SIGFOX

One network A billion dreams

GET STARTED ON SIGFOX

SIGFOX

AGENDA

VALUE PROPOSITION

RADIO TECHNOLOGY

NETWORK ARCHITECTURE

SECURITY

BUILD A DEVICE

CONNECT TO SIGFOX CLOUD

SIGFOX

THE NEXT MAJOR TECHNOLOGICAL REVOLUTION

BIGGER THAN SMARTPHONES

CONNECTING EVERYTHING SO BATTERY POWERED

USE CASES ARE SENSING AND TRACKING SO SMALL MESSAGES

NEED FOR LOW COST, LOW POWER WIRELESS PUBLIC NETWORK

Google

$ 3,2 BILLION

"GOOGLE BUYS NEST FOR $ 3,2 BILLION TO BUILD A STRONG TEAM FOR THE INTERNET OF THINGS."

$ 19 TRILLION

"INTERNET OF THINGS IS A $ 19 TRILLION OPPORTUNITY."

CISCO

STRATEGY FOR IOT

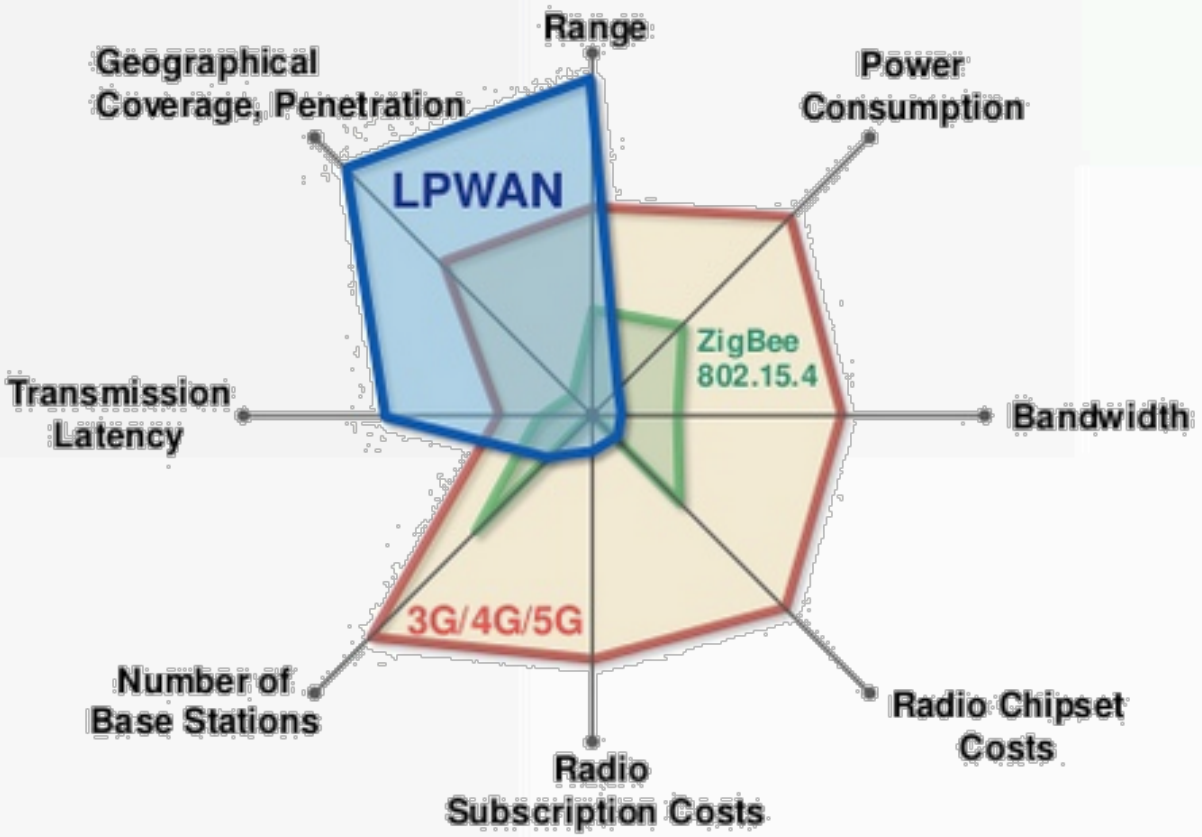
REDUCE
CONSUMPTION & COSTS

SIGFOX

SIGFOX (LPWAN) COMPARED

SIGFOX FILLS A GAP IN THE MARKET

Long range, low bandwidth, low power



SIGFOX

IN A NUTSHELL

VALUE PROPOSITION CHECKLIST

- ✓ Public network professionally managed
- ✓ Out of the box connectivity - no pairing with hub
- ✓ Low power connectivity - battery powered device
- ✓ Low upfront cost – hardware 10 x cheaper than cellular
- ✓ Low subscription cost
- ✓ Jamming very complex
- ✓ Sensing, monitoring and tracking use cases

- X Private network
- X Real-time remote control use cases (<1s)
- X Frequent software update OTA
- X Low latency (<1s)

