IoT alla LoRaWAN style

Tom Puc

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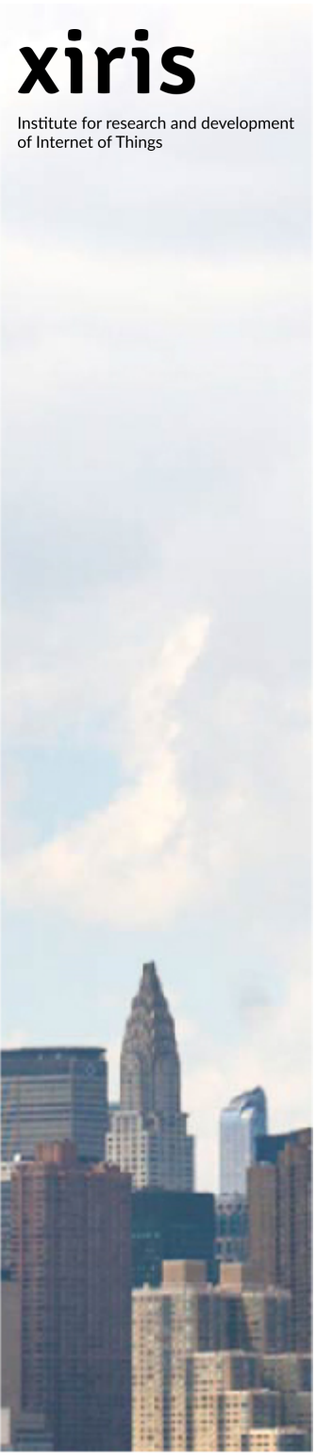
Institute for research and development of Internet of Things

THE THINGS NETWORK NOVA GORICA

SEE 8: 16-17 April 2019, Sarajevo, Bosnia and Herzegovina



About us

- 15 years of “community services” www.novagorica.eu
- wlan.novagorica.eu (free wifi: 450 AP)
- IoT.novagorica.eu
- XIRIS (Institute for research and development of Internet of Things)

Contents

- IoT : the “Things” defined
- What (is LoRaWAN)?
- Why?
- How?
- Use cases -> BoF

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Specifications

IoT “**Things**” requirements for “**Smart <*>**”

- range (>3km)
- cost (RF part <9$, low TCO)
- energy consumption (years…)

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LoRa…WHAT?

	Local Area Network Short Range Communication	**L**ow **P**ower **W**ide **A**rea (LPWAN) Internet of Things	**Cellular Network** Traditional M2M
	40%	**45%**	**15%**
☺	Well established standards In building	Low power consumption Low cost Positioning	Existing coverage High data rate
☹	Battery Live Provisioning Network cost & dependencies	High data rate Emerging standards	Autonomy Total cost of ownership
	Bluetooth 4.0 · ZigBee · Wi Fi	LoRa	GSM · 3G+ / H+ · 4G

http://docplayer.net/14891525-Lorawan-what-is-it-a-technical-overview-of-lora-and-lorawan-technical-marketing-workgroup-1-0.html

sigfox

LoRa Alliance™

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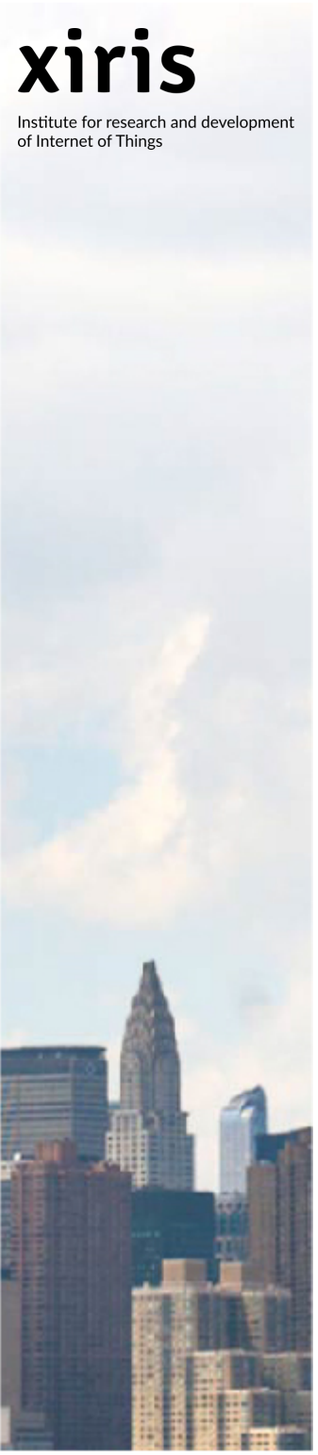

Theory : LoRa (without WAN)

- OSI Layer 1 (“radio”)
- Long range:
  - urban : up to 3 km
  - rural : up to 45 km
  - extremely long range: 702 km!
- from 0,3 to 50 kbps
- Free but regulated
- 1% tx time per hour
- low power (25mW)

