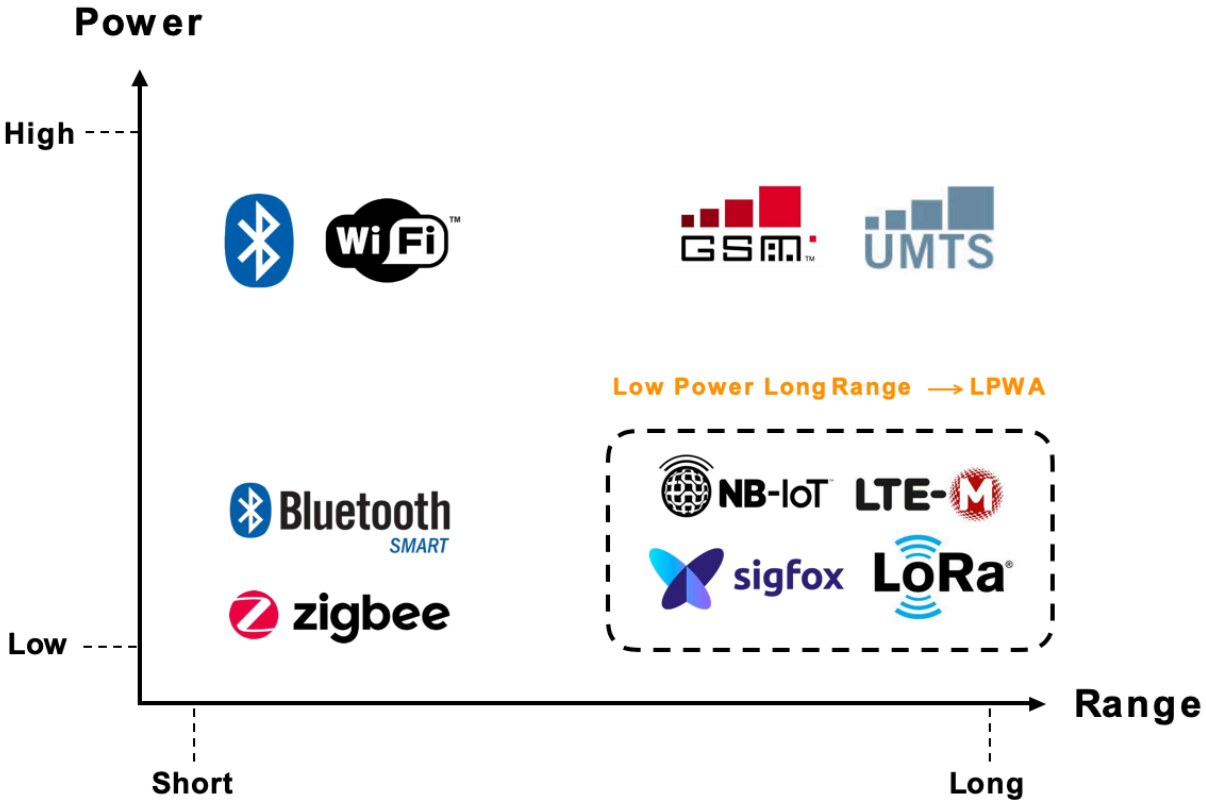
LPWAN: range vs data rate



LPWAN: power vs data rate

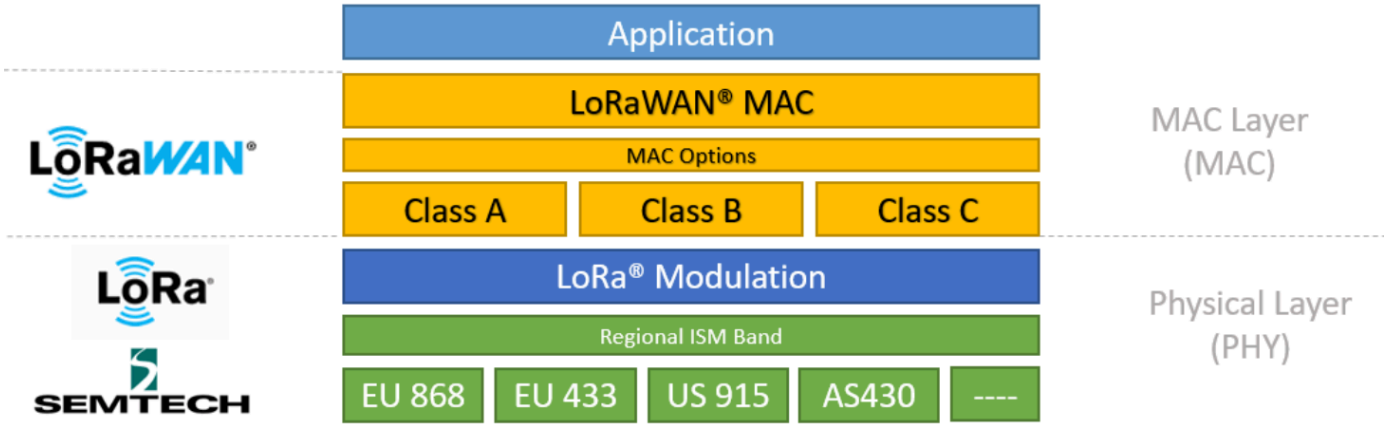


LPWAN: range vs power



LoRaWAN: a sub-gigahertz wireless technology

- LoRaWAN™ is a Low Power Wide Area Network (LPWAN) specification intended for wireless battery-operated Things in a regional, national or global network
  - by Semtech Corporation (http://www.semtech.com/)
- LoRaWAN™ defines the communication protocol and system architecture for the network, while the LoRa physical layer enables the long-range communication link.



https://lora-developers.semtech.com/library/tech-papers-and-guides/lora-and-lorawan/ ©

LoRa® Alliance

https://lora-alliance.org/

- The LoRa® Alliance is an open, non-profit association of members whose mission is:
  - "..promote and drive the success of the LoRaWAN® protocol as the leading open global standard for secure, carrier-grade IoT LPWAN connectivity…"
  - "To develop and promote LoRaWAN® technology and its ecosystem to deliver massive IoT"
- Specification is free to download:
