



# Actility Webinar

Connecting with intelligence



## IoT Solutions Certified for Hazardous Areas in Process Industries

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Explore Ex-Certified (ATEX/IECEx) LoRaWAN<sup>®</sup> Innovations for Hazard Prone Industries: Oil Refineries, Chemical Plants, Mining Operations, and more

**Click here to watch the replay**

*Webinar:*

# **Hazardous Area Certified IoT Solutions for the Process Industries**



Watch on  YouTube





## Challenges of Deploying LoRaWAN Gateways in Hazardous Areas

**James Eastwood**  
Product Manager,  
Extronics Ltd.



## Asset Tracking in Hazardous Environments with Abeeway's ATEX/IECEX-Certified Trackers

**Rohit Gupta**  
Geolocation product  
manager, Actility



## Safety by Design: How TWTG Navigates IECEx/ATEX Certifications for Hazardous Areas

**Thijs Buuron**  
Head of Technology,  
TWTG



## TotalEnergies: Pioneering IoT in High-Risk Zones

**Franck Tanquerel**  
Senior Engineer,  
TotalEnergies



# What are we talking about ?

\*Very\* large sites

Indoor and outdoors

Large metal masses

High-power pumps,  
motors, parasitic RF  
sources

**A nightmare environment  
for RF...**

**... with high stakes...**

Typical figures (example of Antwerp-Rotterdam-  
Amsterdam (ARA) hub.

338,000 barrels of oil per day 1.1  
million tons/yr of ethylene.  
Renovating budget 1 B€

**... and among the best RoI  
opportunities in the  
industry for IoT.**

Saving an hour of production  
funds the project.