SIGFOX

SAMPLE B2B CUSTOMERS

Smart Cities

Public parking monitoring

Asset management

Billboard monitoring
Asset tracking
Waste management

Utilities

Water metering

Healthcare

Fall detection
Distress buttons
Medicine dispensers
Home care management

SIGFOX

SAMPLE B2C CUSTOMERS

Pet tracking

Pet health monitoring

Pet location services

Security

Remote alarm transmissions

Bike & car security

Bicycle recovery services

Car recovery services

Climate monitoring

Indoor air monitoring

Climate monitoring

SIGFOX

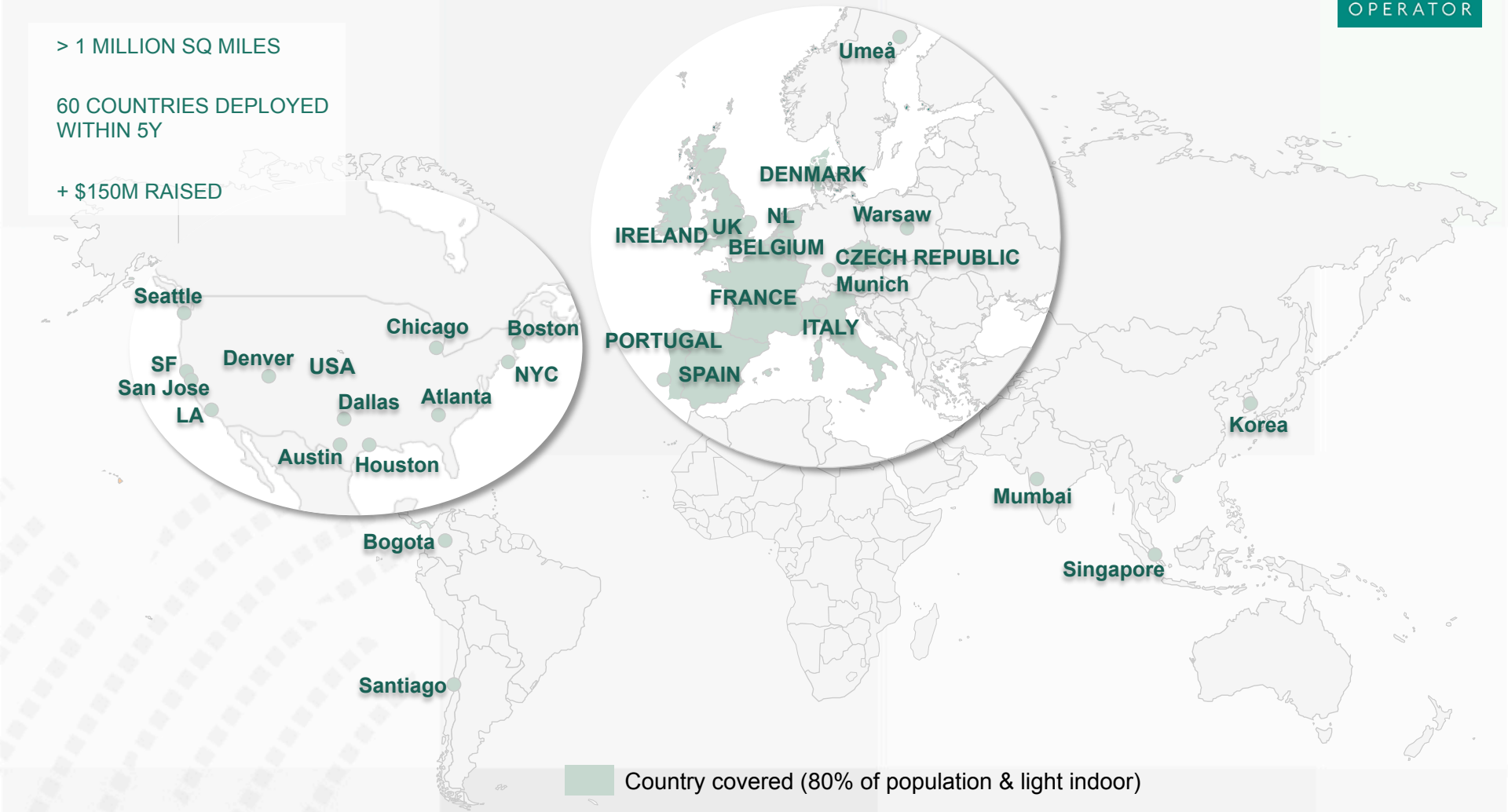
SIGFOX OPERATOR

COVERAGE AT Q1 2016

> 1 MILLION SQ MILES

60 COUNTRIES DEPLOYED WITHIN 5Y

+ $150M RAISED



SIGFOX

AGENDA

VALUE PROPOSITION

RADIO TECHNOLOGY

NETWORK ARCHITECTURE

SECURITY

BUILD A DEVICE

CONNECT TO SIGFOX CLOUD

SIGFOX

PHILOSOPHY OF SIGFOX NETWORK

THE TECHNOLOGY TO MEET THE IOT STRATEGY:

- LOWEST TCO
- OUT OF THE BOX CONNECTIVITY
- LOWEST ENERGY
- GLOBAL REACH

FARTHEST SATELLITE FROM EARTH USES UNB BPSK

Lowest Energy

Lowest TCO

Global reach

Out of the box connectivity

Small messages
14 bytes of header + 12 bytes max of payload

Use existing chipsets

No pairing
Public network

Bidir is device initiated
Sleep time maximized

Unlicensed spectrum
ISM band: ETSI – 868Mhz / FCC – 902Mhz

No synchronization with base stations
Sleep time maximized – Simple processing

Strong resistance to interference

Low radiated power
25mW @ 100bps ETSI
150mW @ 600bps FCC

Long range to reduce number of base stations
Large link budget = 160dB

High capacity network for scalability

Ultra Narrow Band BPSK is the way to go

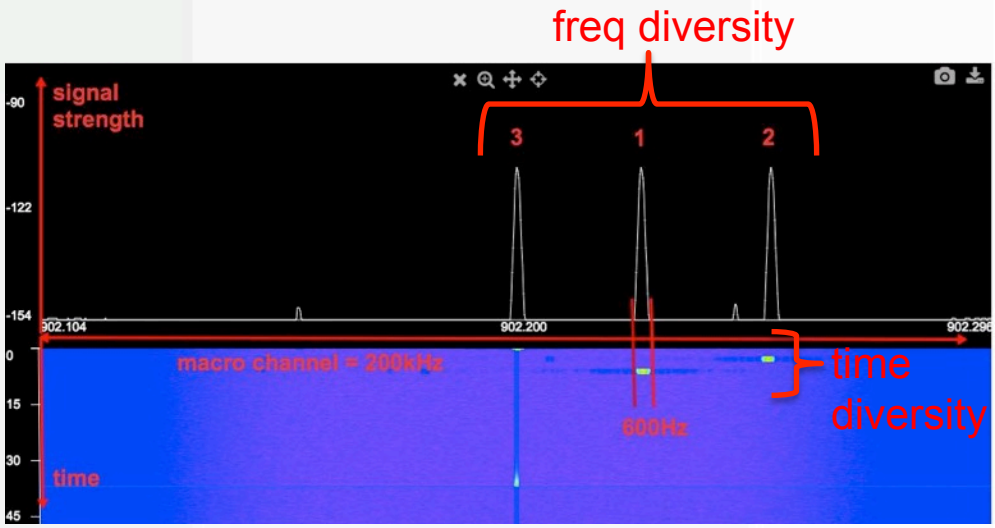
GUARANTEE OF DELIVERY

DIVERSITY REPLACES ACKNOWLEDGEMENT

DIVERSITY

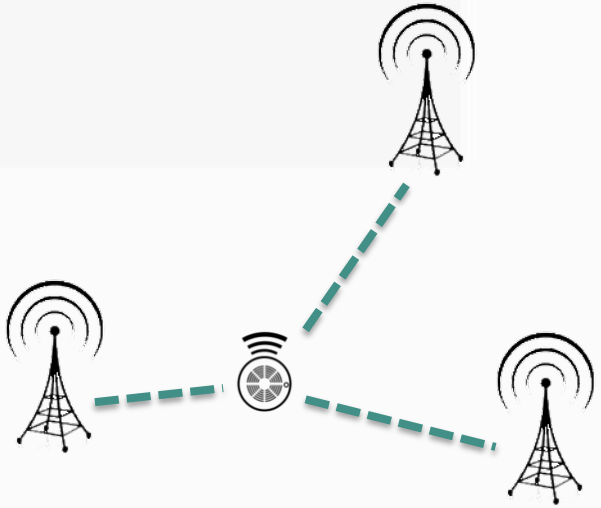
Each message sent over 3 radio frames

- **Time diversity**
- **Frequency diversity**



COLLABORATIVE NETWORK

Space diversity



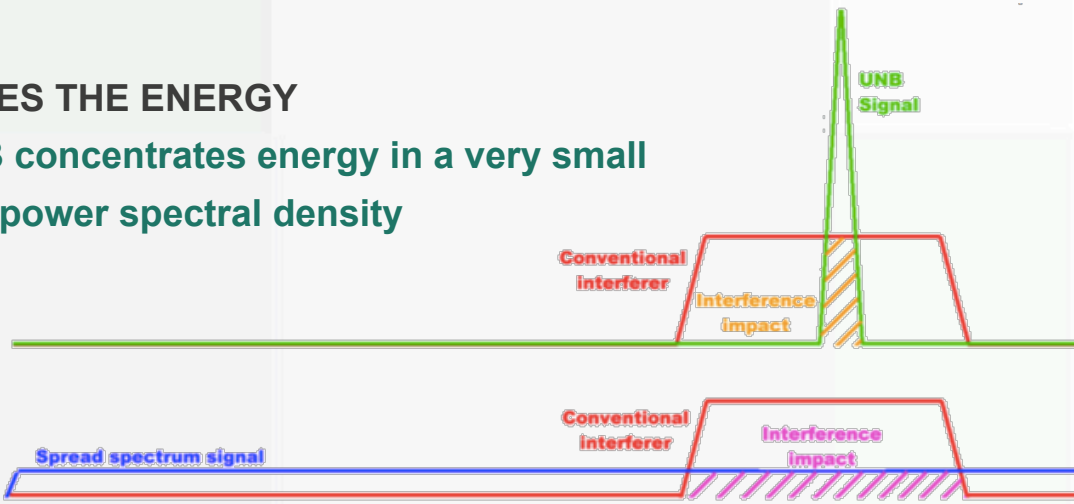
SIGFOX cloud will receive the 3 radio frames 9 times

UNB RESISTANCE TO INTERFERENCE