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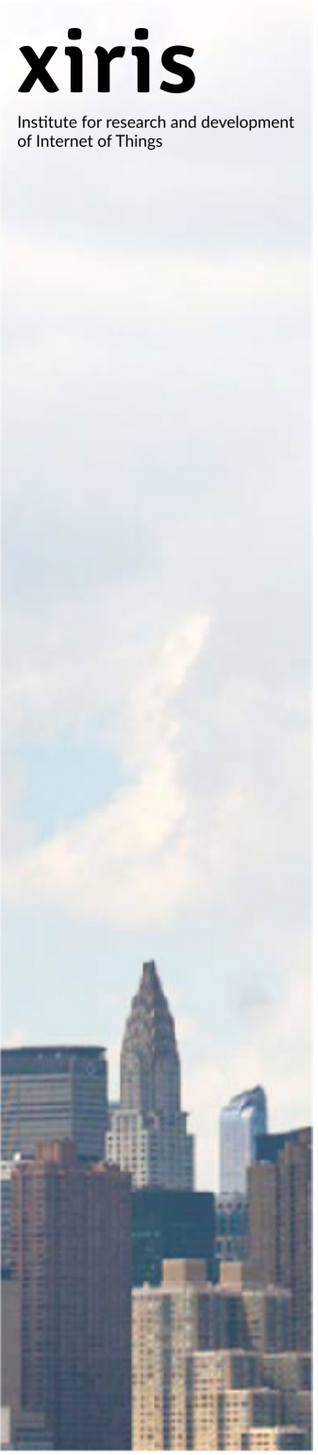

LoRa bps

DataRate	Modulation	SF	BW	bit/s
0	LoRa	12	125	250
1	LoRa	11	125	440
2	LoRa	10	125	980
3	LoRa	9	125	1′760
4	LoRa	8	125	3′125
5	LoRa	7	125	5′470
6	LoRa	7	250	11′000
7	FSK 50 kbps			50′000

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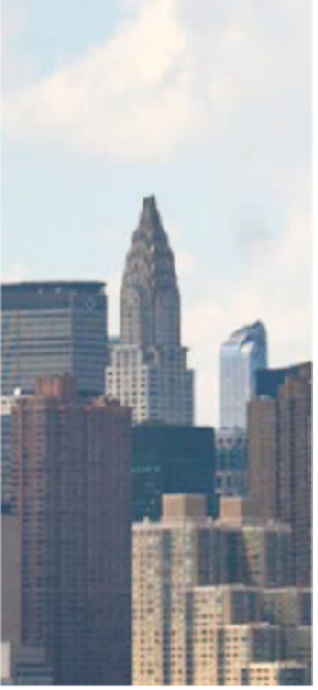
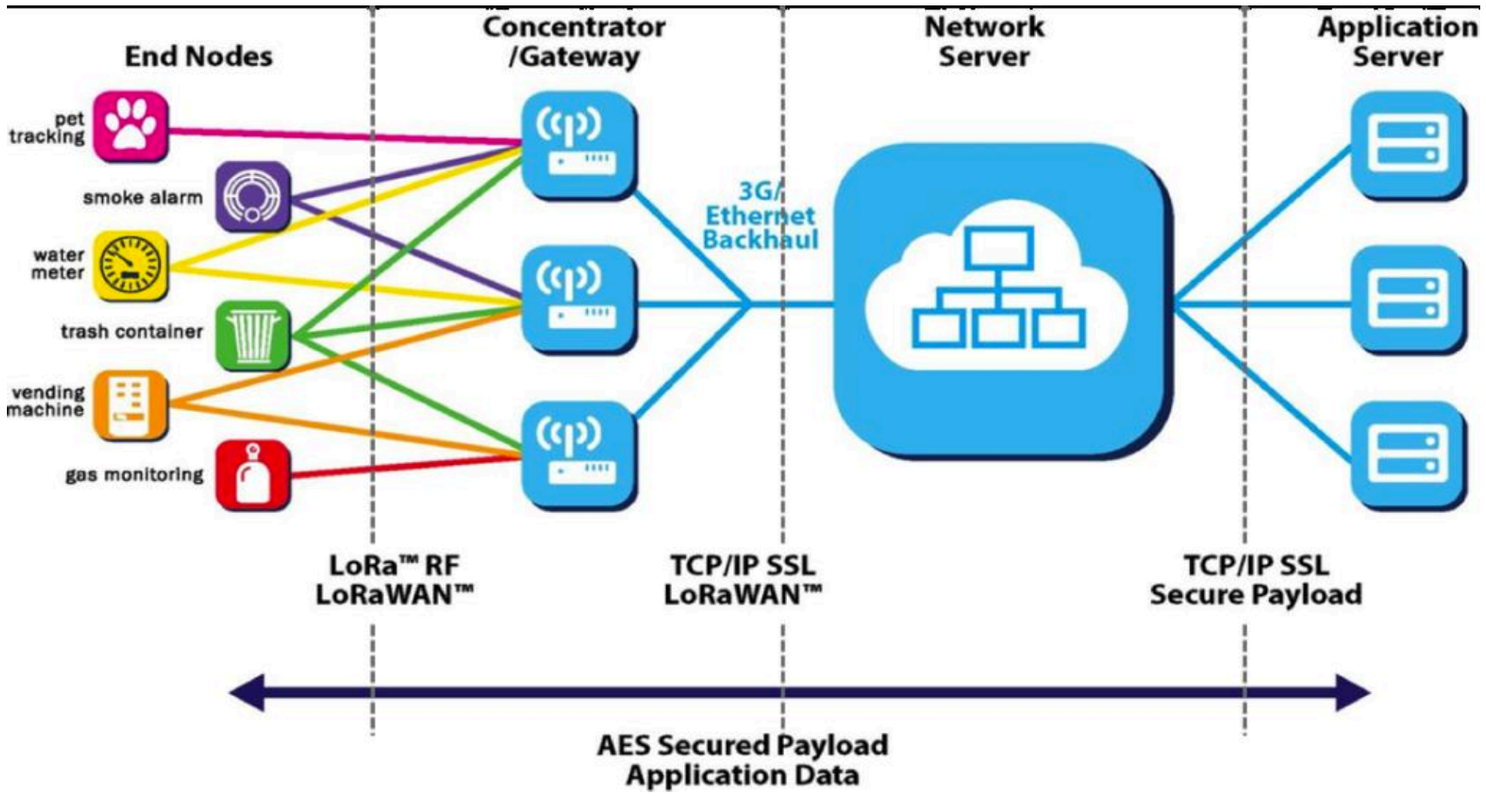