  - https://lora-alliance.org/resource-hub/lorawan-104-specification-package

LoRa Alliance®

LoRaWAN® L2 1.0.4 Specification (TS001-1.0.4)

Authored by the LoRa Alliance Technical Committee

Technical Committee Chair and Vice-Chair:
A.YEGIN (Actility), O.SELLER (Semtech)

Editors:
T.KRAMP (Semtech), O.SELLER (Semtech)

Contributors (in alphabetical order):
A.BERTOLAUD (Gemalto), I.CALABRESE (A2A Smart City), J.CATALANO (Kerlink), J.DELCLEF (ST Microelectronics), V.DELPORT (Microchip Technology), P.DUFFY (Cisco), F.DYDUCH (Bouygues Telecom), T.EIRICH (Semtech), L.FERREIRA (Orange), Y.GAUDIN (Kerlink), S.GHAROUT (Orange), O.HERSENT (Actility), A.KASTTET (Birdz), D.KJENDAL (Senet), V.KLEBAN (Everynet), J.KNAPP (Semtech), T.KRAMP (Semtech), M.KUYPER (Semtech), P.KWOK (Objenious), M.LEGOURIEREC (Sagemcom), C.LEVASSEUR (Bouygues Telecom), M.LUIS (Semtech), M.PAULIAC (Gemalto), P.PIETRI (Orbiwise), O.SELLER (Semtech), D.SMITH (MultiTech), N.SORNIN (Semtech), R.SOSS (Actility), J.STOKKING (The Things Network), T.TASHIRO (M2B Communications), D.THOLL (Tektelic), P.THOMSEN (Orbiwise), A.YEGIN (Actility)

