LoRa(WAN) Overview

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Objectives

- Internet of Things + LoRa / LoRaWAN
- Overview LoRa
- LoRaWAN + The Things Network (TTN)
- Example: `ttnmapper`
- Discussion

Focus: Introductory overview + hands-on

Internet of Things + LoRa / LoRaWAN

- No, I won't introduce IoT, build your own opinion
- *In general:* small (stupid?) device phoning home
- Often low power
- Need for connection
  - WLAN (ESP8266...)
  - ~~GSM~~, UMTS, LTE
  - LoRa, Sigfox, ...

Overview LoRa

We distinguish:

- LoRa (PHY layer) $\Longrightarrow$ «point-to-point links»
- LoRaWAN (TTN) $\Longrightarrow$ «Network layer»

Overview LoRa

LoRa PHY

Overview LoRa

- LoRa $\Longrightarrow$ LOng RAnge
- Proprietary (Cycleo/Semtech, 2008-2013)[1]
- License free (ISM spectrum, 868 / 915 MHz)
- *«Chirp»-Modulation*
- Low Power
- Cheap

[1] Excellent reverse-engineering:
`https://media.ccc.de/v/33c3-7945-decoding_the_lora_phy`

Overview LoRa

- Really long range (e.g. $>$ 200km from Weissenstein[2])
- *Low bandwidth* ($<$ 2.8kB/s)
- Different modes
  - Bandwith (125kHz, 250kHz oder 500kHz)
  - Adjustable coding Rate
  - Spreading Factor (7 - 12)

[2] https://www.thethingsnetwork.org/community/Bern/post/andreas-spiess-cut-the-edge-201km-connect-to-the-ttn-gw-weissenstein

Overview LoRa

Limitations

- Transmit power (of course)
- Duty cycle: 1% or 0.1% depending on freq. band
- 30 sec fair usage (TTN)

Example

- 22 byte payload (9 bytes TTN effective): *56.6 ms airtime*
- $\Longrightarrow$ max. 500 messages/day or 11.6 / 4.7 kB.
- *Start thinking in bytes!*

LoRaWAN + The Things Network (TTN)

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LoRaWAN

- Is MAC / Network layer for LoRa
- Specified by LoRa Alliance (2015)[3]
- Device classes A,B,C
- Uplink/downlink messages, addressing
- Connection/authentication and Encryption
- Adressing (devices, networks, applications)

[3] https://www.lora-alliance.org/portals/0/specs/LoRaWAN%20Specification%201R0.pdf

LoRaWAN + The Things Network (TTN)