LoRa … **Lo**ng **Ra**nge
WAN … **W**ide **A**rea **N**etwork



http://embeddedexperience.blogspot.com.au/2015/08/lora-network-server.html

OSI layer 3

LoRa™ **Alliance** (Cisco, IBM, Semtech, **TTN**…)

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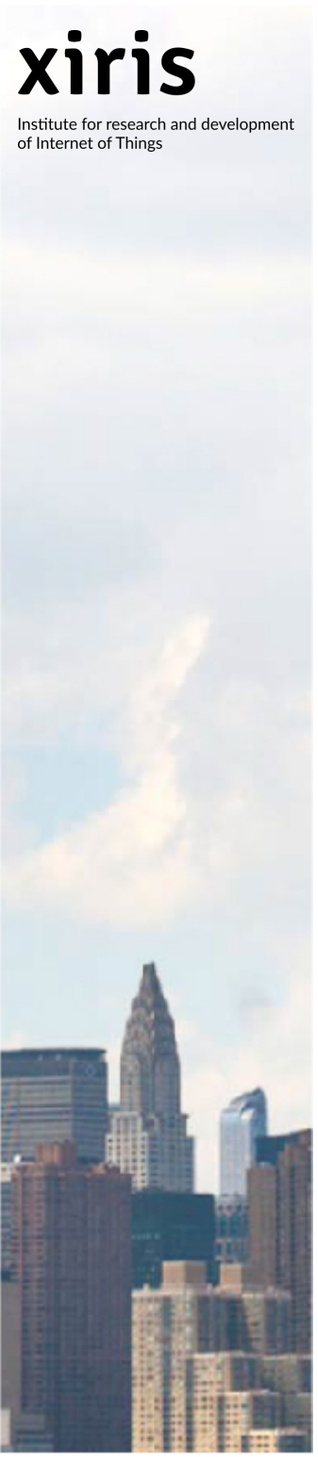

LoRaWAN terminology

- **End Device, Node, Mote** - an object with an embedded low-power communication device.
- **Gateway** - antennas that receive broadcasts from End Devices and send data back to End Devices.
- **Network Server** - servers that route messages from End Devices to the right Application, and back.
- **Application** - a piece of software, running on a server.
- **Uplink Message** - a message from a Device to an Application.
- **Downlink Message** - a message from an Application to a Device.

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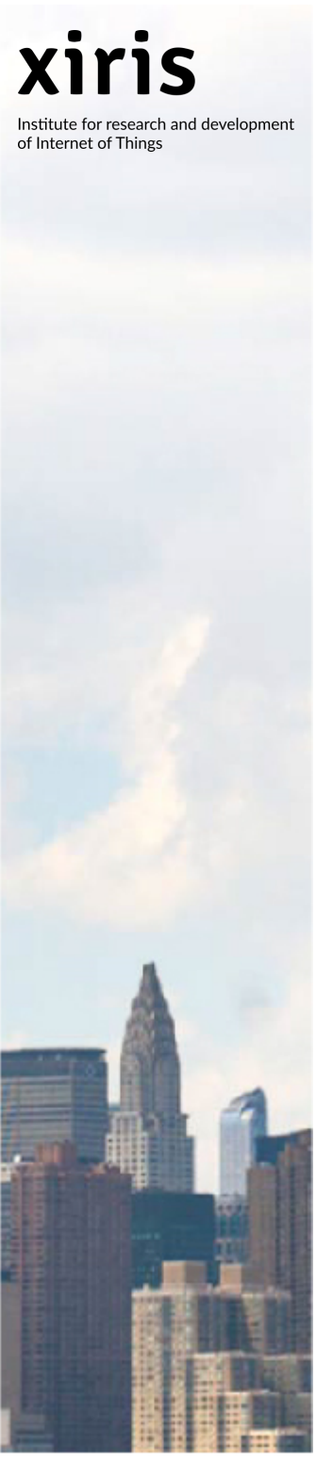

LoRaWAN

Two-way communication:

- **measurements** from node to application (**uplink**)
- **commands** form application to node (**downlink**)

