



sigfox

Protocols for the **connected** objects

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A large blue diagonal graphic that starts from the top right corner and extends towards the bottom left, creating a triangular shape on the right side of the slide.

1.

Introduction

1. Introduction

2009

Beginning of a create story

16,418,500€

Turnover made in 2015

5 million km²

The total superficy covered by Sigfox network

1. Introduction



Low energy
consumption



Low Cost

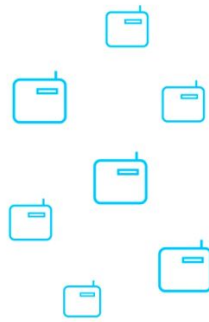


Complementary
technology

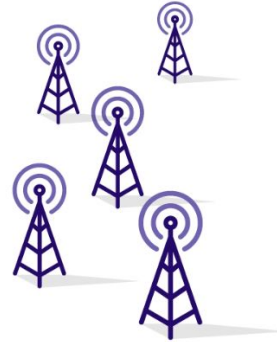
IoT SERVICES
PROVIDER

1. Introduction

Sigfox network architecture



Objects



Sigfox stations



Sigfox CLOUD™



Customer IT

ARCHITECTURE OVERVIEW

2.

Physical layer

2.1

Frequency

2. Physical layer

868 - 869 MHz

In Europe



902 - 928 MHz

In the rest of the world

2.2

Bandwidth and modulation

2. Physical layer

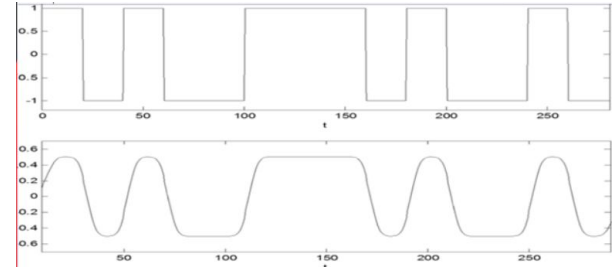
Uplink messages

DBPSK modulation

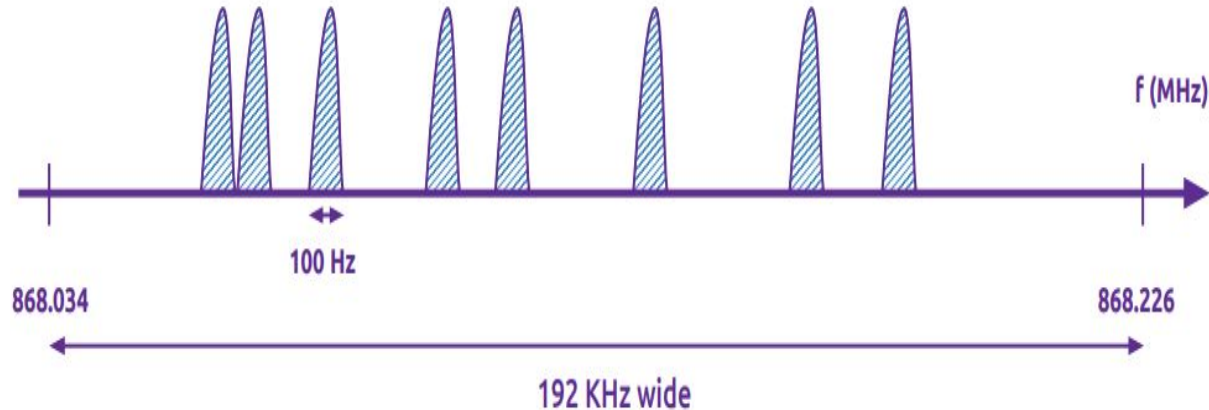


Downlink messages

GFSK modulation



SIGFOX
BANDWIDTH

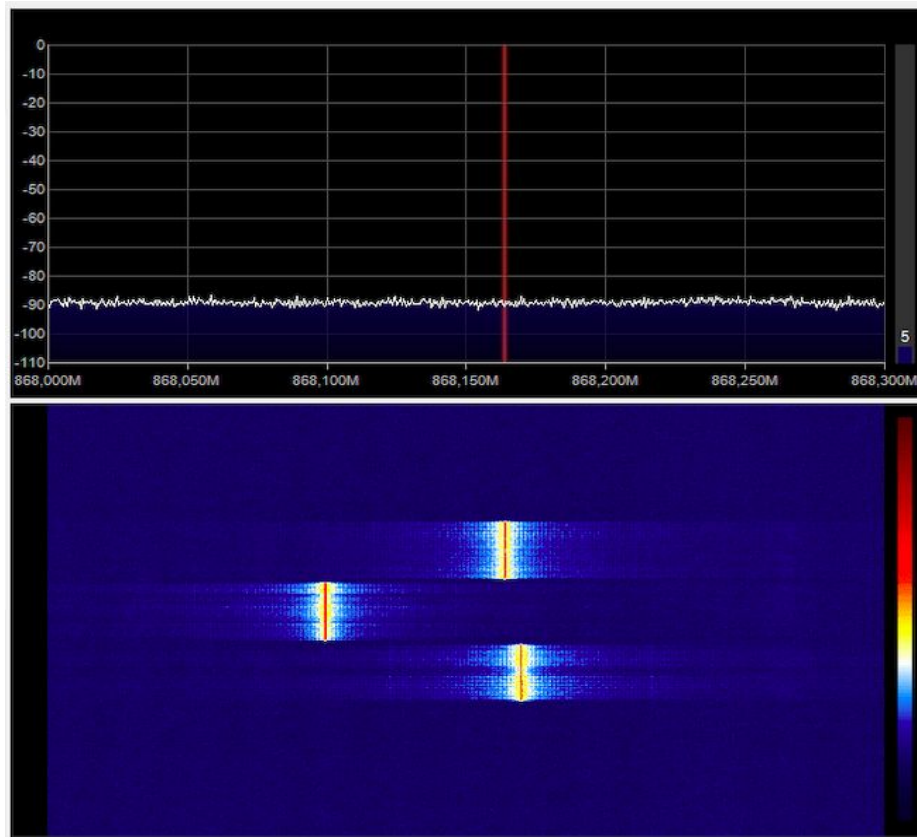


2.3

Time/Frequency hopping

2. Physical layer

Each message sent **3 times** on **3 different frequencies** and **delayed in time**.



SIGFOX
Time/Frequency
hopping

A large green diagonal shape that starts from the top right and extends towards the bottom left, covering the right half of the slide.

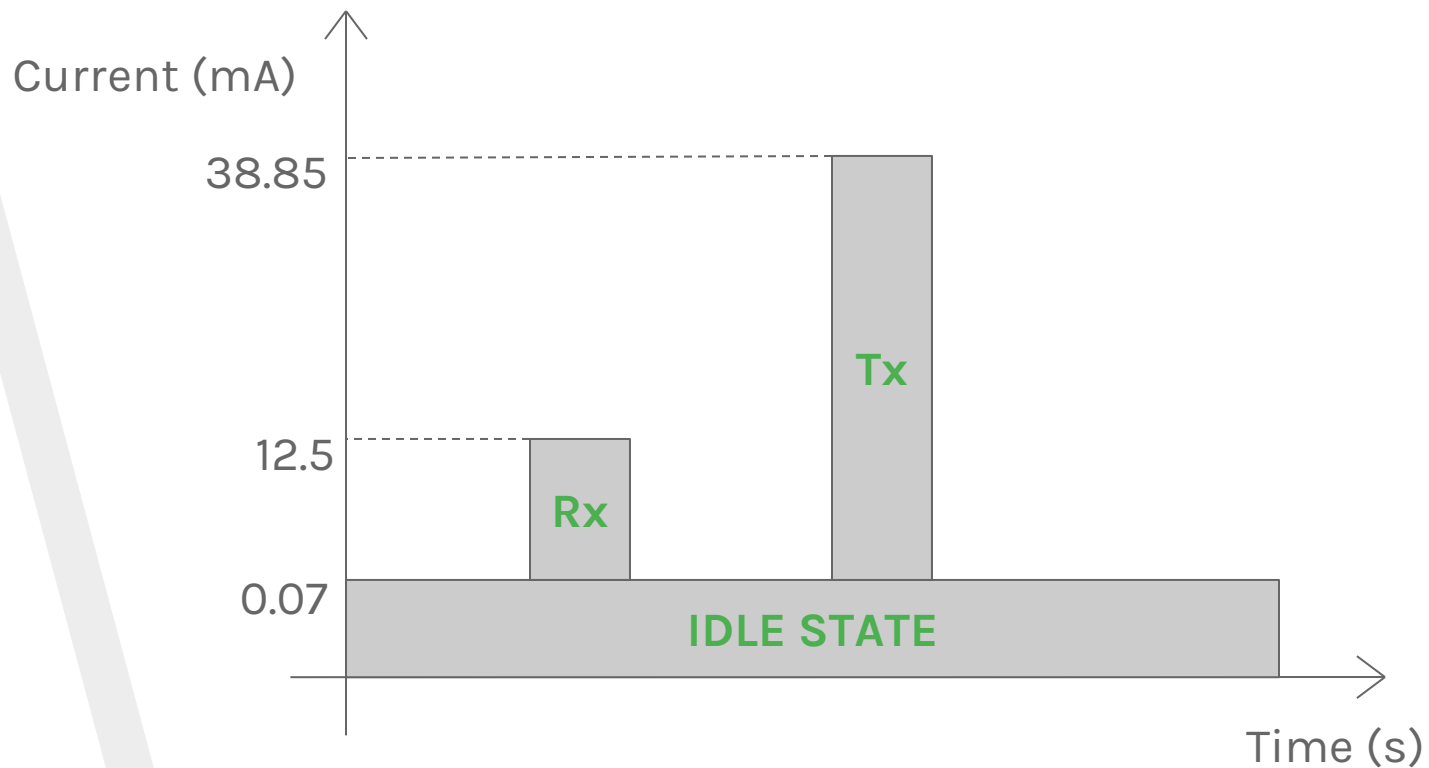
3.