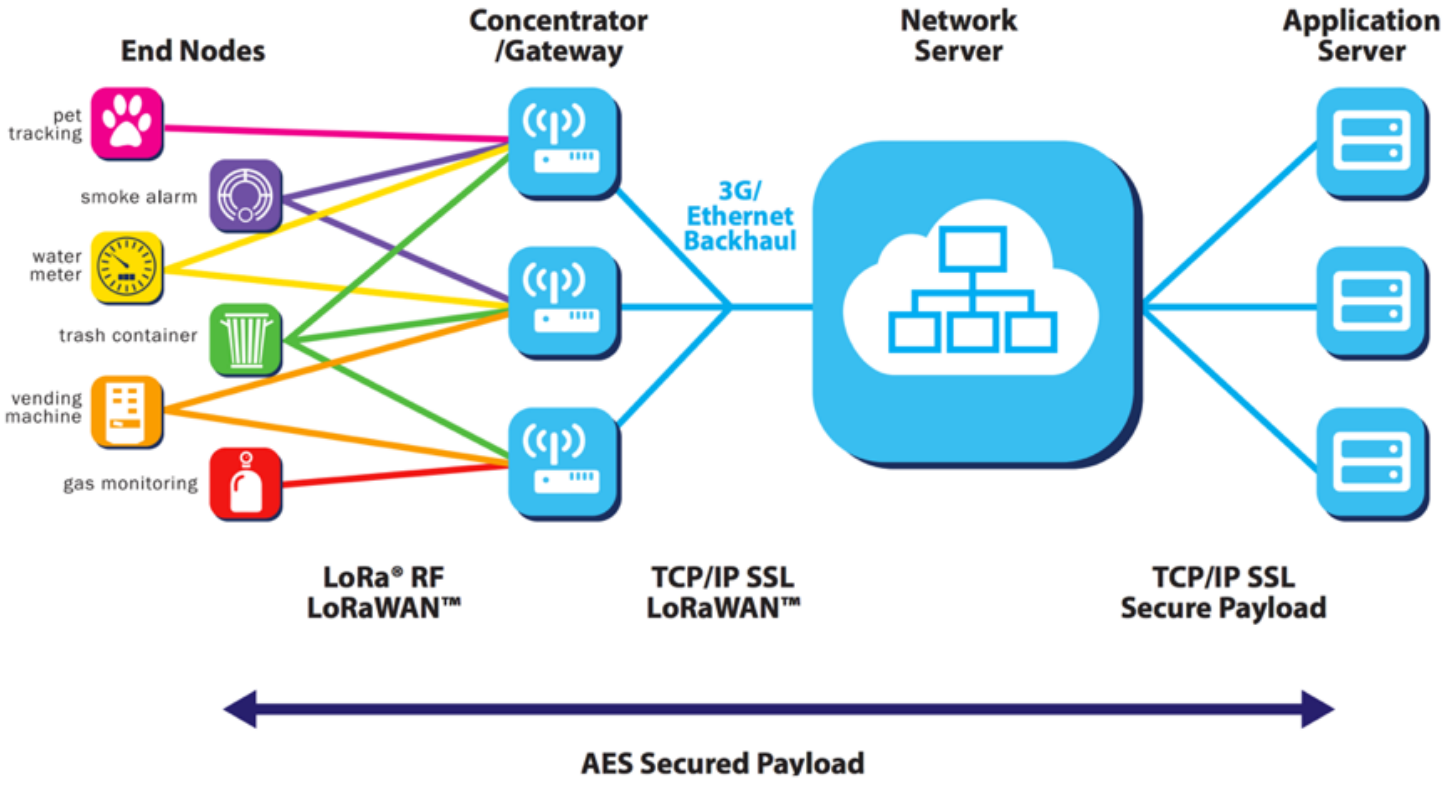
Addressing + Activation

- 64 bit unique DevEUI
- 32 bit DevAddr (7 + 25 bit)
- Activation by personalisation (ABP)
- Over the air activation (OTAA)

Keys (depending on activation)

- Network Session Key $\Longrightarrow$ MIC check
- Application Session Key
- Application Key

LoRa(WAN)



(https://radio.freifunk.net/wp-content/uploads/sites/38/2016/09/iacjecdc.png)

LoRaWAN + The Things Network (TTN)

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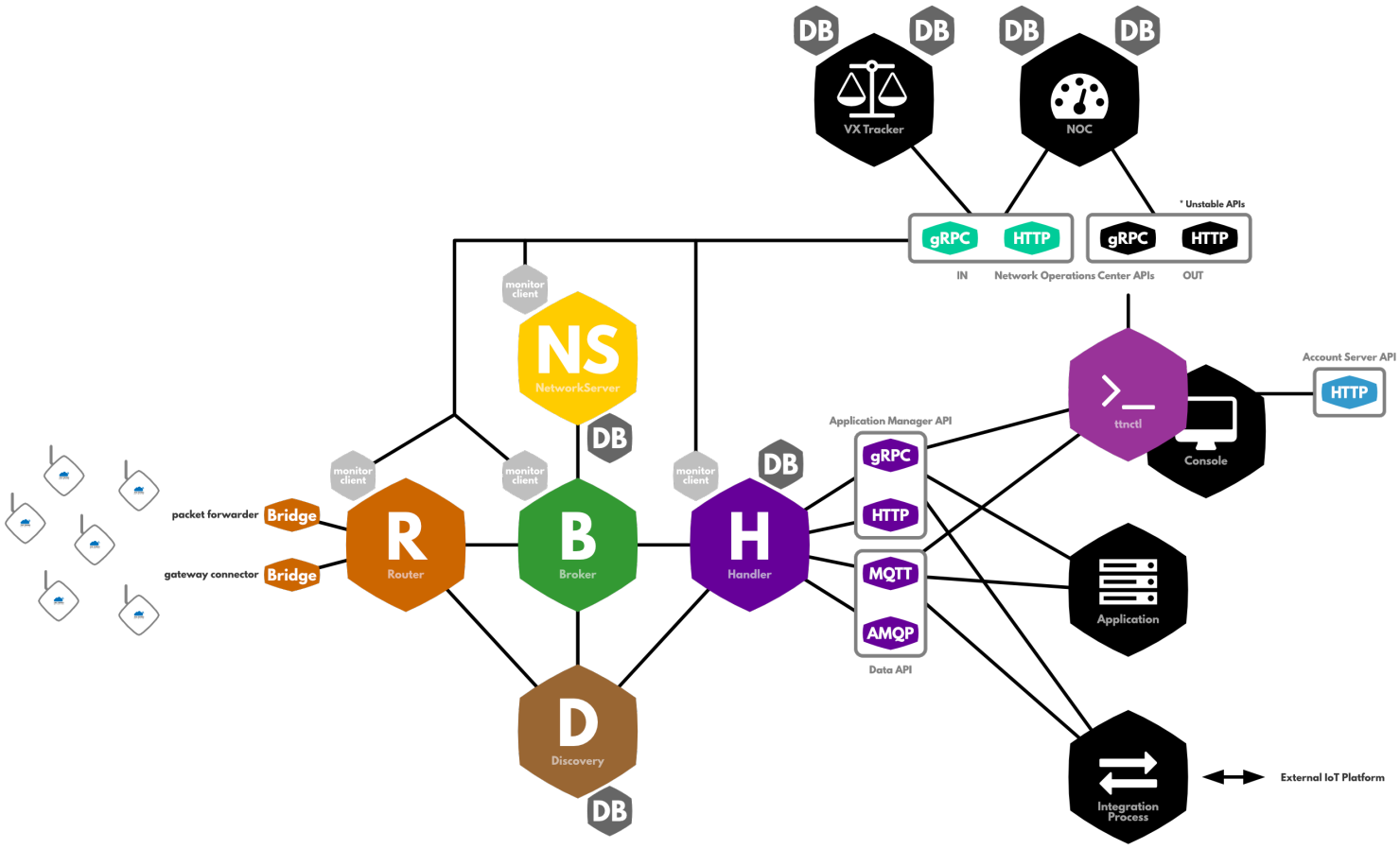
The Things Network (TTN)

- Community building free worldwide LoRaWAN
- $\sim$19k contributors / $\sim$90 countries
- Origin .nl, strong swiss community

LoRaWAN + The Things Network (TTN)



(https://www.thethingsnetwork.org/wiki/Backend/Home)

Demo: ttnmapper

Discussion

Thanks a lot!