# Don't buy the "LoRa's magic will solve all your problems"

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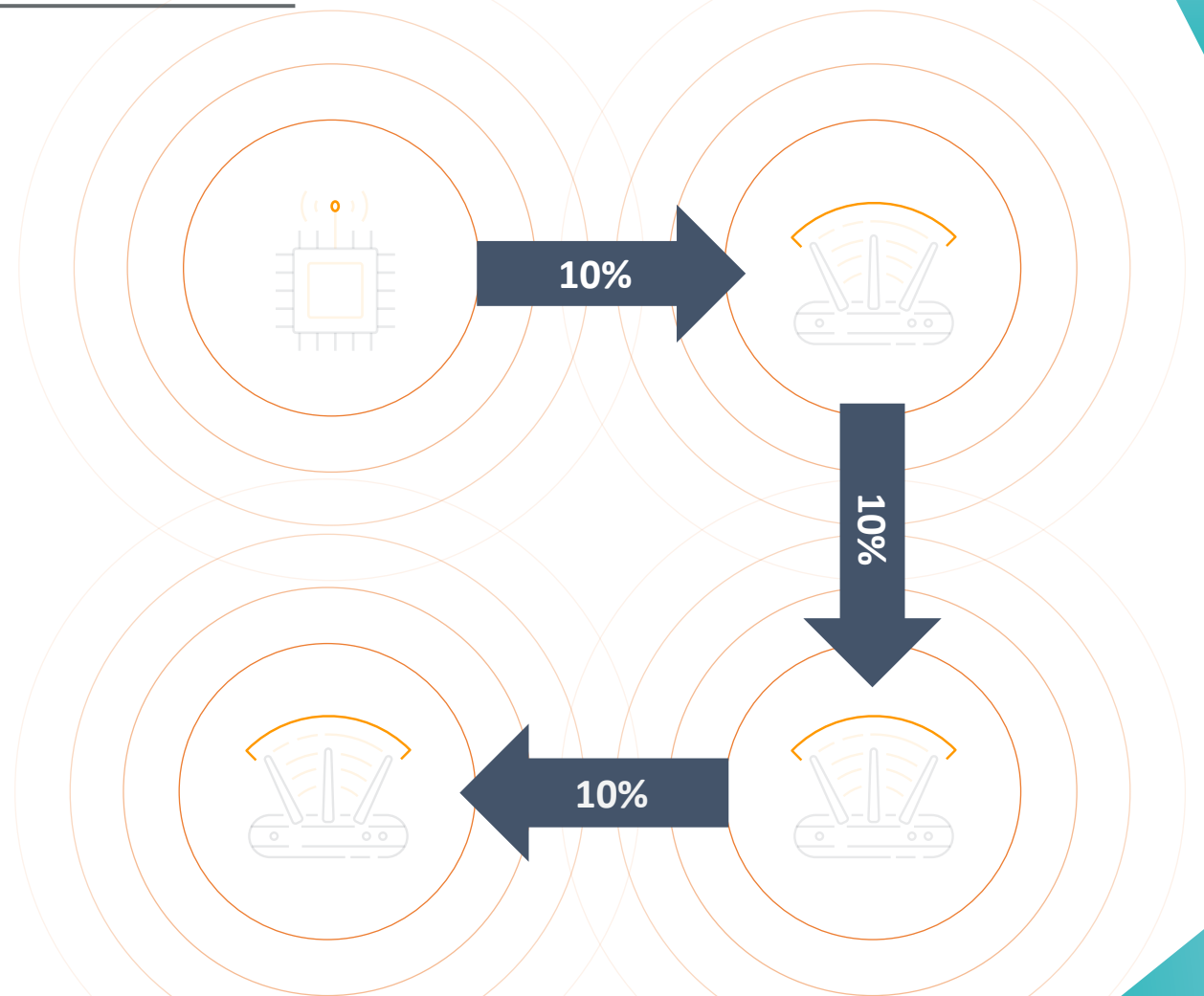
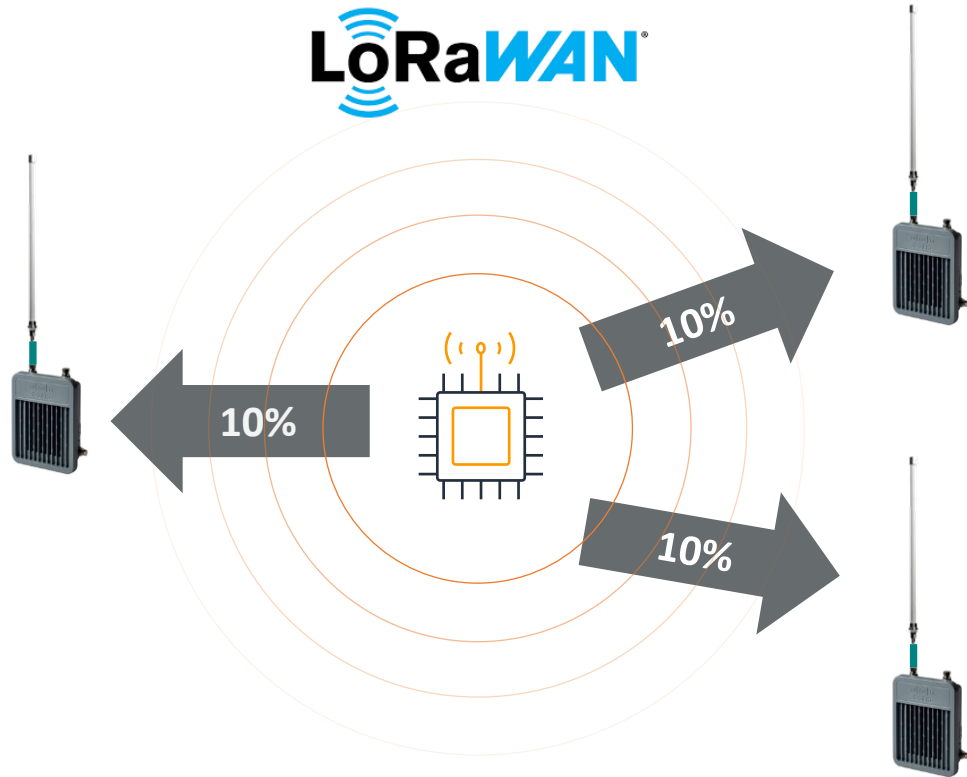
It is tempting to just throw-in a few gateways and believe in LoRa's long-range magic to operate.

Because of long range, we can avoid hazardous areas for the network, so life is easy.

Unfortunately, it's not so simple.

- Metallic buildings are very good faraday cages → indoor GWs often required
- In a high interference environment, macro-diversity is key to QoS (more on this later)
- Need to consider range versus capacity (uplink and downlink capacity)

# Macro-diversity is key to industrial QoS (LoRa versus Mesh)



LoRaWAN macro diversity: Packet is lost only if lost on all 3 antennas:

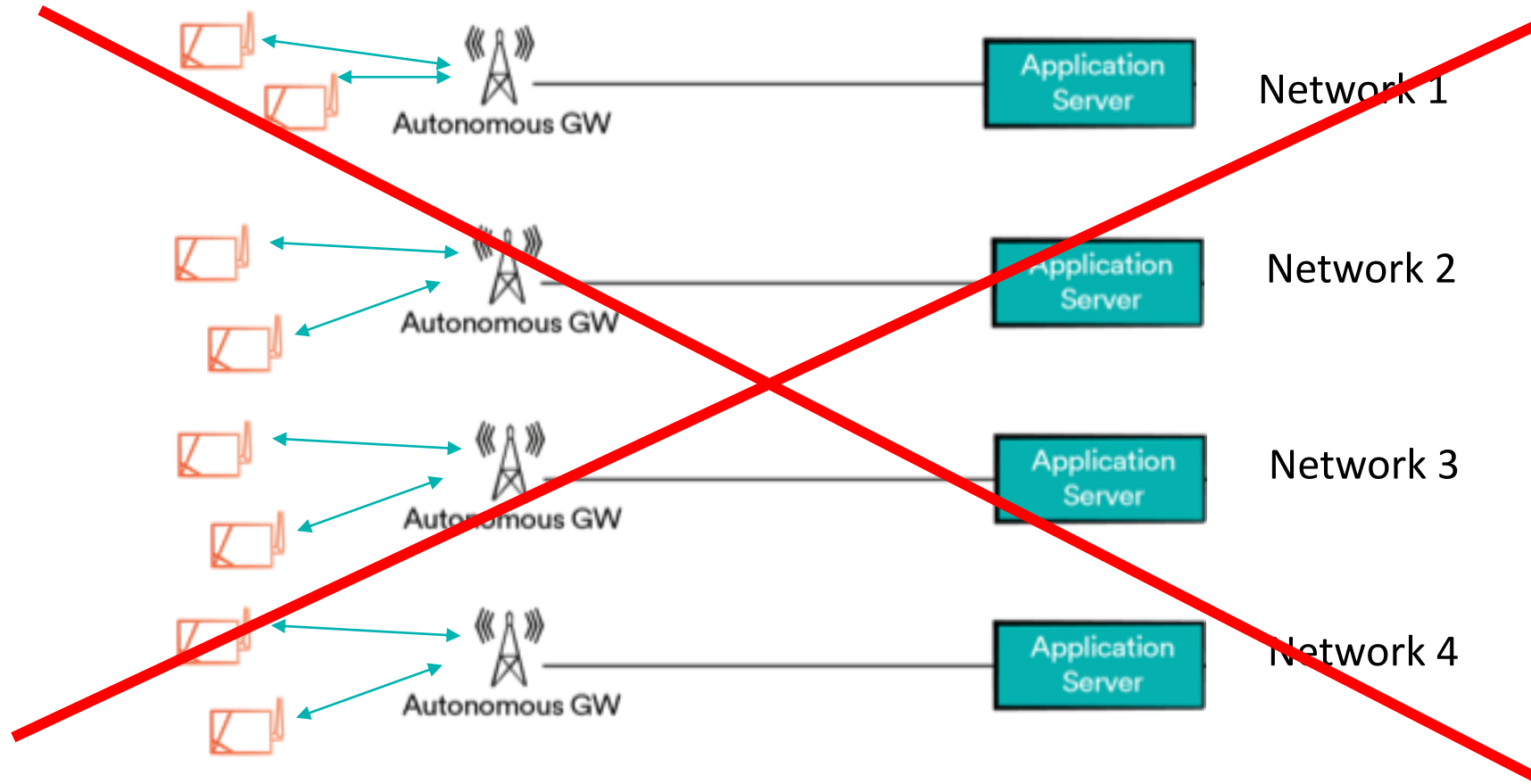
$$\text{PER} = 0.1^3 = 0.001 = 0.1\%$$

Activity

Mesh: Packet is received only if not lost on any hop

$$\text{PER} = 1 - 0.9^3 = 27\%$$

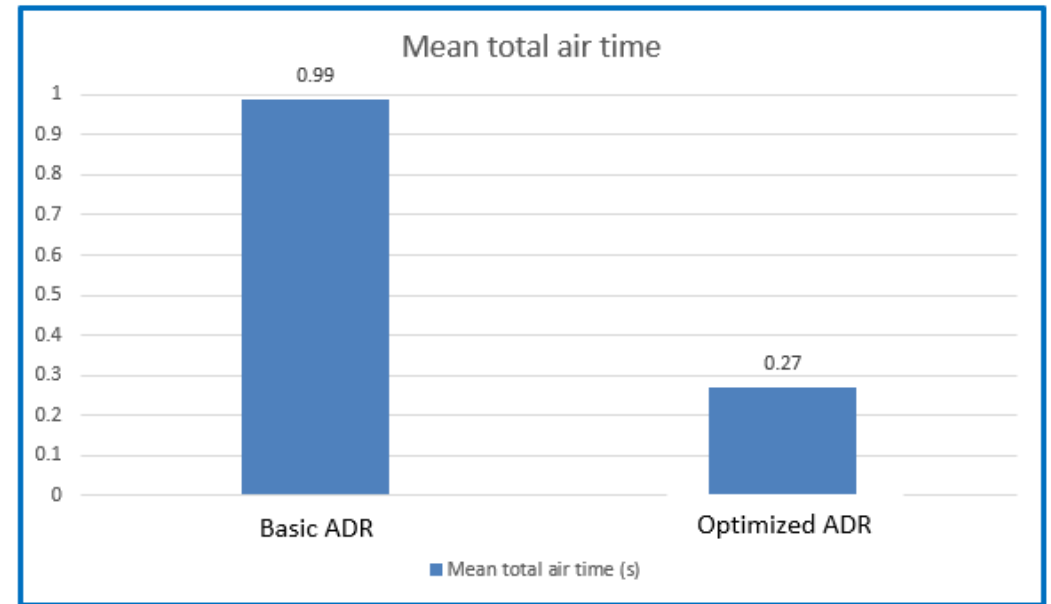
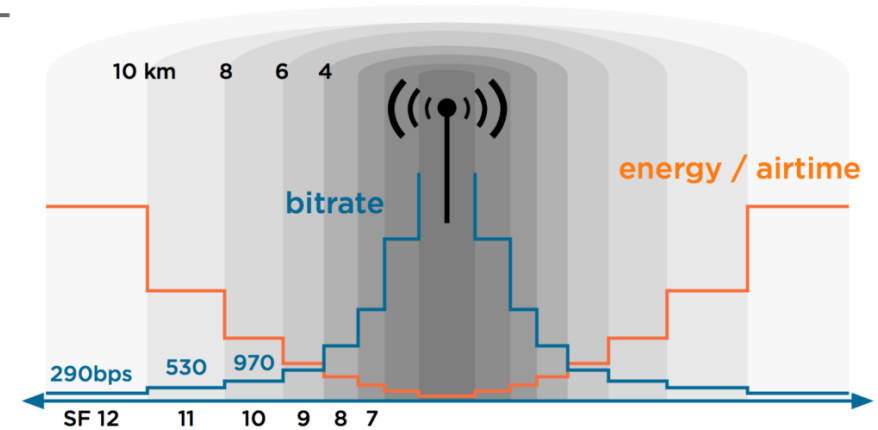
# Never deploy autonomous GWs without macro-diversity



# « ADR » is key for LoRaWAN performance

An efficient ADR mechanism shall:

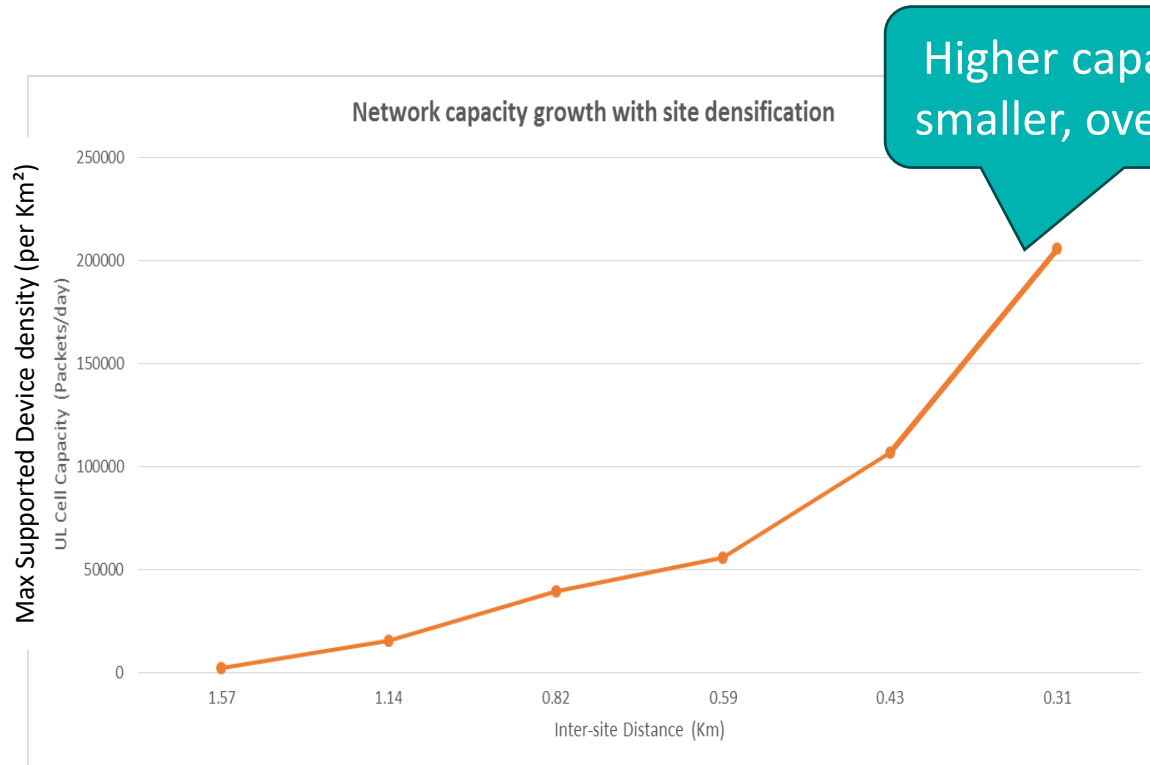
- **Dynamically adapt the device's transmission parameters** (TxPower, number of transmissions, data rate) according to the quality of the device-BS radio link
- **Minimize the device's battery consumption** while fulfilling the target quality metrics (especially the uplink packet error rate)
- **Adjust its reactivity** to avoid too volatile decisions (increasing signaling overhead induced by MAC commands) or slow response to abrupt RF changes (e.g. the nearest GW to the device goes down)