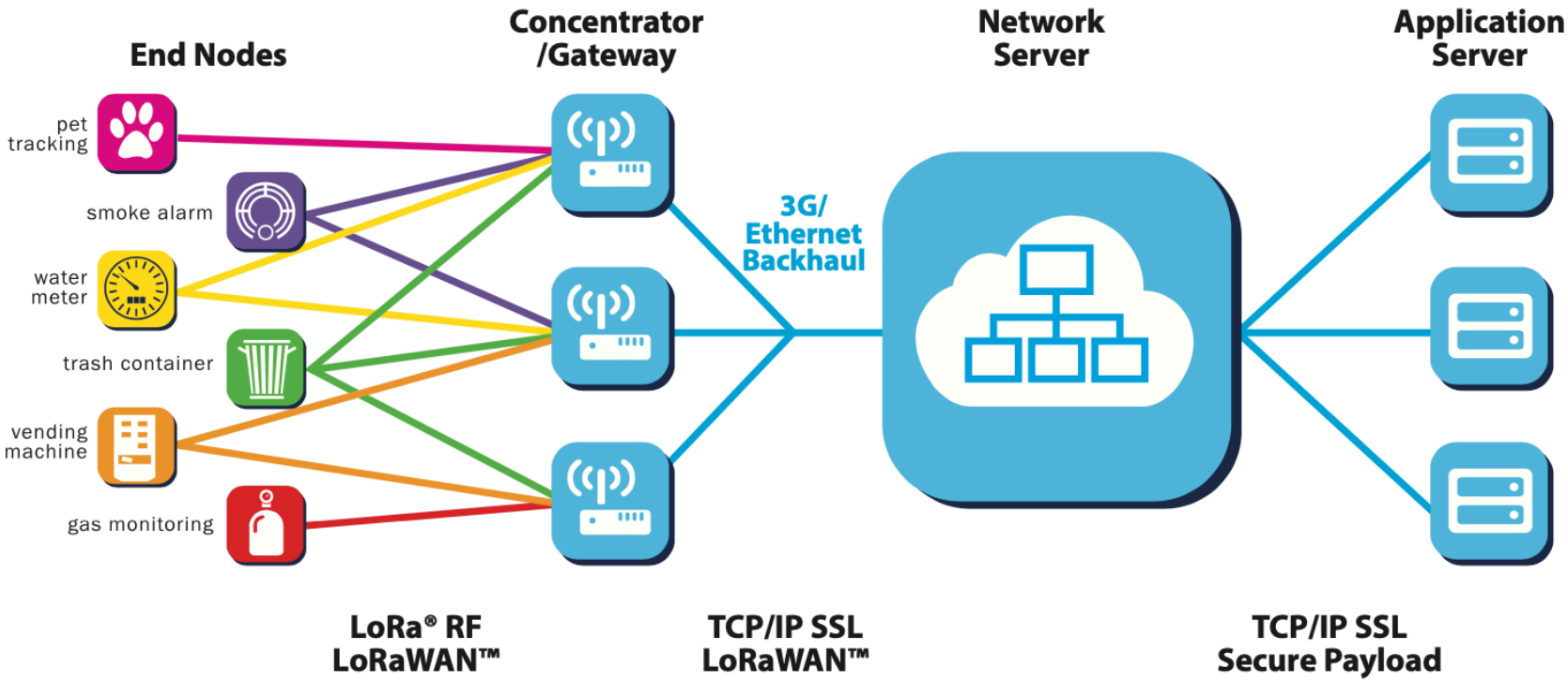
Version: 1.0.4
Date: October 2020
Status: Released

LoRaWAN specification depends on the region

	Europe	North America
Frequency band	867-869MHz	902-928MHz
Channels	10	64 + 8 +8
Channel BW Up	125/250kHz	125/500kHz
Channel BW Dn	125kHz	500kHz
TX Power Up	+14dBm	+20dBm typ (+30dBm allowed)
TX Power Dn	+14dBm	+27dBm
SF Up	7-12	7-10
Data rate	250bps- 50kbps	980bps-21.9kpbs
Link Budget Up	155dB	154dB
Link Budget Dn	155dB	157dB