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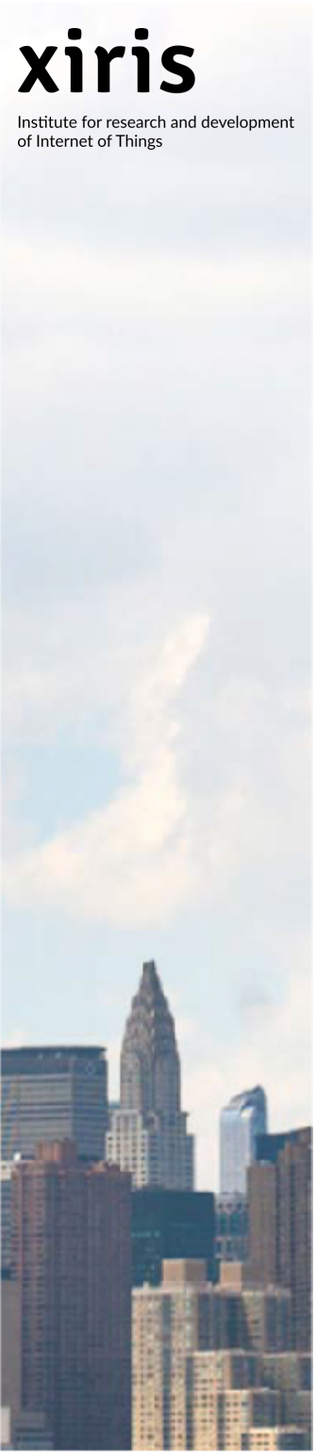
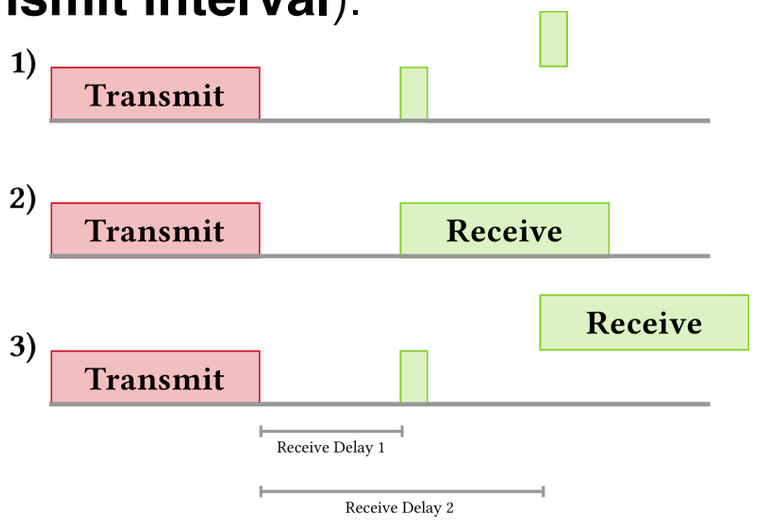


LoRaWAN Classes (latency styles)

Class A : Uplink messages (from the device to the server) can be sent at any time (**defined by transmit interval**).



Class B : extends Class A by adding **scheduled receive windows** for downlink messages from the server.

Class C : extends Class A by keeping the **receive windows open** unless they are transmitting.

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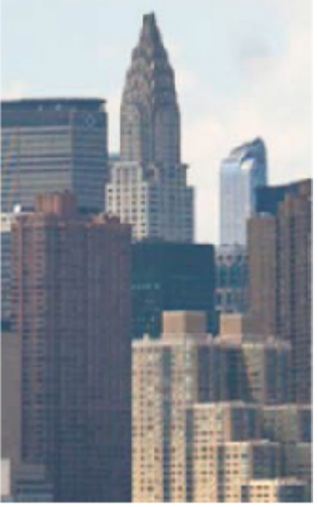
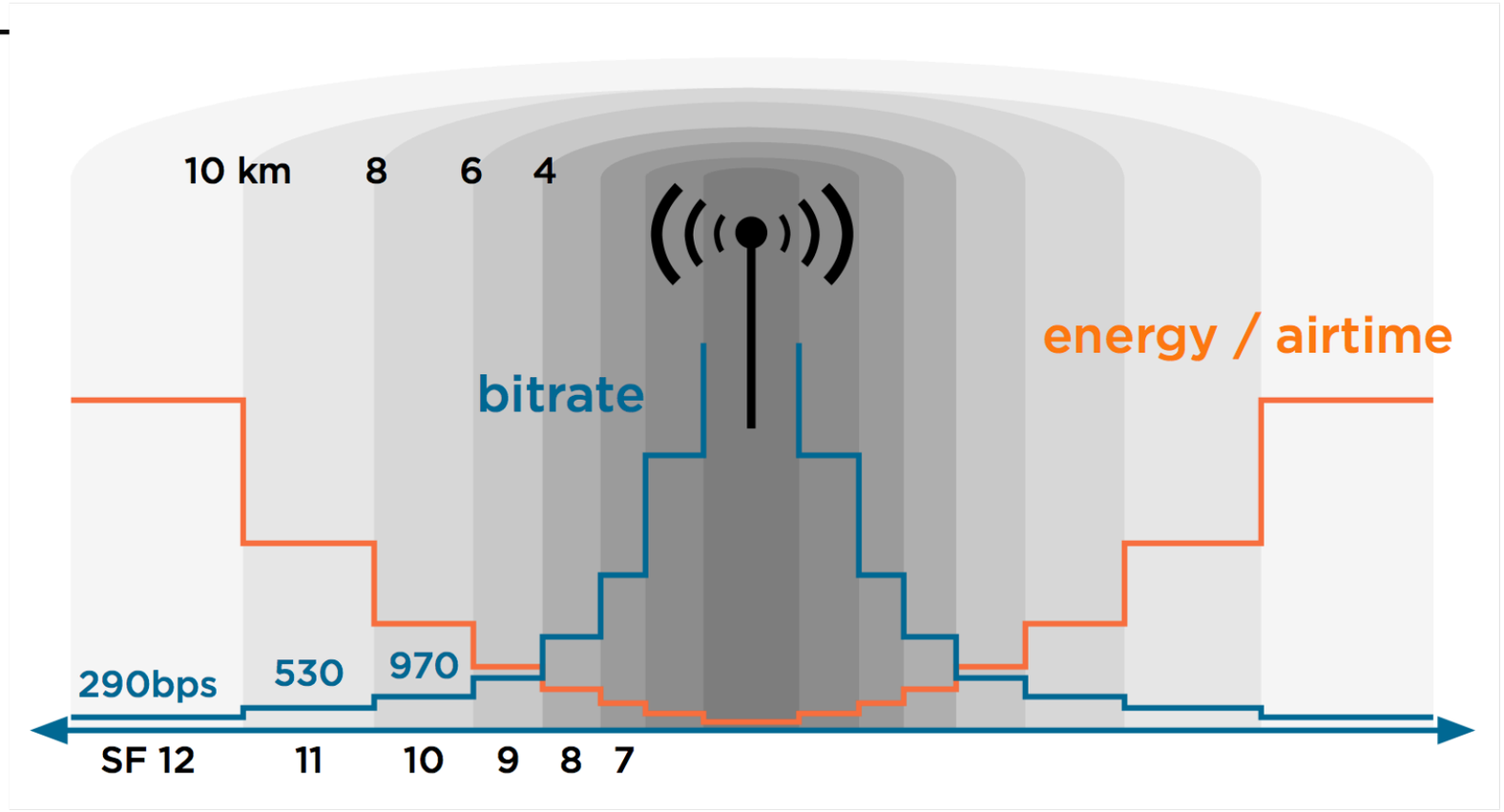