UNB BEST TECHNOLOGY AGAINST INTERFERER

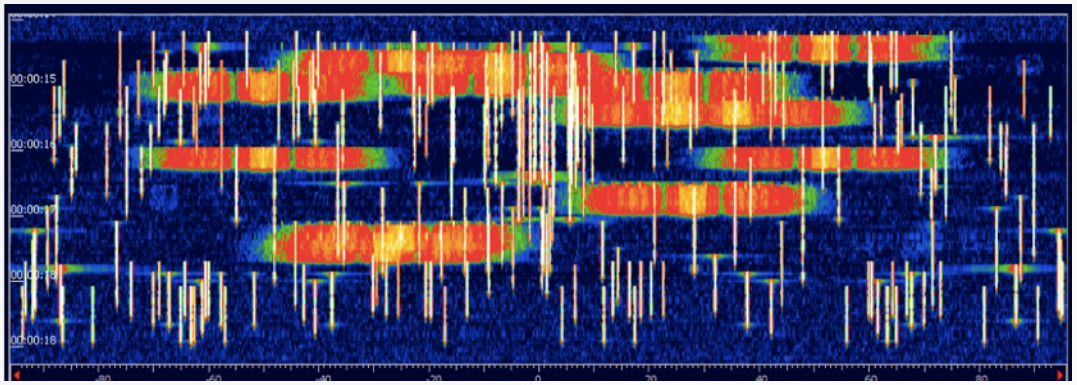
UNB CONCENTRATES THE ENERGY

At equal power UNB concentrates energy in a very small bandwidth = higher power spectral density



UNB REDUCES CHANCES OF COLLISION WITH INTERFERER

Small bandwidth reduces probability of collision with high power interferer



SIGFOX + conventional signals at same spectrum and power → no loss

COLLABORATIVE NETWORK MITIGATES INTERFERER IMPACT

Having 3 base stations at 3 different locations reduces the impact of interferers in the message delivery

SIGFOX

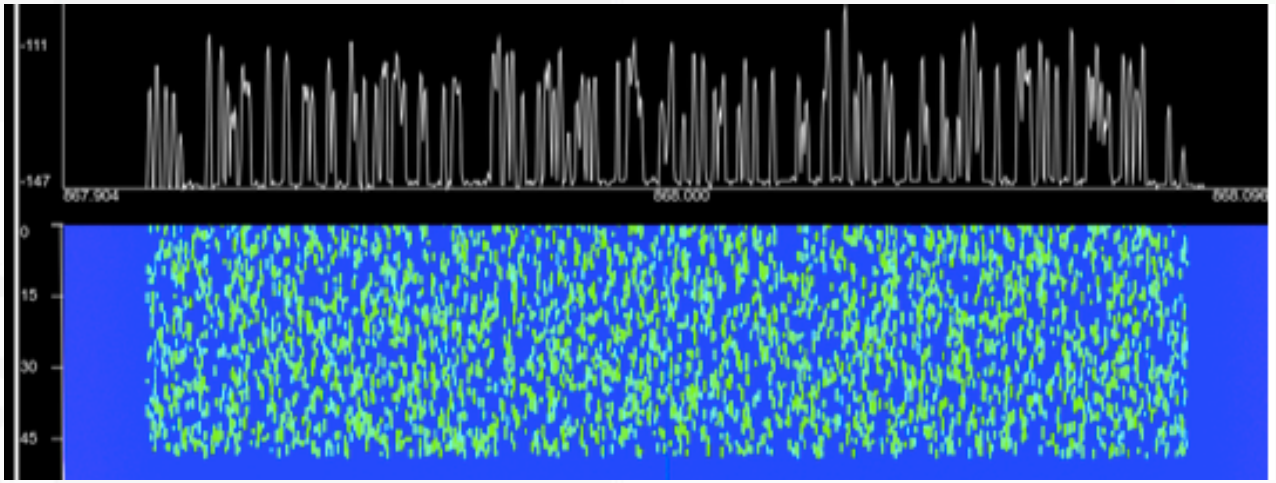
HIGH CAPACITY

ULTRA NARROW BAND ALLOWS HIGH CAPACITY

@ 10message/day/device = 1.8M devices per base station

CAPACITY MEASURED ON THE FIELD

UNB IS BEST SUITED FOR HIGH CAPACITY



200 simultaneous messages within a 200kHz channel

Future proof : 2M messages per base station
…and after : cell size reduction, add another 200kHz channel

UNB VS SPREAD SPECTRUM (SS)

BETTER RESISTANCE TO INTERFERER

NO COLLABORATIVE NETWORK

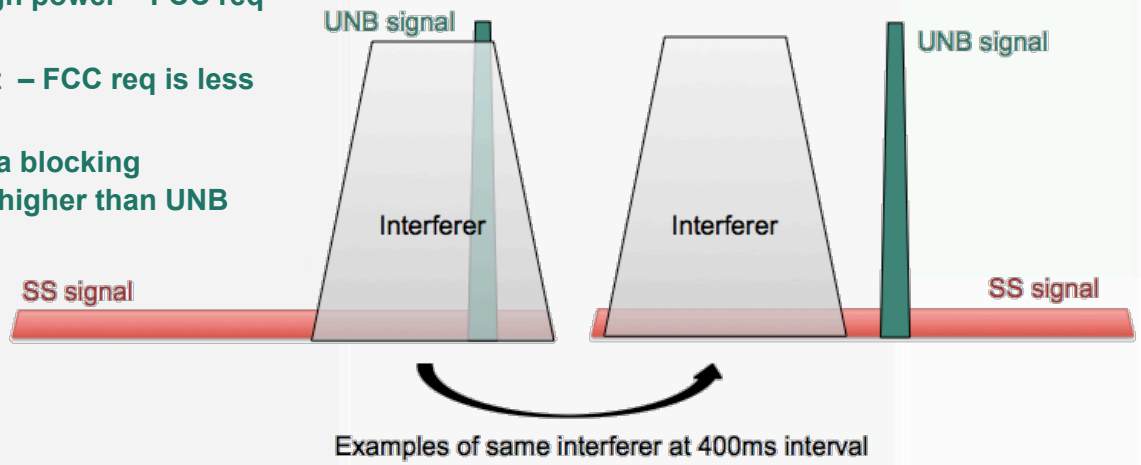
HIGHER CAPACITY

UNB BETTER RESISTANCE TO INTERFERER

Interferers in ISM band :