Power
consumption

3.1

Devices consumption

3. Power Consumption



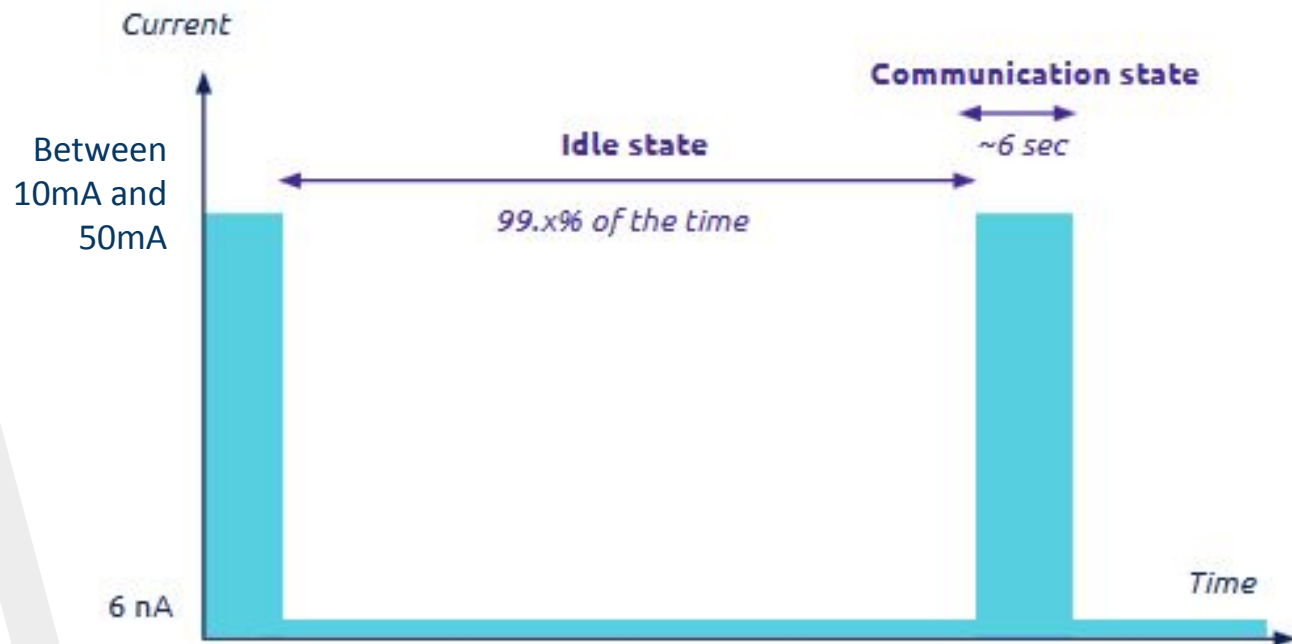
DEVICES
CONSUMPTION

3. Power Consumption

Idle State	Reception	Transmission
231 μ W	41.25 mW	128.5 mW

DEVICES