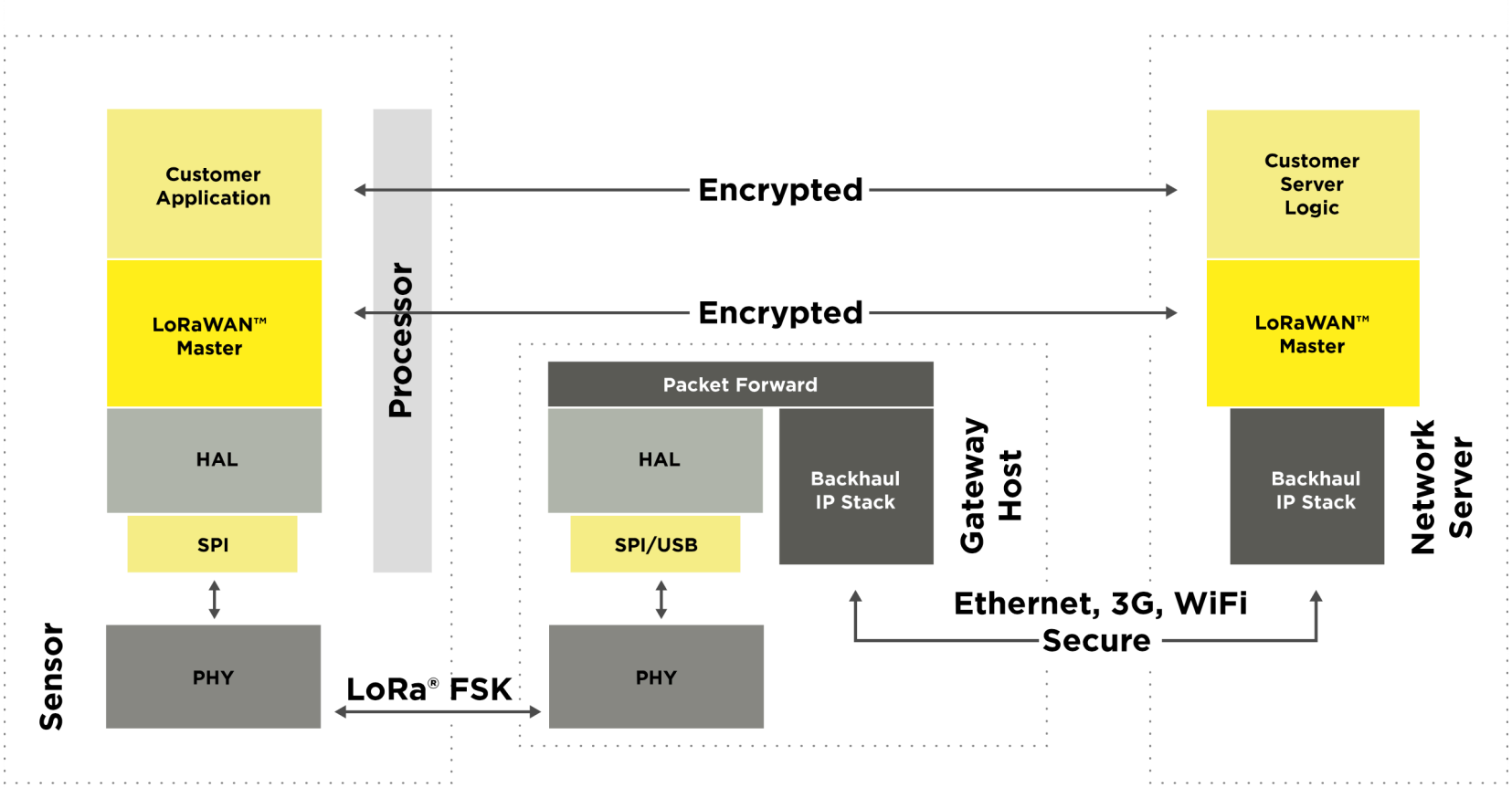
https://lora-alliance.org/resource-hub/rp2-101-lorawanr-regional-parameters-0