Field tests show significant reduction (-72%) of average total air-time per uplink frame counter.

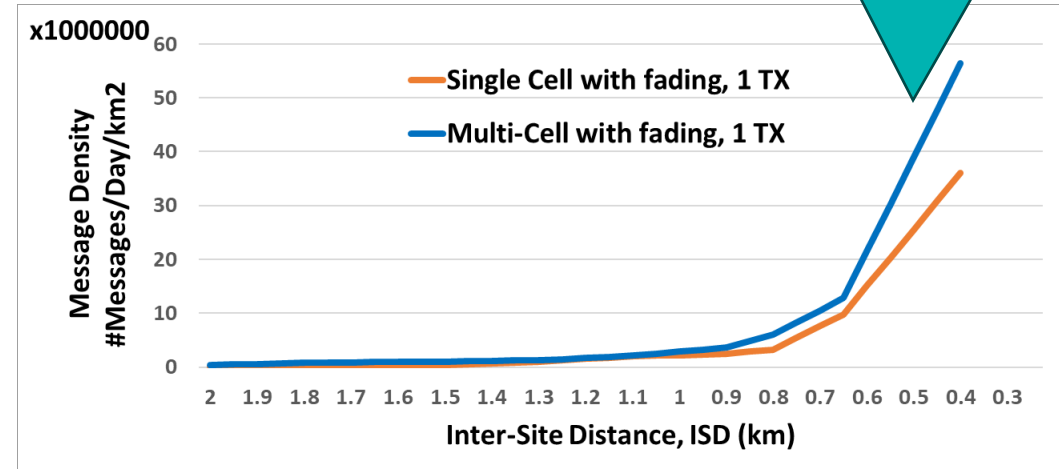


# High-density sensor deployments are capacity, not coverage-constrained



Higher capacity imposes smaller, overlapping cells

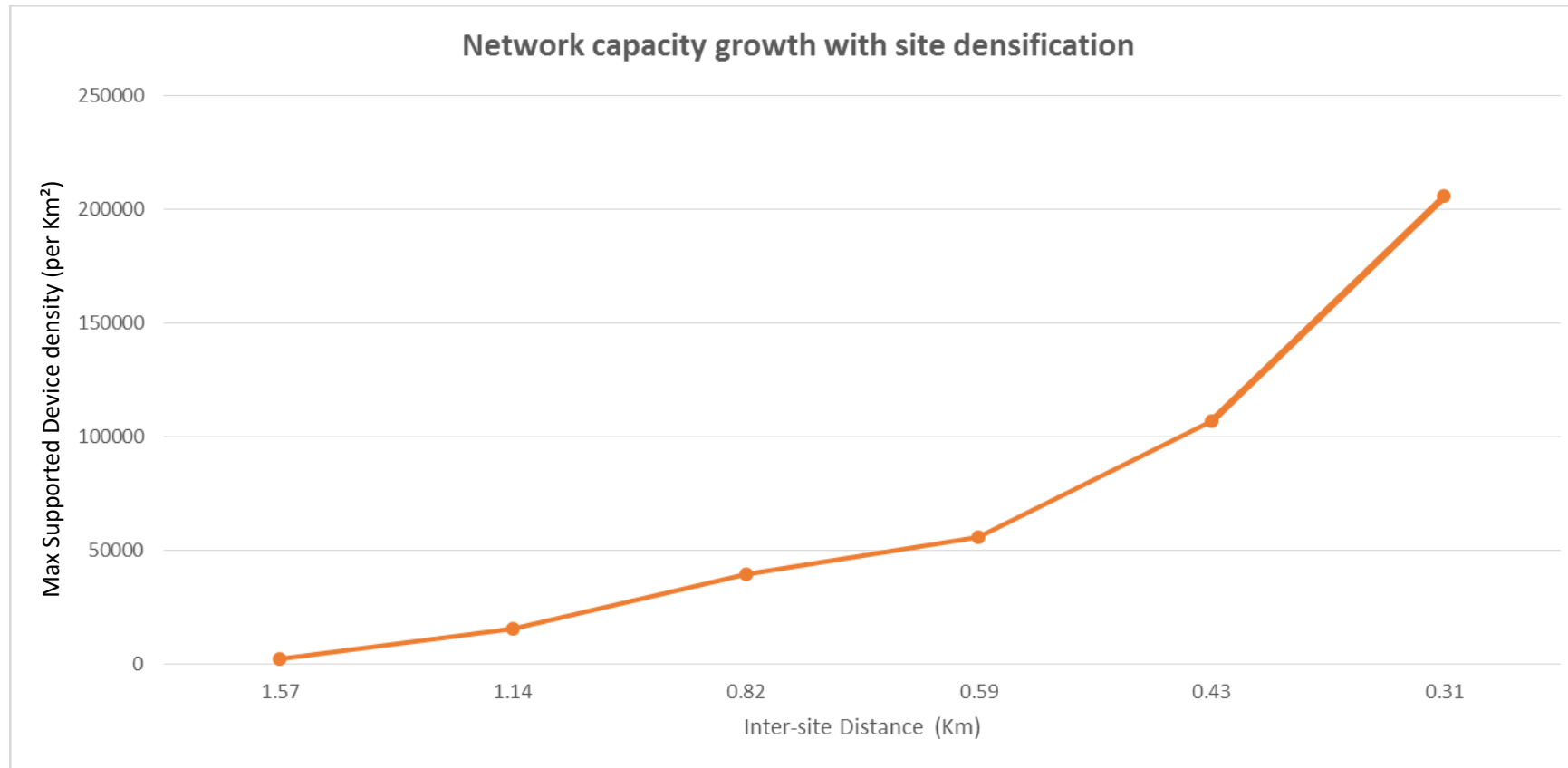
Benefit of macro-diversity in noisy environments



Assumptions: Cell range/ISD based on RX2 coverage, UL with 3 repetitions, 5% collision rate, -3dBi device antenna gain => Link Budget is DL limited

# Capacity vs. Inter-site distance

- Assumptions: Cell range/ISD based on RX2 coverage, UL with 3 repetitions, 5% collision rate, -3dBi device antenna gain => Link Budget is DL limited



# The LNS is the key enabler of industrial-grade network performance

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LoRaWAN™ Network Server (LNS) orchestrates macro-diversity and ADR, both key to QoS and capacity.

- Uplink:
  - Data routing to Application Servers or to home LNS (roaming)
  - Verify message integrity (via MIC)
  - Uplink **frame deduplication** (RF macro diversity or frame repetition by the device)
  - **Adaptive Data Rate**