CONSUMPTION

3. Power Consumption



DEVICES
CONSUMPTION

3. Power Consumption

Min Power	Max Power	Max Idle State Power
33 mW	165 mW	19.8 mW

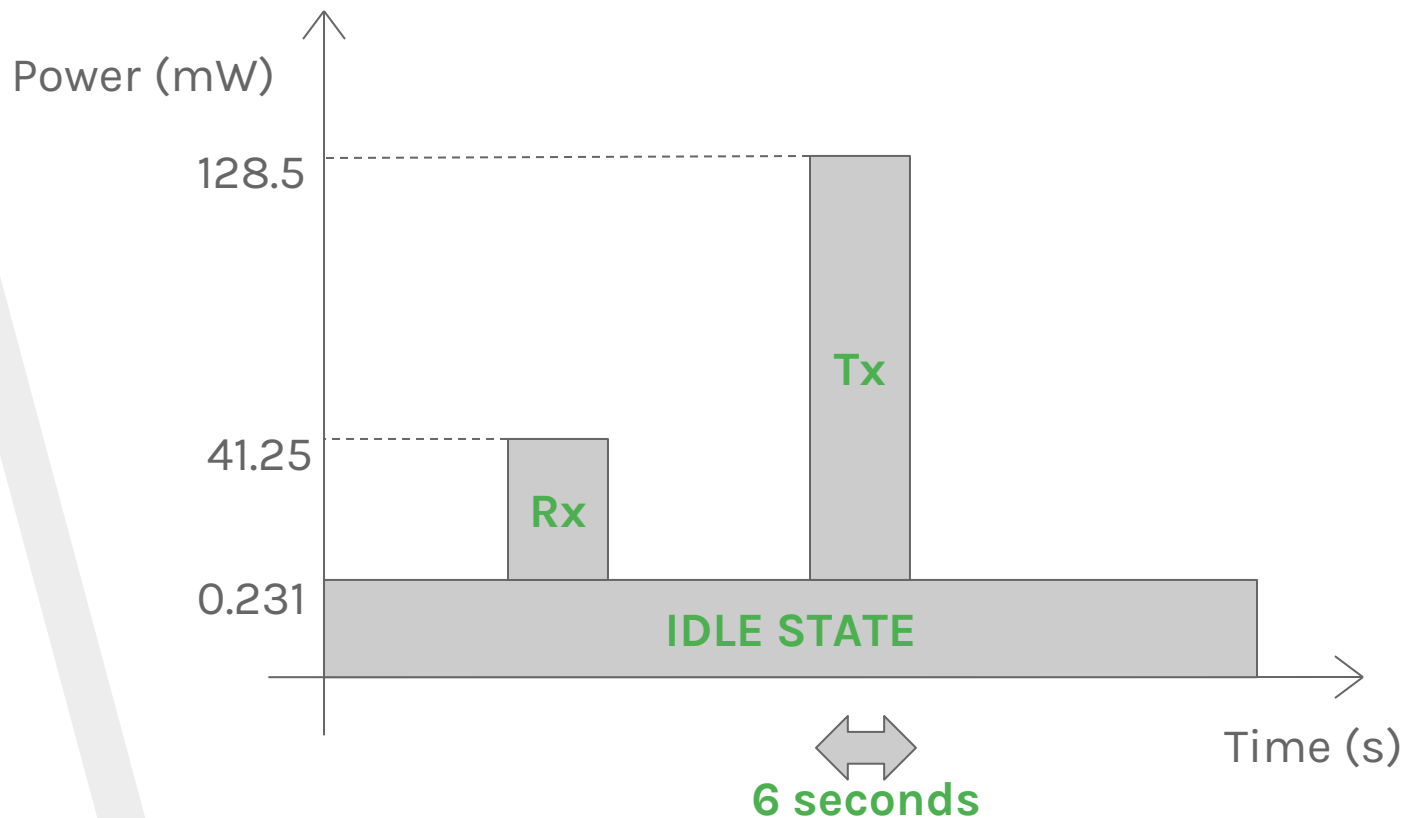
Considering a device supplied with 3.3 V