LoRaWAN network architecture



LoRa Alliance ©

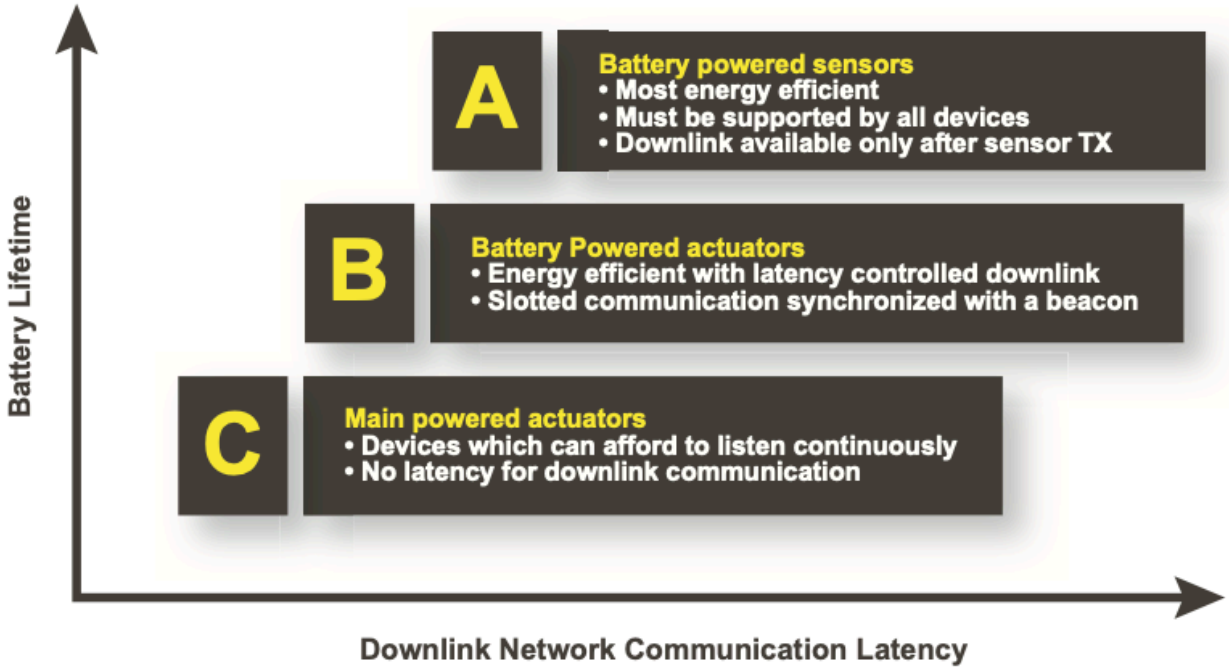
LoRaWAN data flow



HAL: Hardware Abstraction Layer

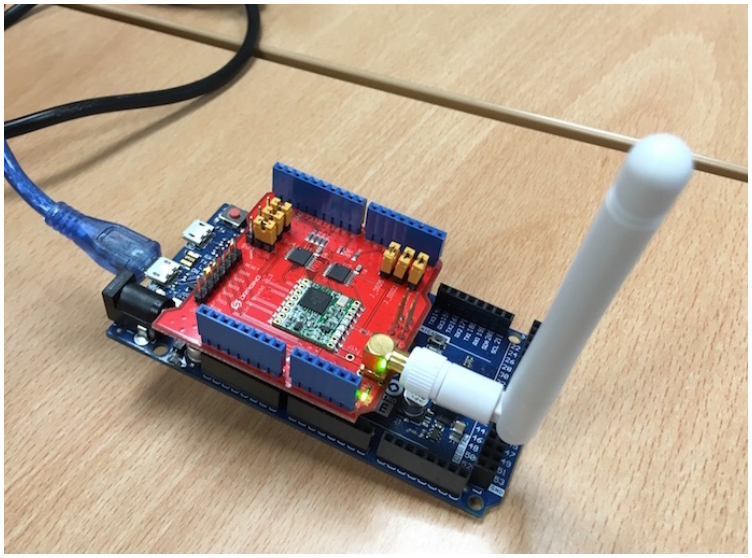
Three types of devices

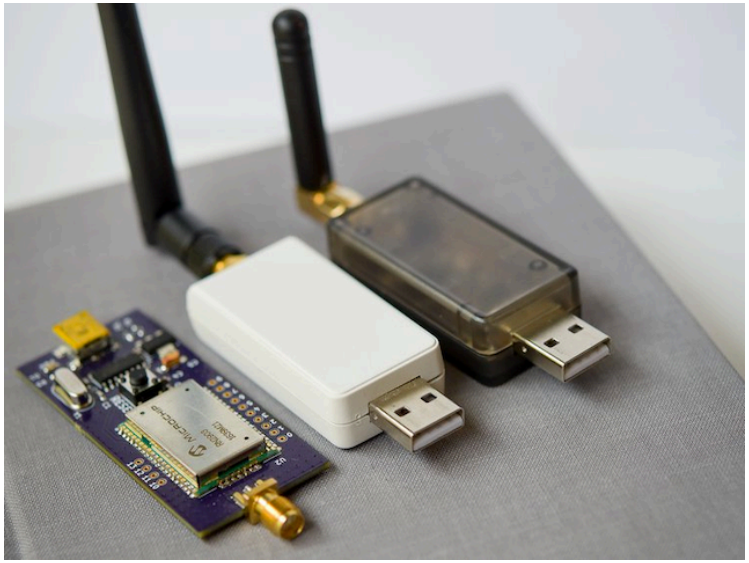