- Downlink:
  - **Route selection/optimization**
  - **Downlink scheduling:** RX1, RX2, RXC, pingslots
- MAC Layer management
  - MAC commands (per device)
  - MAC-level acknowledgments
  - MAC-level security, e.g. replay attack detection and mitigation

# Performance benchmark by IIoT integrators

## QoS at scale: field tests by a Singaporean industrial IoT system integrator

Number of Nodes = 2  
 Message Length = 51  
 Confirmed Message  
 Modem number of attempts = 1  
 Application retries until no error  
 Activity SaaS

ThingPark LNS

Message Duration

Attempts	2	3	4	5	6	7	8	9	10	12	Grand Total
1	96.24%	0.92%	0.06%	0.92%	0.09%	0.03%	0.03%	0.00%	0.03%	0.00%	98.32%
2	0.00%	0.00%	0.06%	0.06%	1.20%	0.03%	0.00%	0.00%	0.00%	0.03%	1.39%
3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.16%	0.13%	0.00%	0.28%
Grand Total	96.24%	0.92%	0.13%	0.98%	1.30%	0.06%	0.03%	0.16%	0.16%	0.03%	100.00%

96.24% of the message is successfully sent out within 1 attempt with message interval of 2 seconds.

%Message Received by Activity TPE

Hour	Received
13	100.00%
14	100.00%
Grand Total	100.00%

Server receives 100% of the messages.