- **Can be very high power – FCC req is P<4W**
- **Are hoping fast – FCC req is less than 400ms**

Chances of having a blocking interferer in SS are higher than UNB



SS CANNOT BENEFIT OF THE COLLABORATIVE NETWORK

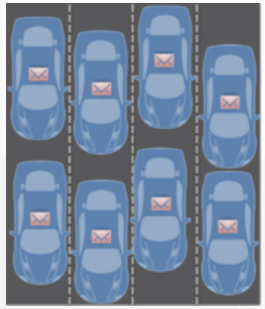
SS has to be a point to point communication

Different devices using the same spreading code with different base stations will interfere each other

UNB HAS HIGHER CAPACITY

UNB vs SS

For same bandwidth more capacity



SIGFOX

AGENDA

VALUE PROPOSITION

RADIO TECHNOLOGY

NETWORK ARCHITECTURE

SECURITY

BUILD A DEVICE

CONNECT TO SIGFOX CLOUD

SIGFOX

UPLINK MESSAGE

NO NETWORK SYNCHRONIZATION

MOST SIMPLE DESIGN

PROTOCOL

Each uplink message is self contained – less than 26 bytes

preamble	frame sync	device ID	payload container 0 - 4 - 8 – 12 bytes	authentication hash	CRC

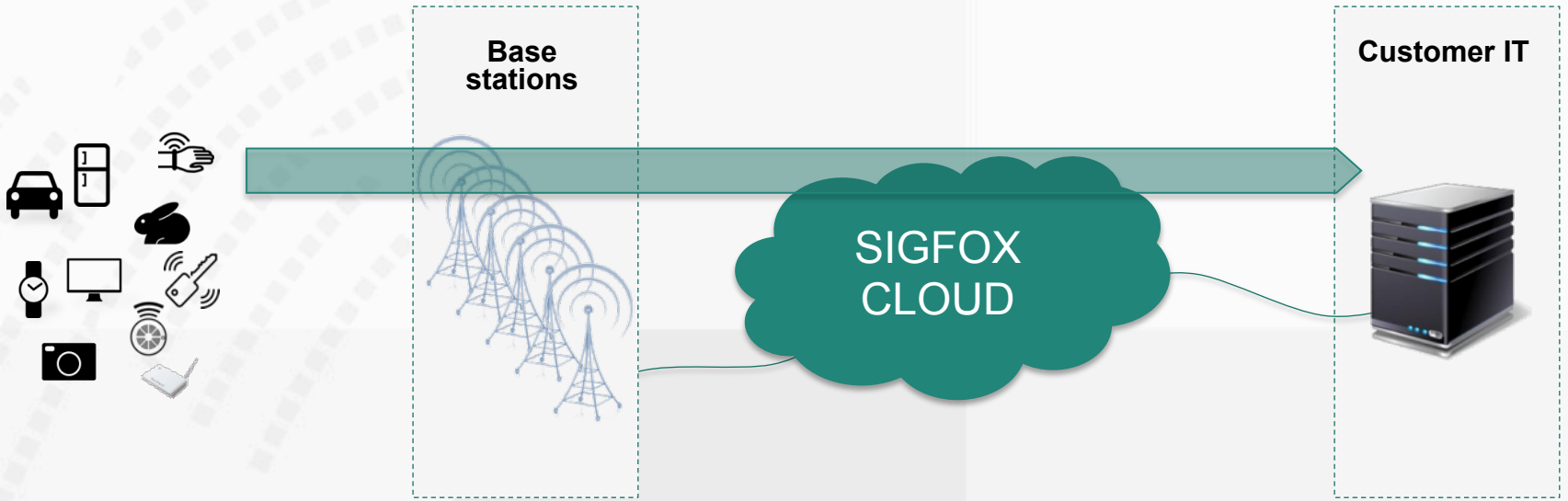
UPLINK TRANSMISSION

1. Device sends message when needed

2. SIGFOX base stations collect the message

3. SIGFOX cloud authenticates the message and regroup the duplicates

4. SIGFOX cloud pushes the message to the customer IT



BI DIRECTIONAL MESSAGE

DEVICE INITIATED

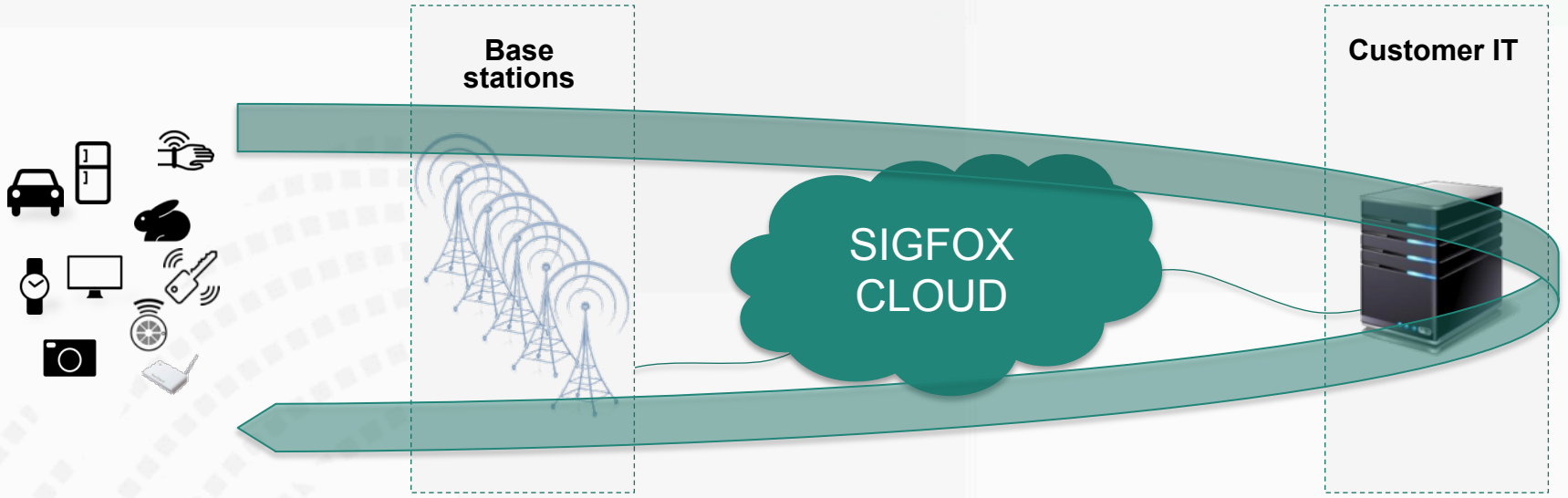
MAXIMIZE SLEEPING MODE

1. Device sends message when needed with bidirectional request

2. SIGFOX base stations collect the message

3. SIGFOX cloud authenticates the message and regroup the duplicates

4. SIGFOX cloud pushes the message to the customer IT



8. Device gets the reply and acknowledges it

7. SIGFOX base station send the message

6. SIGFOX cloud requests the base station close by to send the reply

5. Customer IT replies to the bidirectional request

SIGFOX

AGENDA

VALUE PROPOSITION

RADIO TECHNOLOGY

NETWORK ARCHITECTURE

SECURITY

BUILD A DEVICE

CONNECT TO SIGFOX CLOUD

RADIO SECURITY

IDENTIFICATION

AUTHENTICATION

RESISTANCE TO SPOOFING AND JAMMERS

IDENTIFICATION AND AUTHENTICATION

Each device contains a unique ID and secure key

- **Identification is done with the ID**
- **Authentication is done with an AES encrypted signature sent in the header**

RESISTANCE TO SPOOFING

Each message contains a sequence number

SIGFOX cloud detects differences in the sequence number

RESISTANCE TO JAMMING

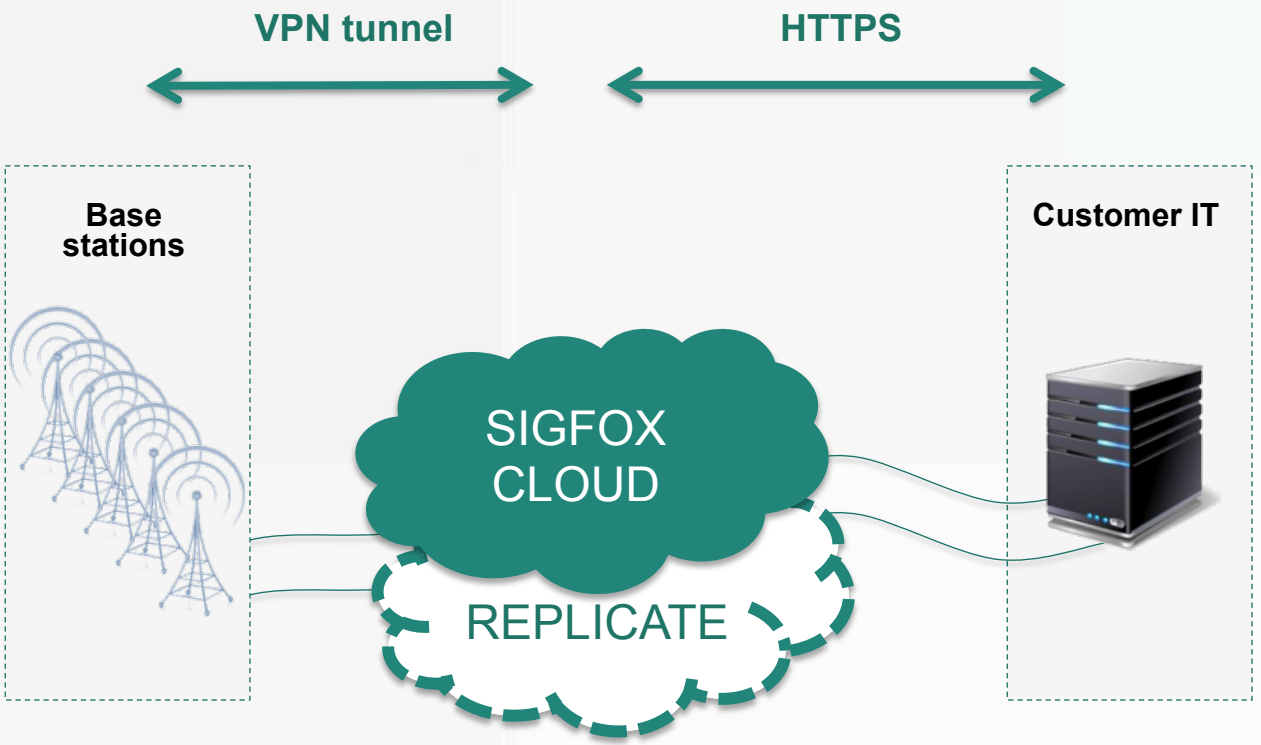
No synchronization is required to send messages on the SIGFOX network
So jamming the device receiver will not affect the delivery of the uplink message