LoRa and power efficiency



fixed nodes : Adaptive Data Rate (ADR flag)

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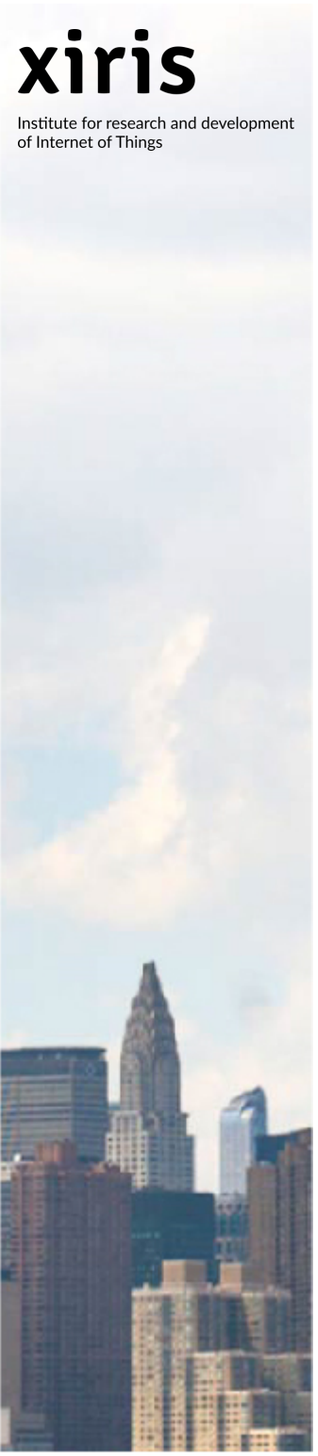

Addressing

- Devices and applications have a 64 bit unique identifier (**DevEUI** and **AppEUI**).

- When a device joins the network, it receives a dynamic (non-unique) 32-bit address (**DevAddr**).

7 bit prefix of DevAddr are LoRa Alliance
(https://www.thethingsnetwork.org/docs/lorawan/address-space.html#prefix-assignments)

Device registration modes:

- Over-the-Air Activation (OTAA)

- Activation by Personalization (ABP)

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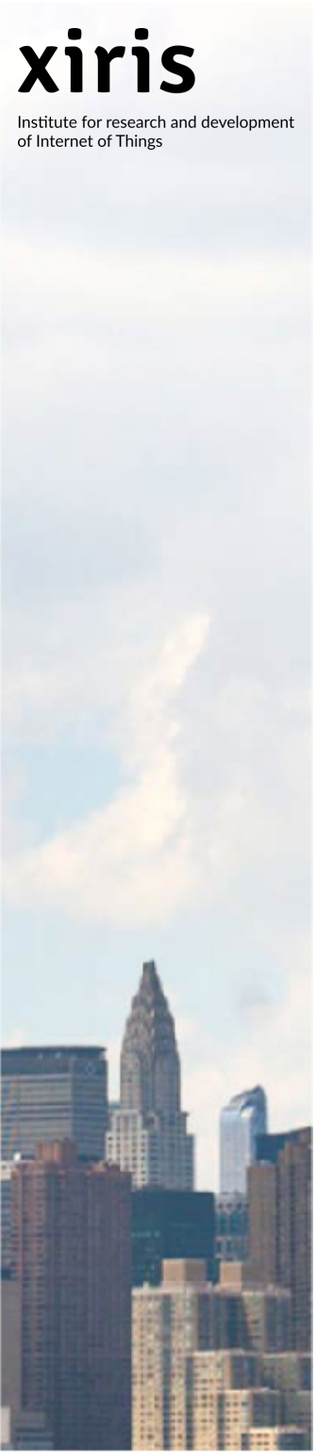
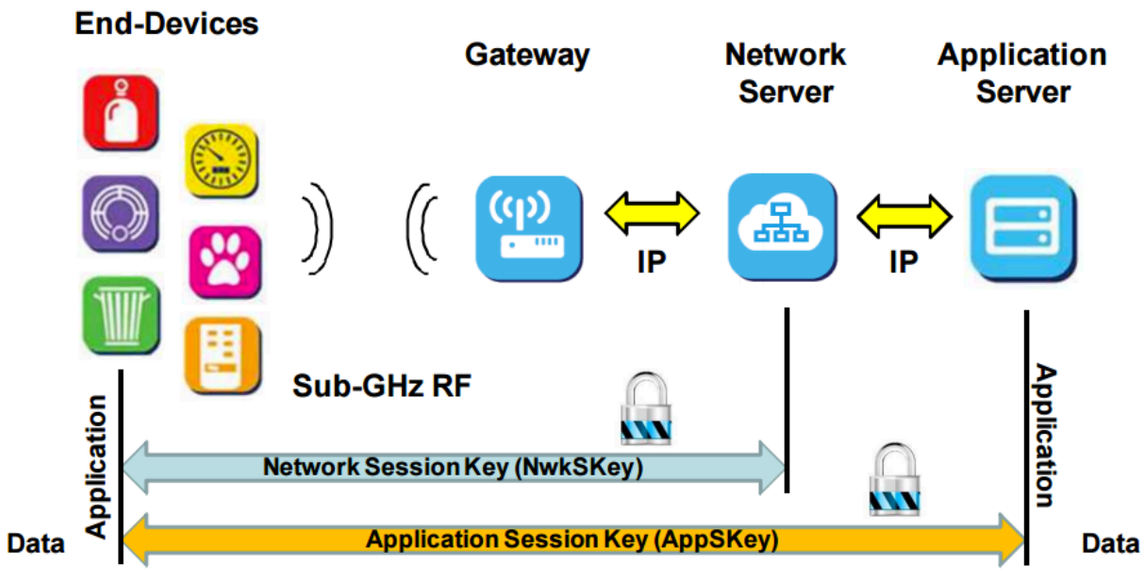