DEVICES
CONSUMPTION

3.2

Energy per bit

3. Power Consumption



ENERGY
PER BIT

12 bytes or 96 bits



$E = 8 \text{ mJ/bit}$

3. Power Consumption

6 Seconds

26 Bytes DF



33mW

$$E_{\min} = 198 \text{ mJ}$$

$$E_{\min}/\text{bit} = 0.95 \text{ mJ/bit}$$

6 Seconds

14 Bytes DF



165mW

$$E_{\max} = 990 \text{ mJ}$$

$$E_{\max}/\text{bit} = 8.84 \text{ mJ/bit}$$

ENERGY
PER BIT

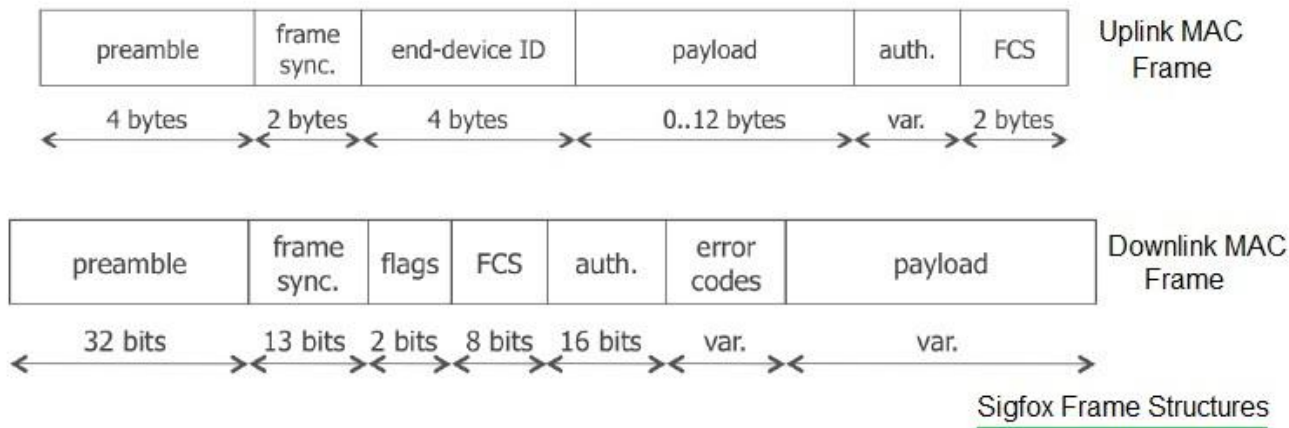


4.

MAC layer

4. MAC layer

- ▶ **RFTDMA** (Random Frequency and Time Division Multiple Access)
- ▶ **MAX 140 messages sent, 4 received** per day