- LoRaWAN has three different classes of end-point devices to address the different needs reflected in the wide range of applications:



LoRa® Alliance Technical Marketing Workgroup

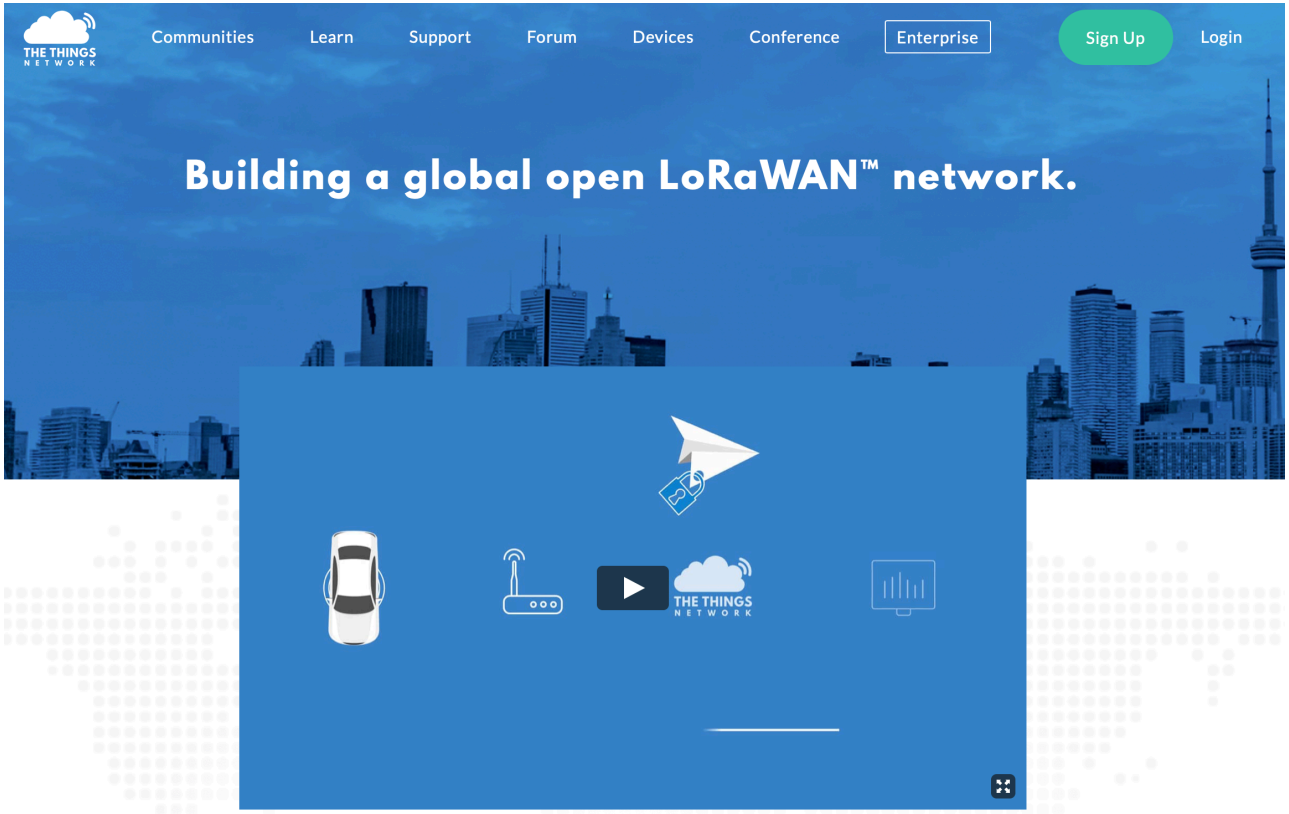
Some devices





The Things Network (TTN)