Security !



http://security.stackexchange.com/questions/126987/security-of-an-iot-network-using-aes-lorawan

When a device joins the network (this is called a join or activation), an application session key **AppSKey** and a network session key **NwkSKey** are generated.

Frame Counters prevent replay attacks where an attacker re-transmits a previously recorded message.

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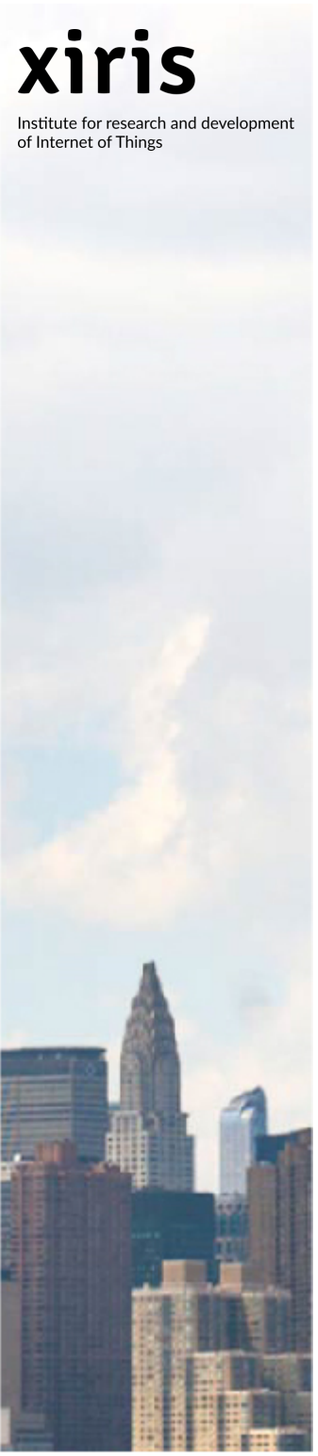

IoT over LoRaWAN: What we need?

- **a problem**
- **devices** (with sensors, actuators …)
- LoRaWAN **network** (account or our infrastructure)
- some programmer skills (not necessary)

… a **community**

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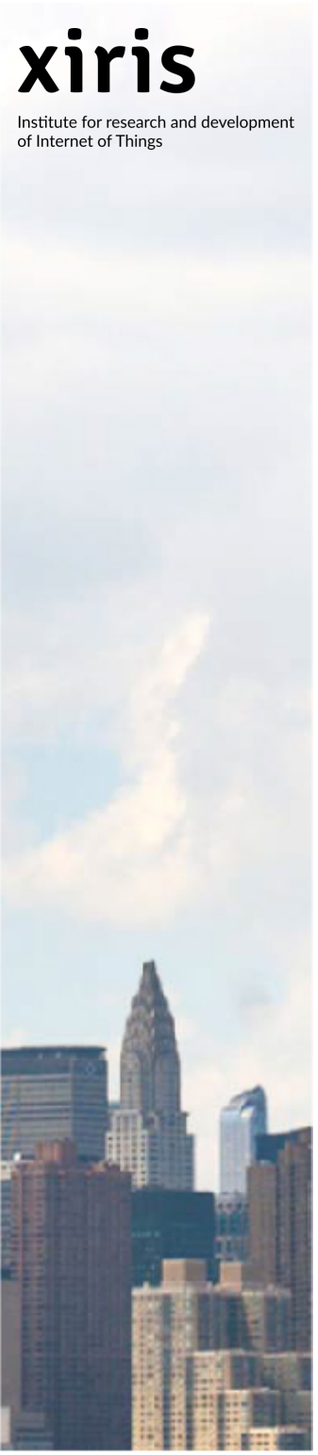

THE THINGS NETWORK

BUILDING A FULLY DISTRIBUTED INTERNET OF THINGS DATA INFRASTRUCTURE.