SIGFOX

ARCHITECTURE SECURITY

SECURITY GUARANTEED FROM END TO END

CLOUD REDUNDANCY FOR SLA OF 99.99%



SIGFOX

AGENDA

VALUE PROPOSITION

RADIO TECHNOLOGY

NETWORK ARCHITECTURE

SECURITY

BUILD A DEVICE

CONNECT TO SIGFOX CLOUD

SIGFOX

BUILD A SIGFOX PRODUCT

MINIMUM INTEGRATION EFFORT

OUT-OF-THE BOX CONNECTIVITY

BUILD A SIGFOX READY™ DEVICE

✓ Choose your FCC SIGFOX Ready™ technological block

Texas Instruments available now

Atmel available Q1 2016

AXSEM available Q1 2016

Silicon Labs available Q1 2016

✓ Sign the relevant SIGFOX Ready™ certification program agreement

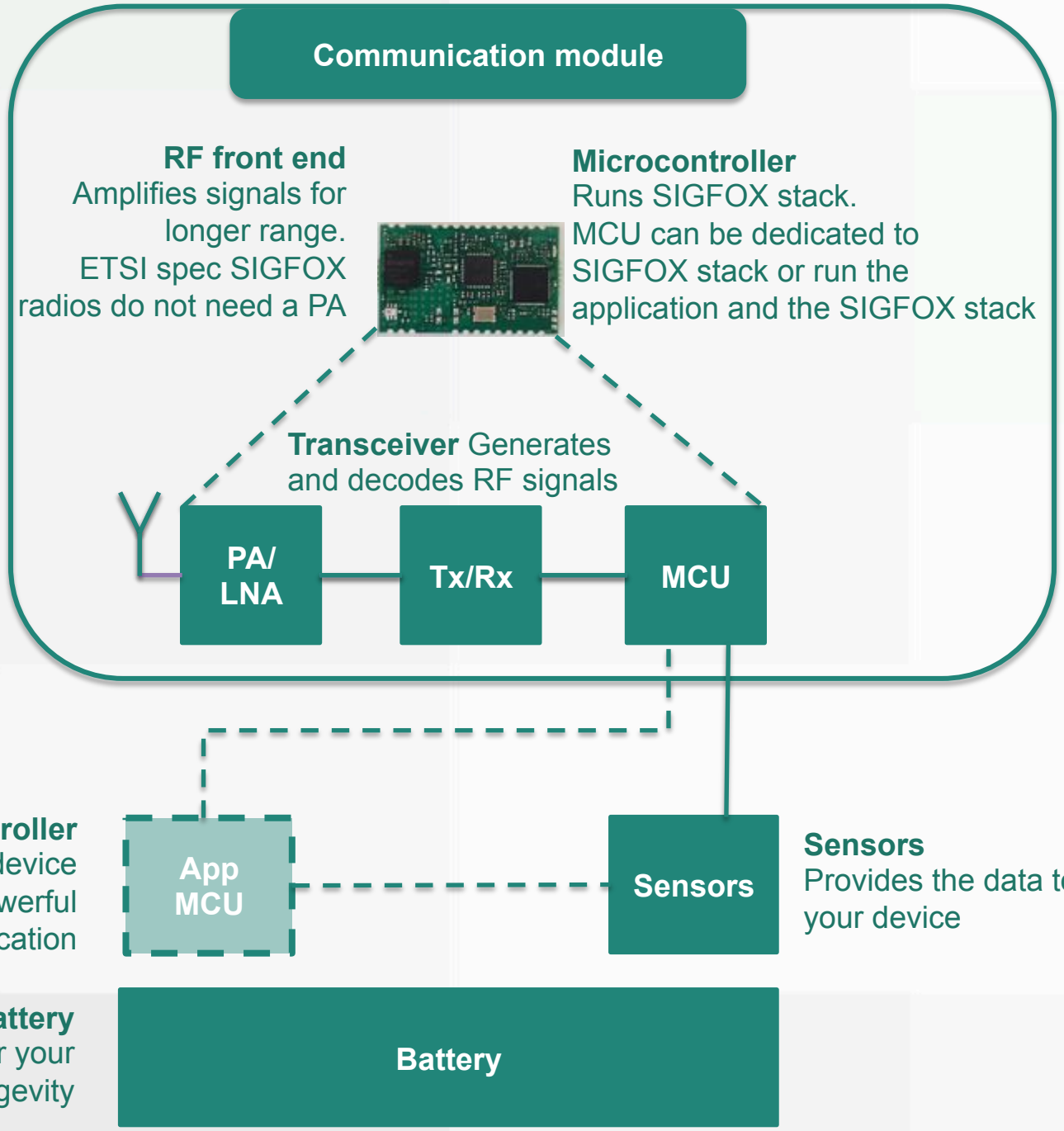
✓ Get access to SIGFOX cloud and support to build your device

✓ Submit your final product to the SIGFOX certification team

SIGFOX READY

No coverage yet?
SIGFOX can loan base stations

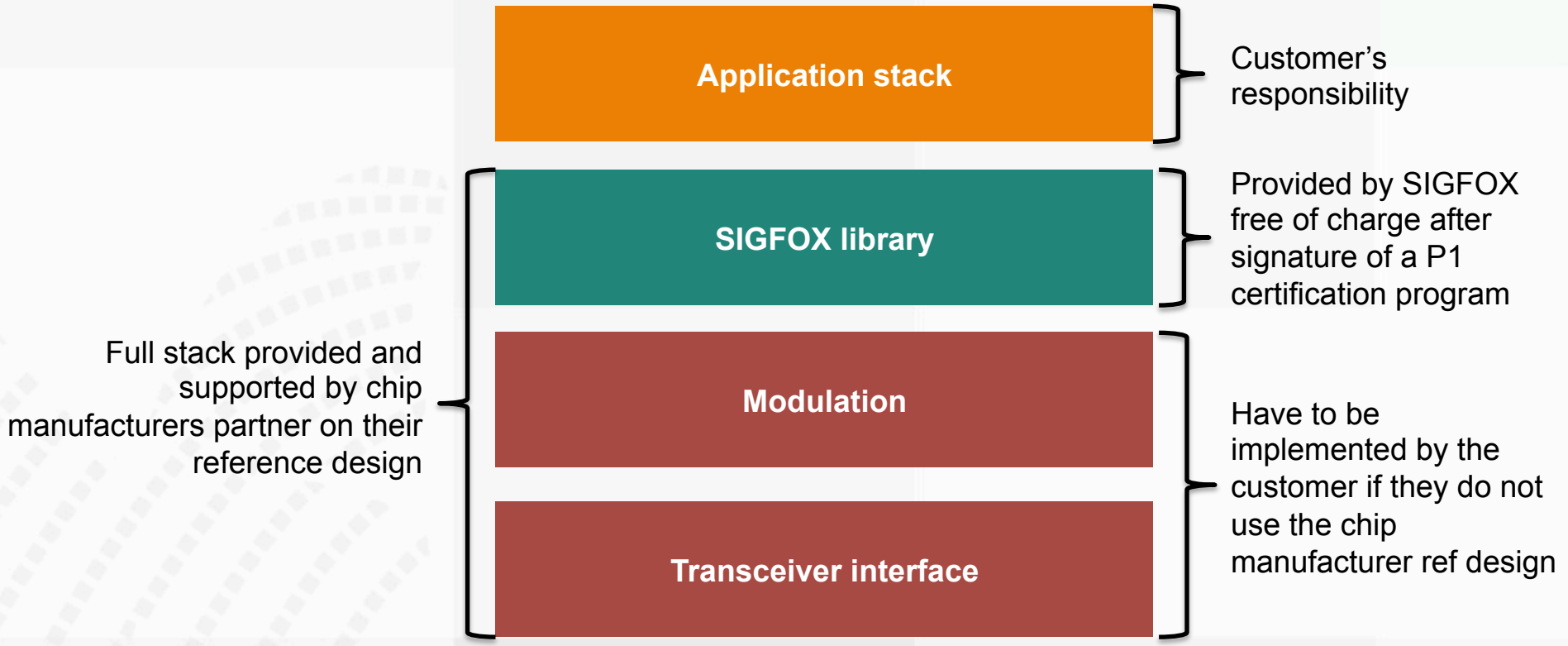
TYPICAL HARDWARE ARCHITECTURE



TYPICAL SOFTWARE ARCHITECTURE

SIGFOX uses BPSK modulation for uplink. This is implemented on the micro controller closely controlling the transceiver

SIGFOX uses GFSK modulation for downlink. This is a standard modulation available on most sub Ghz chip on the market.



SIGFOX

UPLINK MESSAGE EXAMPLE

12 BYTES ENOUGH FOR SENSING AND TRACKING

From 0 to 12 bytes, max 140 messages per day:

- **6 bytes: GPS coordinates**

Location report with below 3m precision (GPS technical accuracy is above 3m)

- **2 bytes: temperature reporting**

Lab thermometer with -100°/+200° range, 0.004° precision

- **1 byte: speed reporting**

Speed Radar up to 255km/h

- **1 byte: object state reporting**

Up to 8 switches report like set in day/night, hot/cold, on/off

- **0 byte: heartbeat**

Object is in working state, battery is OK....

- **0 byte: Request for duplex operation**

Do you have some information for me?

BIDIRECTIONAL MESSAGE EXAMPLE

CONFIGURATION
UPDATE POSSIBLE

8 bytes, max 4 messages per day:

- **Change configuration (4 billion possibilities)**

Change operational mode, add color indicator of danger probability...

- **Adjust sensor scale**

Change sensor vibration sensibility of seismograph if too many reports...