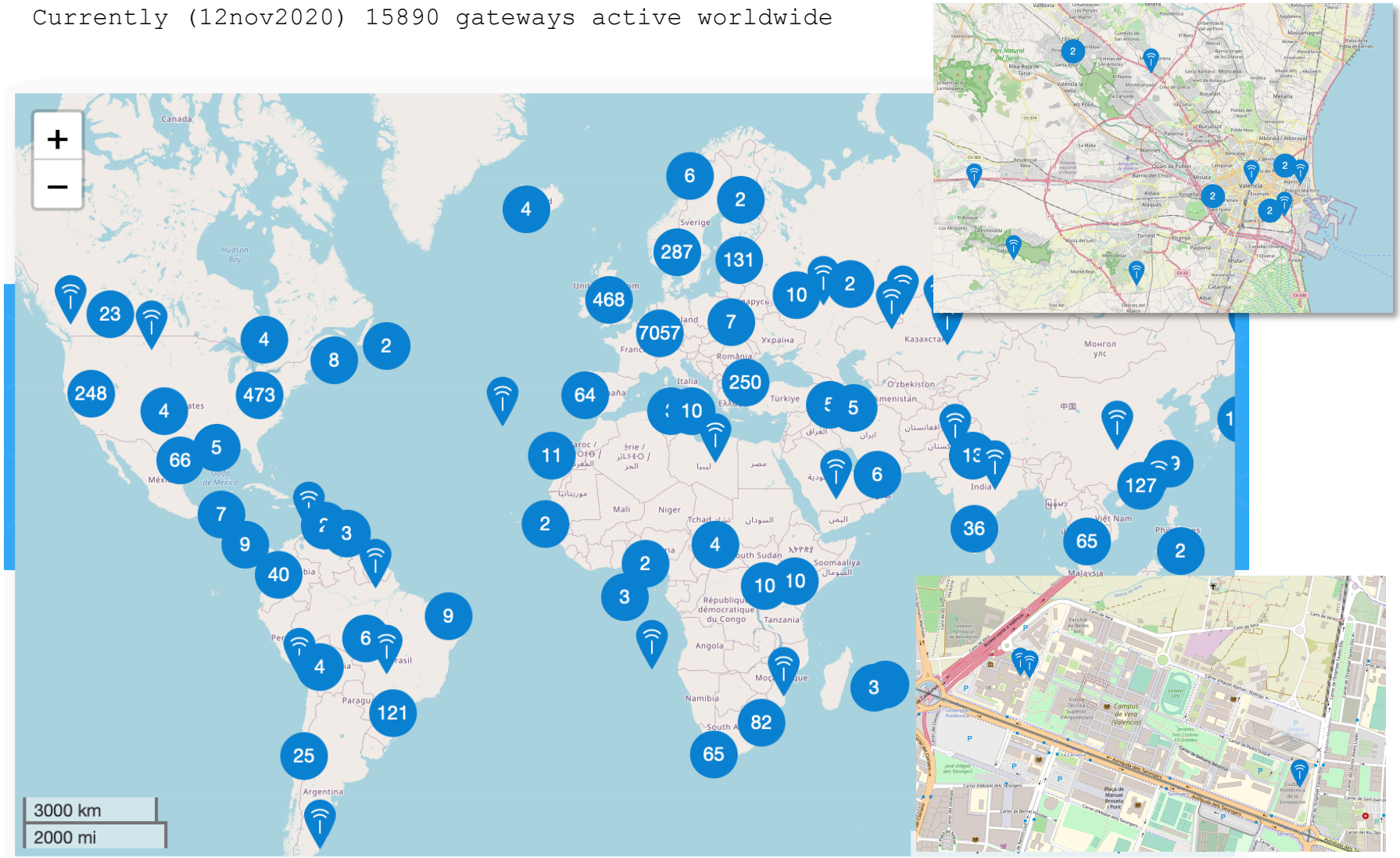
https://www.thethingsnetwork.org



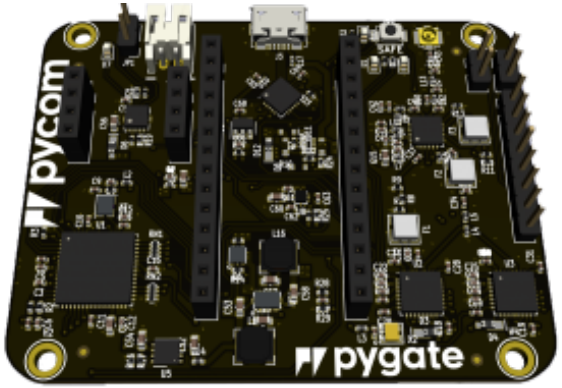
Supporting 120401 developers in building industrial grade LoRaWAN solutions

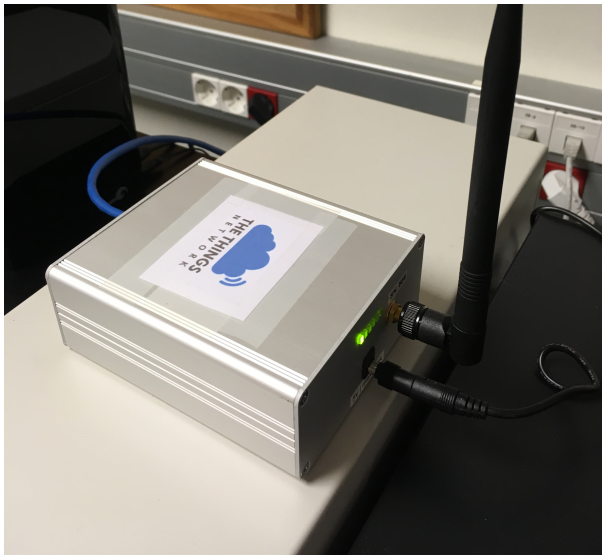