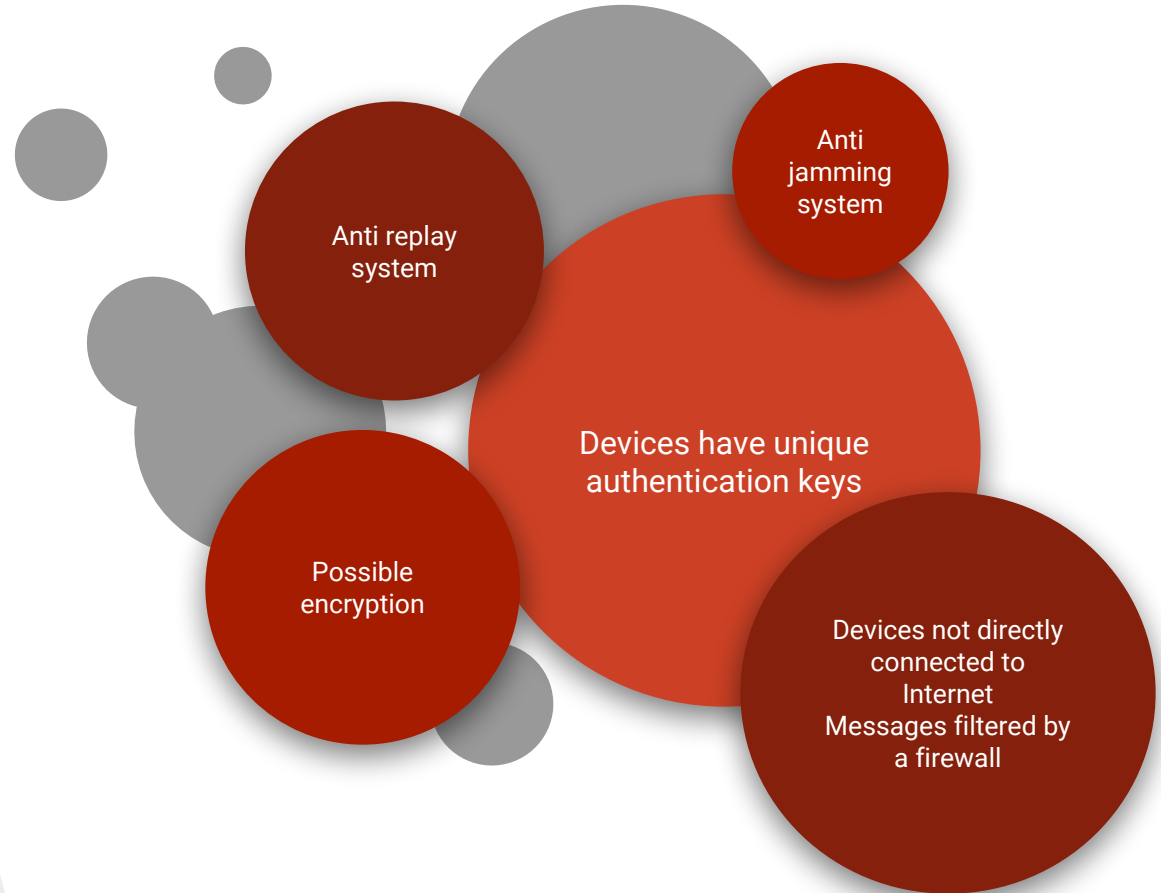
A thick, solid red diagonal stripe runs from the top-left towards the bottom-right, dividing the slide into a white upper-left section and a red lower-right section.

5.

