

Do-it-Yourself IoT with LoRaWAN

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Hello

I'm @tamberg.

- Making/engineering/teaching IoT
- Organizing IoT Zurich Meetup
- Labmanager at FabLab Zurich
- "Hacking" at Bitwascherei

* <http://tmb.gr>



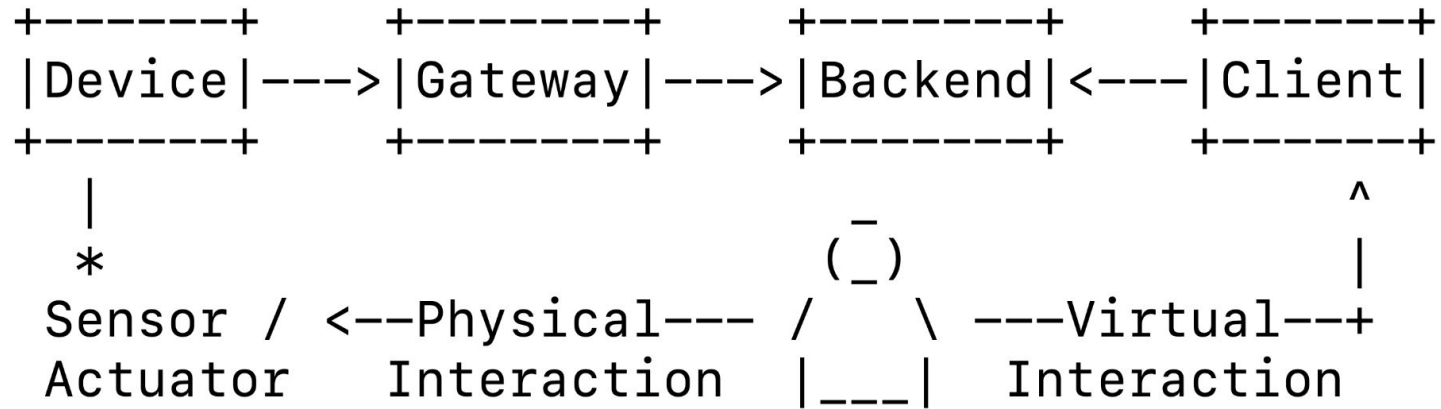
Do-it-Yourself (DIY)

Because we can!

- DIY kits to get started
- Make / learn / share
- Interdisciplinary
- Self-motivated



Internet of Things (IoT)



A->B: depends on



Long Range Wide Area Networks (LoRaWAN)

- Long range (1 - 10 km)
- Low power (0.4 J / 10 bytes)
- Cheap (USD 10 for a LoRaWAN node)

* <https://github.com/IRNAS/lorawan-power-consumption>



LoRaWAN Topology

Star of stars topology.

- 1..N devices (called nodes) per gateway
- 1..N gateways per LoRaWAN backend
- 1 network, 1..N app servers
- N app clients, each

* <https://www.thethingsnetwork.org/docs/lorawan/architecture/>



LoRaWAN Gateway

Forwards LoRa payload to backend.

- Embedded computer or MCU
- Multi-channel LoRa radio, antenna
- Internet uplink, e.g. via 4/5G module

* <https://github.com/ttn-zh/ic880a-gateway/wiki>

LoRaWAN Node

Reads sensors, sends data via LoRa.

- Microcontroller
- Radio module, antenna
- Sensors, e.g. temp & humi
- Battery, solar panel / charger

* <https://github.com/mitwelten/mitwelten-iot-hardware-poc>



LoRa Radio Modules

All modules use Semtech chips, e.g.

- Microchip RN2483
- HopeRF RFM95W
- Wio-E5 STM32
- Wio-SX1262

* <https://www.semtech.com/lora> (410+ M)

LoRaWAN Frequencies

Legal frequency depends on region.

- LoRa radio uses license free ISM bands
- EU 868 MHz, US 915 MHz, Asia 433 MHz
- Frequency plans exist per country

* <https://www.thethingsindustries.com/docs/concepts/features/lorawan/frequency-plans>



The Things Network (TTN)

Open LoRaWAN infrastructure.

- Built/hosted in Amsterdam
- Open source stack
- Open network

* <https://github.com/orgs/TheThingsNetwork>



TTN Communities

Anyone can host a gateway.

- Building the network
- Maintenance is work
- It's getting quiet

* <https://thethingsnetwork.org/community>



TTN Zurich Community

People, all the way down.

- Initiated by Gonzalo Casas
- Hosted at #IoTZH Meetups
- Most gateways on TTN
- Swiss TTN backend

* <https://opennetworkinfrastructure.org>



TTN Applications

Anyone can connect a node.

- Get a TTN account
- Get network, app keys
- Send data from your nodes
- Get your data from the backend

* <https://eu1.cloud.thethings.network>



LoRaWAN Use Cases

Monitoring rather than control.

- Building-wide indoor monitoring
- Park-scale environmental monitoring
- City- or town-scale outdoor monitoring

* <https://resources.lora-alliance.org/use-case>



Use case: Room Climate in a Building

- A few gateways for a building
- Nodes with a small battery
- Choose LoRaWAN provider
- No wires to install

* <https://avelon.com/en/wisely>



Use case: Counting People in a Park

- A single gateway for 0.3 x 2 km
- About 25 PAX counter nodes
- Detecting smartphones
- Anonymised count

* <https://discover.mitwelten.org>



Use case: #MakeZurich Civic Hackdays

- Initiated by the Zurich TTN community
- Organised with EWZ, a power utility
- Custom hackday badge with LoRaWAN
- Involving local FabLab/hackspace

* <http://www.tamberg.org/makezurich/2023/MakeZurichBadge2023.pdf>



LoRaWAN Limitations

Ideal for small, slow data.

- Payload size < 51 byte
- Unreliable, no ack
- Duty cycle 1%

* <https://resources.lora-alliance.org/technical-specifications>



LoRa Mesh Networks

Great promise, same limits.

- Meshtastic, FreakWAN, ...
- "Multi-hop broadcast"
- Humans or sensors

* <https://meshtastic.org/docs>



LoRa Future

Good enough, net working.

- LoRa Satellite IoT (?)
- LoRaPlus, 2.4 GHz, 2+ Mbps
- LPWANs like Mioty, LTE Cat 1bis

* <https://www.semtech.com/products/wireless-rf/lora-plus/lr2021>



LoRa Workshop

Hands-on, this afternoon.

- Everybody is welcome
- Try LoRa yourself
- Bring a laptop

* <https://github.com/tamberg/lora-intro>



Thanks

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* tmb.gr/hny26 => slides.txt