Number of Nodes = 2  
 Confirmed Message  
 Modem Retry = 1

Open Source LNS

Delay vs ACK (Node)

Delay	RXWIN1	RXWIN2	NOACK
2	67.50%	0.90%	31.60%
4	70.40%	0.50%	29.10%
6	70.80%	0.20%	29.00%
8	64.90%	0.30%	34.80%
10	67.20%	0.20%	32.60%
12	65.90%	0.50%	33.60%
14	65.50%	0.20%	34.30%
16	68.20%	0.40%	31.40%
18	65.70%	0.70%	33.60%
20	64.50%	0.30%	35.20%
Grand Total	67.06%	0.42%	32.52%

Node receives 67.6% acknowledgement.

Delay	5	4
2	96.10%	3.70%
4	98.30%	1.60%
6	96.30%	3.50%
8	96.70%	3.30%
10	97.00%	2.90%
12	96.10%	3.80%
14	96.80%	3.10%
16	97.00%	2.90%
18	96.80%	3.20%
20	97.80%	2.20%
Grand Total	96.89%	3.02%

Message rate = 1 Message per 5.0 seconds

% ACK Received (Node)

Hour	RXWIN1	RXWIN2	NOACK
0	64.53%	0.28%	35.20%
1	71.98%	0.29%	27.73%
2	61.42%	0.59%	37.98%
3	61.23%	0.31%	38.46%
4	70.87%	0.65%	28.48%
5	69.26%	0.00%	30.74%
6	67.59%	0.93%	31.48%
7	60.00%	0.74%	39.26%
8	56.06%	0.00%	43.94%
9	74.63%	0.98%	24.39%
10	68.09%	0.53%	31.37%
11	67.35%	0.96%	31.69%
12	71.74%	0.62%	27.64%
13	70.19%	0.17%	29.64%
14	66.93%	0.32%	32.74%
15	67.21%	0.32%	32.47%
16	64.52%	0.00%	35.48%
17	67.25%	0.39%	32.36%
18	65.19%	0.21%	34.60%
19	68.22%	0.22%	31.56%
20	67.63%	0.24%	32.13%
21	65.93%	0.49%	33.58%
22	63.59%	0.53%	35.88%
23	65.68%	0.54%	33.78%
Grand Tot	67.06%	0.42%	32.52%

% Message Received (Server)

Hour	Received	Not Received
0	93.85%	6.15%
1	90.27%	9.73%
2	90.21%	9.79%
3	87.08%	12.92%
4	89.97%	10.03%
5	88.67%	11.33%
6	87.50%	12.50%
7	87.41%	12.59%
8	87.88%	12.12%
9	91.71%	8.29%
10	91.27%	8.73%
11	90.67%	9.33%
12	89.29%	10.71%
13	89.27%	10.73%
14	91.49%	8.51%
15	88.96%	11.04%
16	87.63%	12.37%
17	92.44%	7.56%
18	89.87%	10.13%
19	91.33%	8.67%
20	93.05%	6.95%
21	89.46%	10.54%
22	92.35%	7.65%
23	92.76%	7.24%
Grand Tot	90.34%	9.66%

Server receives 90.34% of the messages.

# Is it secure enough for production?

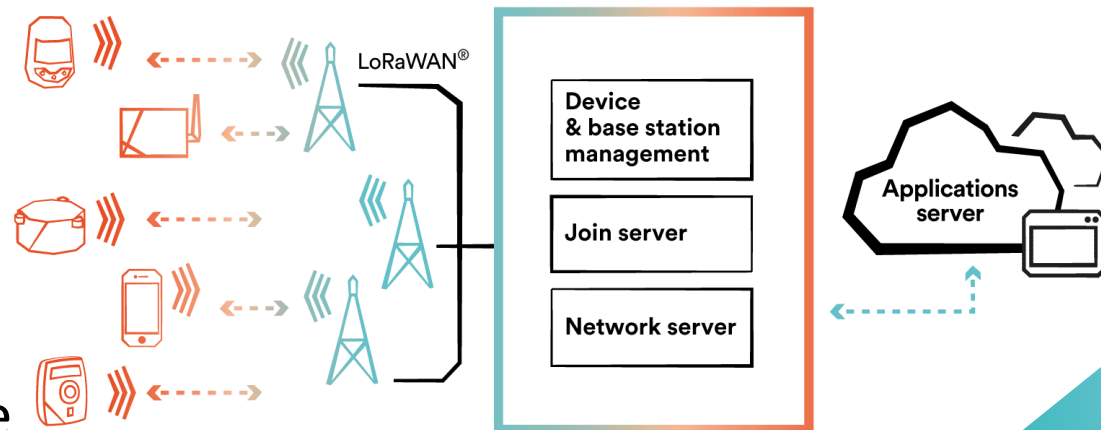
## • Protocol security



- Does LNS implement [LoRaWAN security best practices](#) (e.g. to mitigate replay attacks)?
- Does LNS support E2E payload encryption between device and AS?
- Does the solution support a standalone Join Server? Does JS use HSM to store device keys?