- **Adjust messages frequency**

Request close surveillance of water lever after rain...

- **Request additional data**

Request status of solar panel if battery drain is too high...

- **Request firmware upgrade (through high throughput connection)**

Ask object to perform an update using GSM because of outdated version...

SIGFOX

AGENDA

VALUE PROPOSITION

RADIO TECHNOLOGY

NETWORK ARCHITECTURE

SECURITY

BUILD A DEVICE

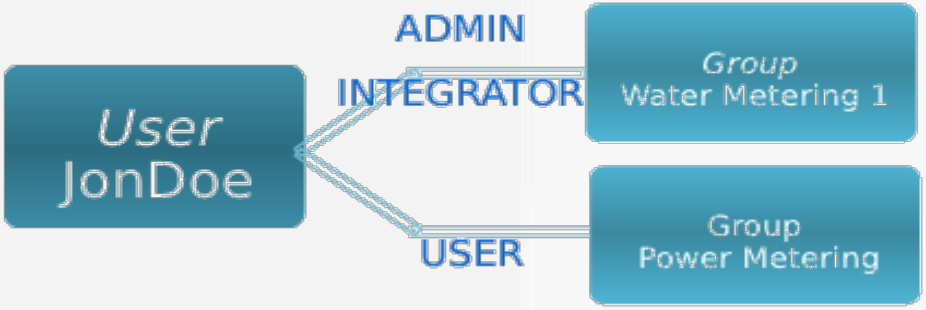
CONNECT TO SIGFOX CLOUD

SIGFOX

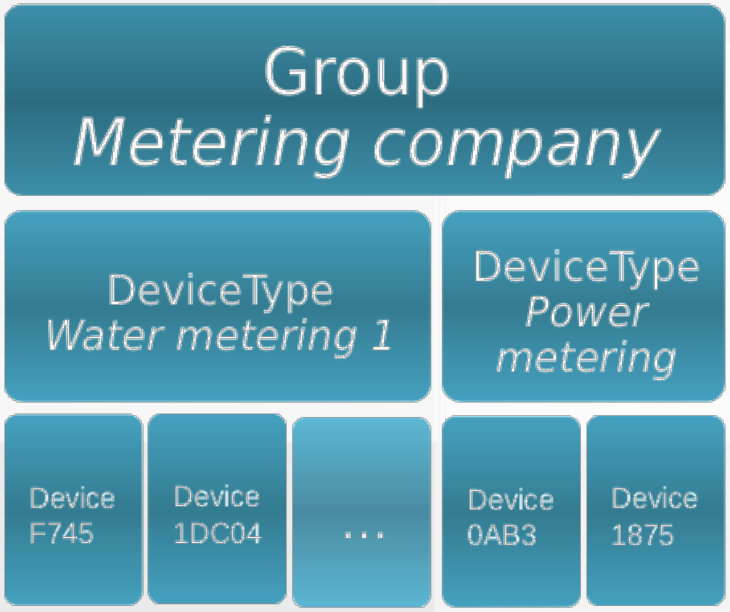
MANAGE YOUR DEVICE

MANAGE YOUR DEVICES

Users are attached to groups and have user rights associated to each group



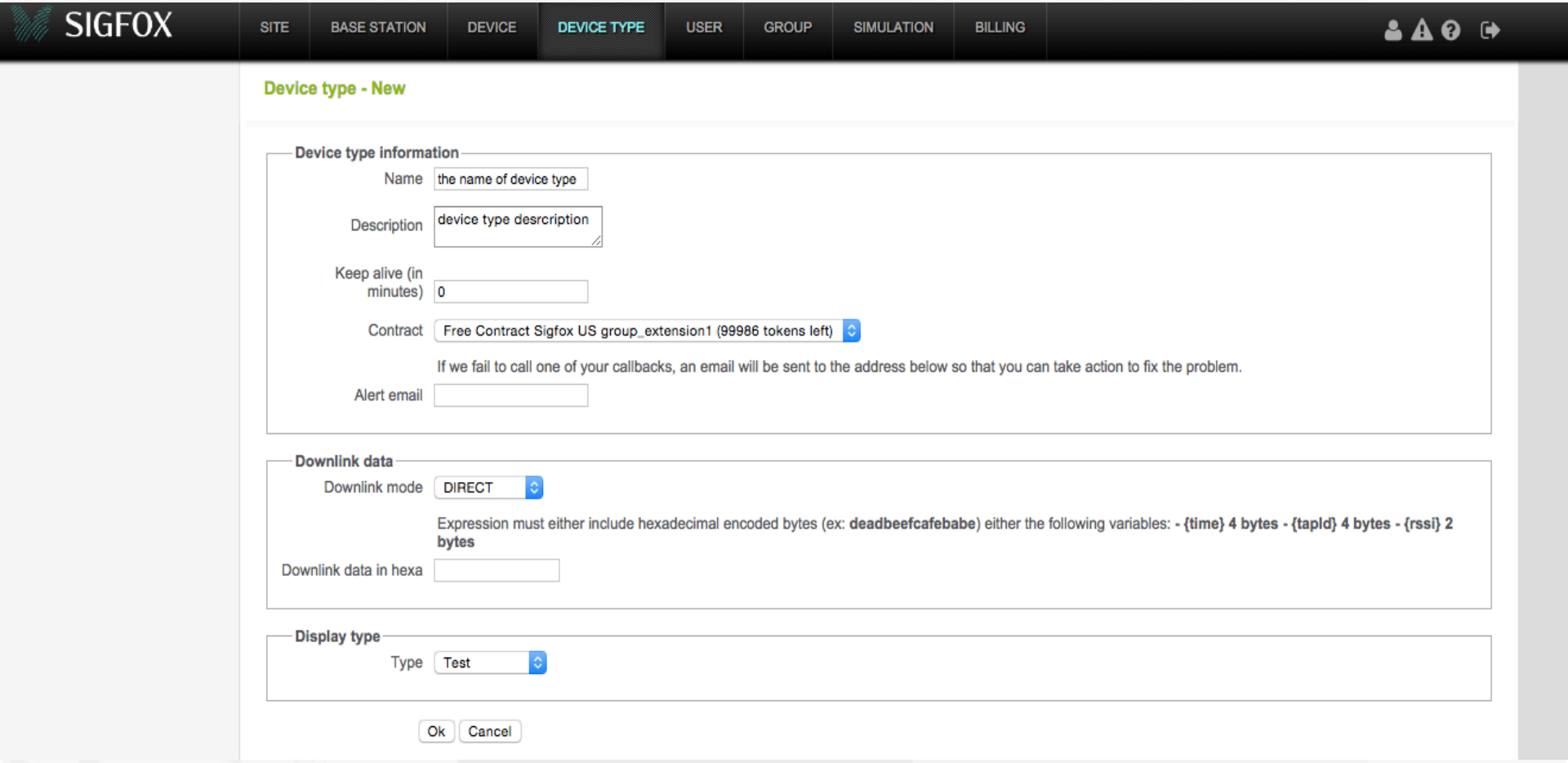
Devices are attached to a device type which is attached to a group and a contract