The Things Network (TTN)

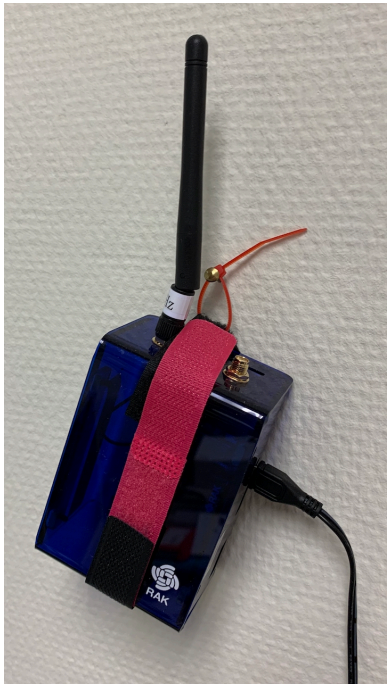
Currently (12nov2020) 15890 gateways active worldwide

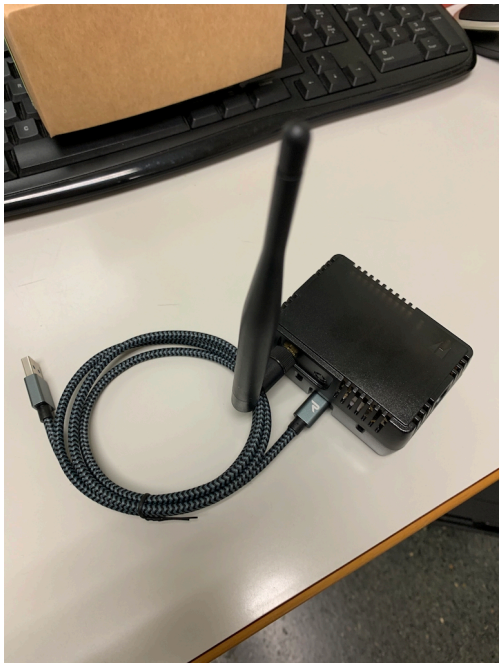


GRC Gateways









The Things Network (TTN)