You are the network.

Our network is built by you - the people.

You can contribute by placing a gateway and expand our network.

The more gateways are placed, the larger the coverage.

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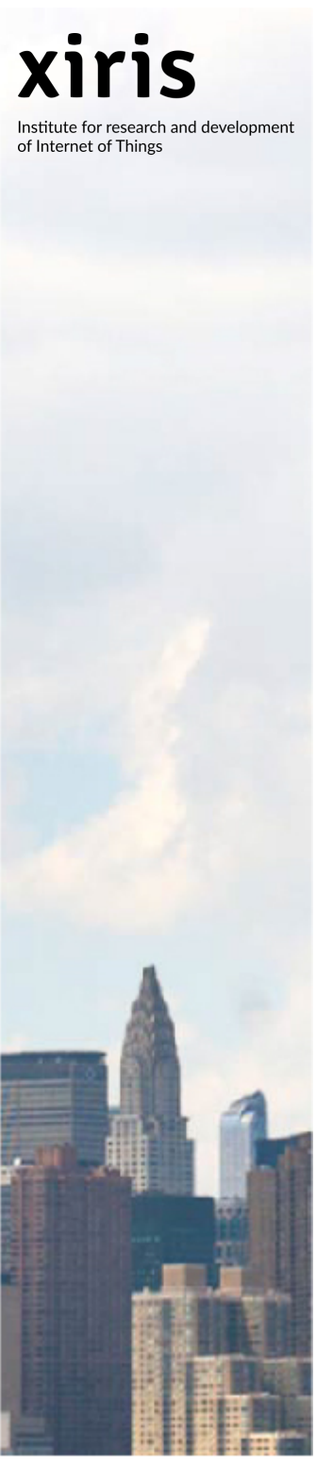
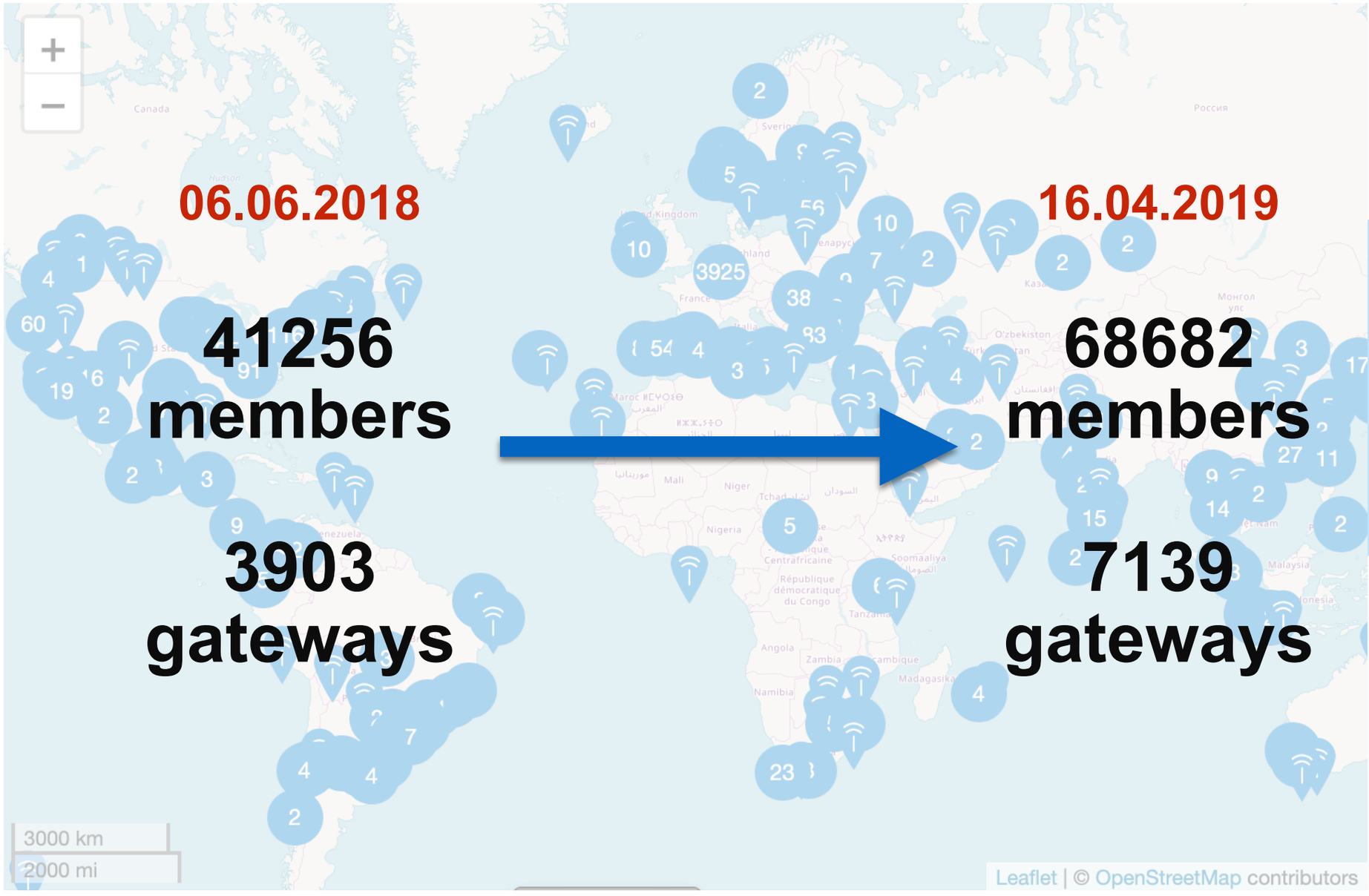