Security

5. Security

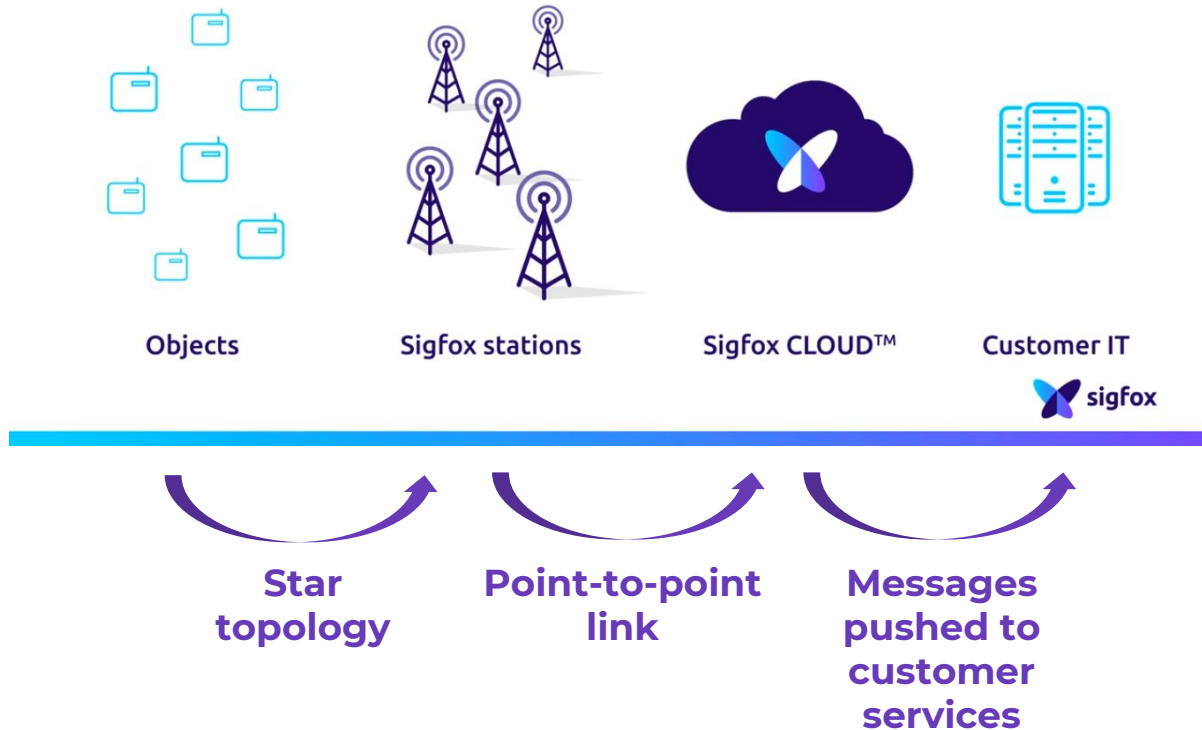
SECURITY FEATURES



6.

Routing and IP

6. Routing and IP



7.

Mobility

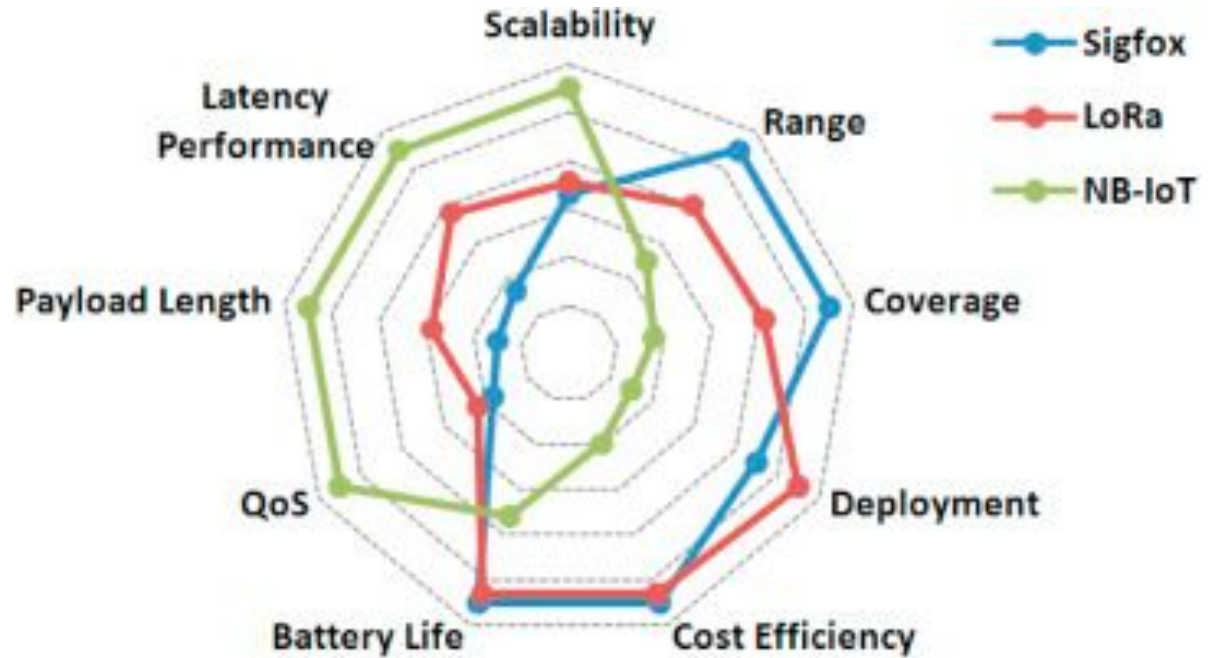
7. Mobility

- ▶ Unreliable communication at pedestrian speed
- ▶ **Not adapted**

8.

Conclusion

8. Conclusion



Conclusion

Thank you!



Any questions?