CREATE YOUR DEVICE TYPE

CREATE YOUR DEVICE TYPE

Device type is necessary for the device to be created. Callbacks are managed at the device type level

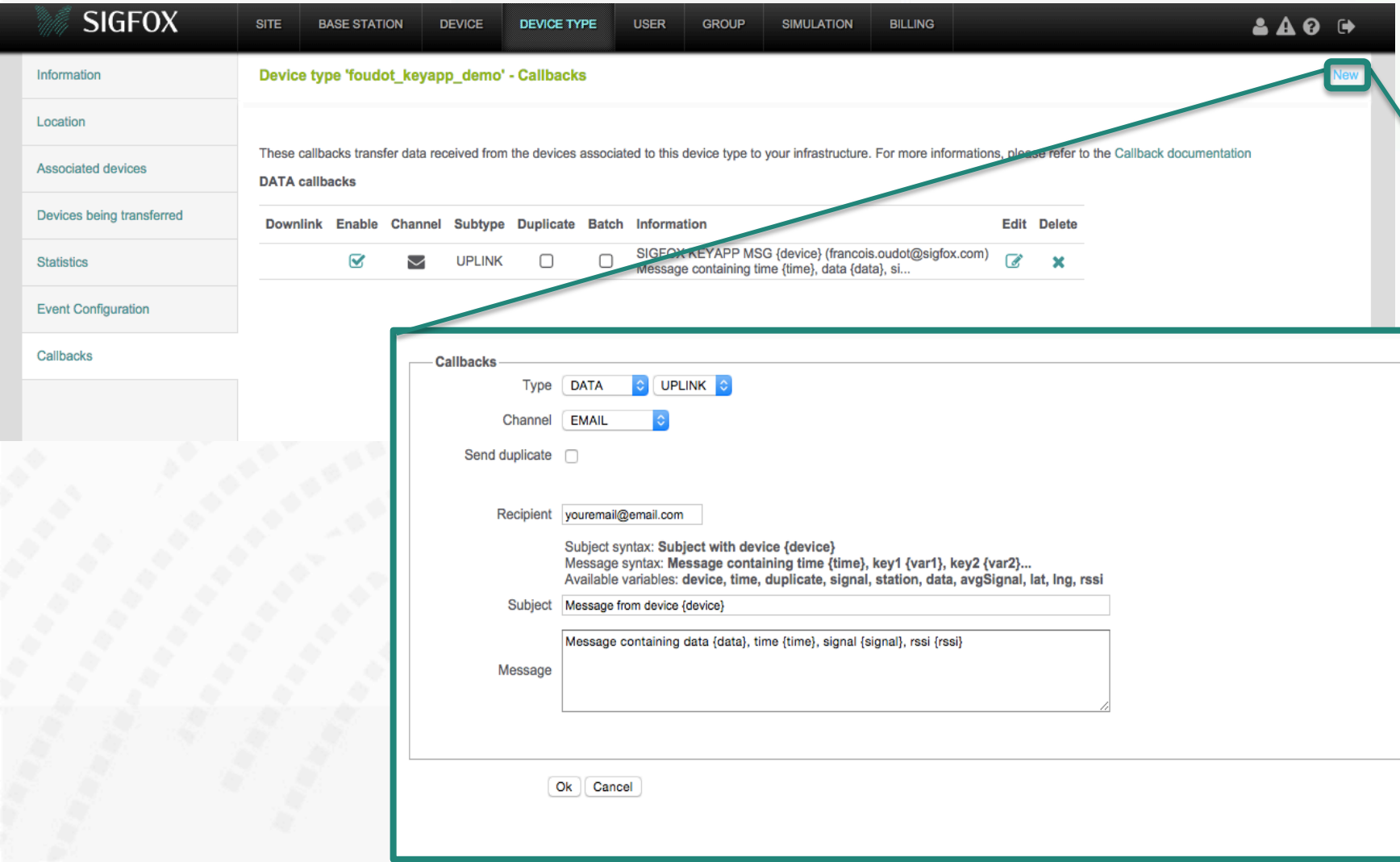


SIGFOX

CREATE YOUR CALLBACKS

CREATE YOUR CALLBACKS

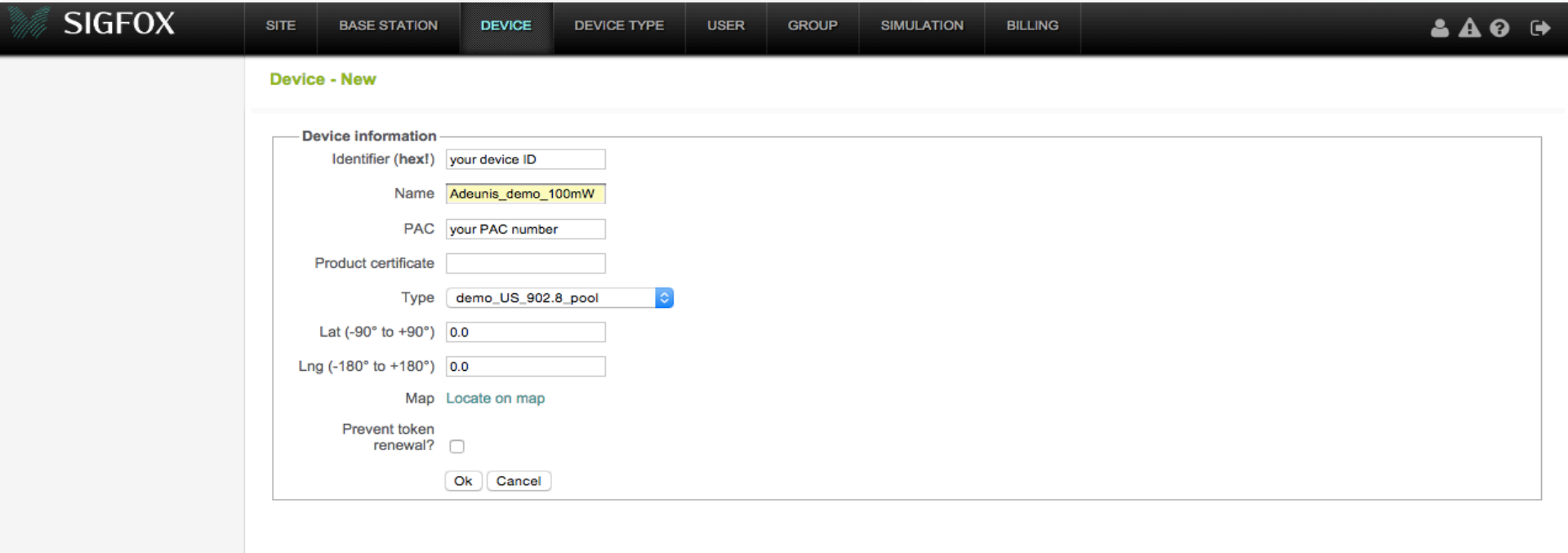
Callbacks are actions that will be performed when a message (or an event) arrives on the SIGFOX cloud



ACTIVATE YOUR DEVICE

ACTIVATE YOUR DEVICE

A device needs to be associated to a device type



www.sigfox.com

francois.oudot@sigfox.com