The Things Network



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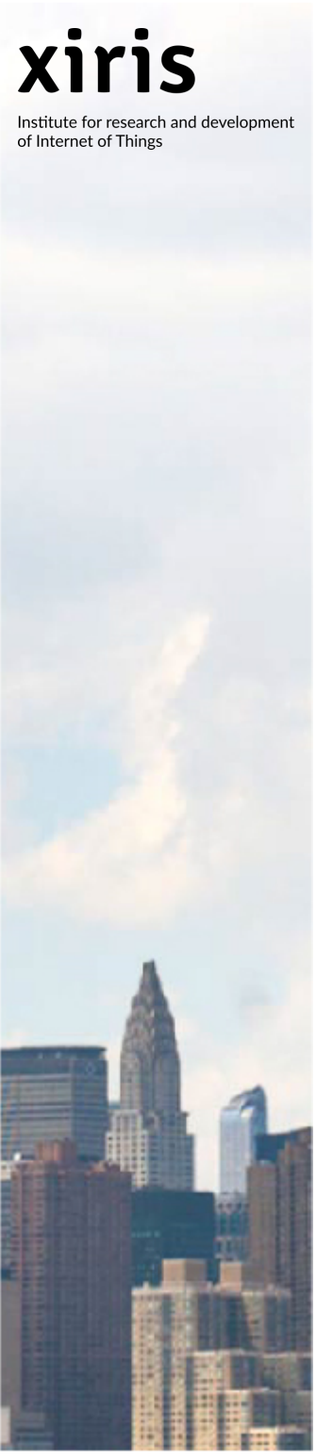

Community!

THE THINGS NETWORK NOVA GORICA

Complete the five steps to become an official community of The Things Network.

9/8
Members
Get 8 members on board
Invite people

3/2
Gateways
Connect 2 gateways
Place gateway

2/2
Exposure
Let your presence be known
Go to forum post

1/1
Communication channel
Create a channel for internal communication
Go to channel

Celebrate !
Official release
Unleash Nova Gorica and become an official community of The Things Network
Unleash !

Slovenia

Ajdovscina

Maribor

Nova Gorica ✓

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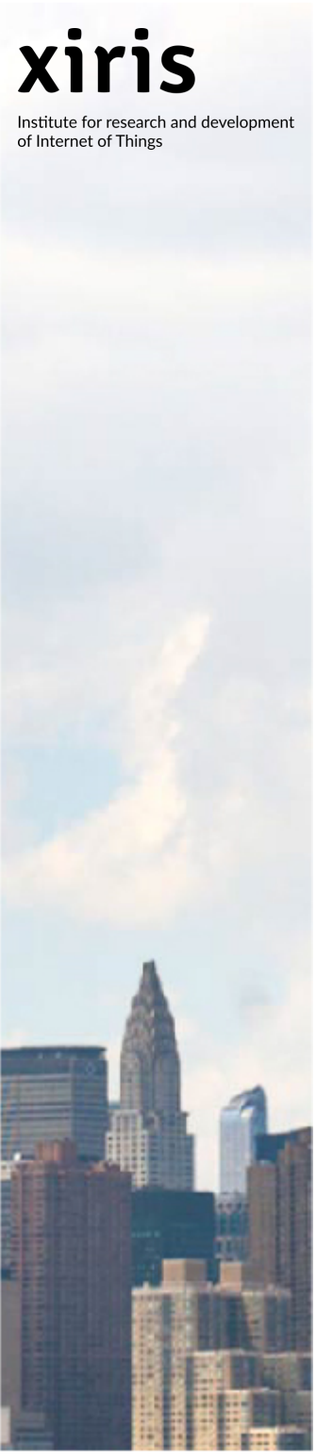

BoF

Gateways

Devices

Use cases

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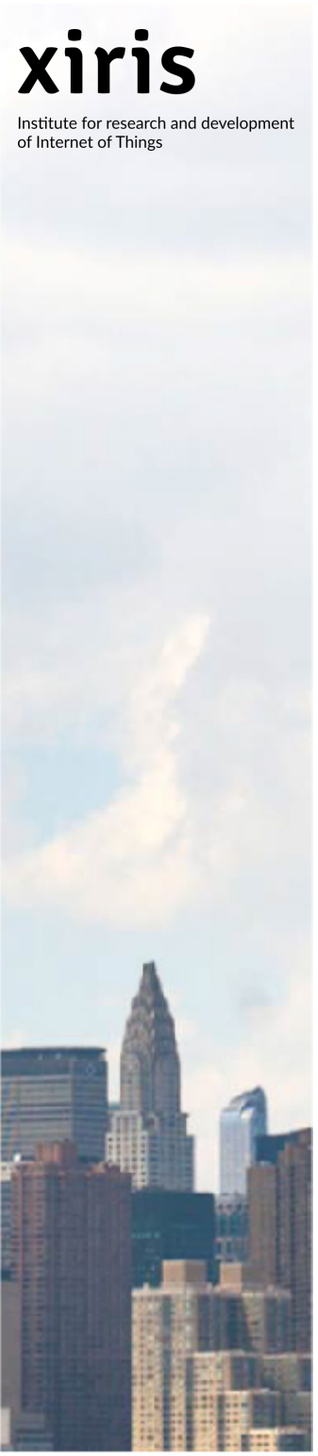

info@xiris.si