## • Interface security

- How is GW-LNS interface secured? Does it support both IPSec and TLS options?
- How does the GW securely retrieve its certificate (PKI Management)?
- Who maintains the GW agent SW ? Is there a security SLA on 100% of the stacks?



# Main take-aways

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- You may need more GWs than you think due to capacity and macro-diversity constraints
- Some of these GWs are likely to require certification for location in Hazardous zones to cover indoor areas for capacity/macro-diversity
- Once the topology is in place, the quality of the ADR algorithm (not standardized, only the control commands are standardized) will have a dramatic influence on network stability, scalability and QoS.



*None of this shows in the lab phase, but appears at scale.*

# LoRa<sup>®</sup> is not magic... but still your best friend for ATEX/IECEX !

- **Infrastructure:**
  - ATEX infrastructure is expensive, expect a reduction in required number of infrastructure nodes by over an order of magnitude compared to mesh or 2.4GHz solutions in general.
- **Devices**
  - Explosions are triggered by sparks and high temperatures
  - When certifying, your enemies are:
    - Large (or even medium !) capacitors
    - Need for high-current fuses, which influence worst case temperatures under failure condition shorts
  - LoRaWAN makes it much easier to avoid large peak currents (300mA for cellular sensors versus 30mA for LoRa<sup>®</sup>), because the whole design is ultra-low power



## Deploying LoRaWAN gateways in hazardous environments





# Accurate area classification key to project success

- Area classification should be confirmed at the start of the requirement, not later on
- Incorrect classification could lead to project failure
  - Often requests for Zone 0, IIC, T6
- Accurate specification means we can offer the most appropriate solution



# Area classification: what to consider

- Zone 1 & 21
  - Hazardous in normal operation
  - Equipment is heavier and more expensive than Zone 2/22
- Zone 2 & 22
  - Safe in normal operation
  - Equipment is typically lower cost than Zone 1
- ATEX and IECEx accepted worldwide
- Class/Div certification required in North America

ATEX/IECEX Equipment Group	Maximum RF Threshold Power (Watts)
Gas Group IIA	6
Gas Group IIB	3.5
Gas Group IIC	2
Dust Group III	6

Maximum EIRP thresholds allowed in hazardous areas



FLAMMABLE GASES



COMBUSTIBLE DUST



VAPOURS & LIQUIDS



IGNITABLE FIBRES

# iWAP107 Zone 1/21 & Class 1, Division 1 Wireless Enclosure



Universal wireless enclosure system, global certification for use in Zone 1 & 21. Class I, II, III & Division 1.

- Choose from a wide range of wireless gateways from any vendor. Provides vendors a turn-key solution for Ex requirements
- Use non-certified external antennas with the intrinsically safe RF outputs. Allows for optimised wireless deployments
  - Antennas can be remotely mounted
- Highly rugged IP66 rated with a wide temperature range
  - Industrial gateways have wider operating temperatures

# iWAPXN3 Zone 2/22 & Class 2, Division 2 Wireless Enclosure

Universal wireless enclosure system, global certification for use in Zone 2 & 22. Class I, II & Division 2 and Zone 2.

- Choose from a wide range of wireless gateways from any vendor. Provides vendors a turn-key solution for Ex requirements
- Use non-certified external antennas with the intrinsically safe RF outputs. Allows for optimised wireless deployments
  - Antennas can be remotely mounted
- Four standard sizes to choose from
- Highly rugged, IP66 and NEMA 4 rated





Thank you.

If you would like further information,  
please get in touch via [info@extronics.com](mailto:info@extronics.com)  
or call us on **+44 845 277 5000**



# Safety by Design: How TWTG Navigates IECEx/ATEX Certifications for Hazardous Areas

Industry Case Studies with LoRaWAN December 6, 2023



# Introduction

**Thijs Buuron - Head of Technology TWTG**

**[linkedin.com/in/thijsbuuron/](https://www.linkedin.com/in/thijsbuuron/)**



# The Road towards ATEX/IECEX Certifications





# What is ATEX (Ex) protection Atmospheres Explosives



- ATEX/IECEX is a standard for equipment intended for use in places with a potentially explosive atmosphere.

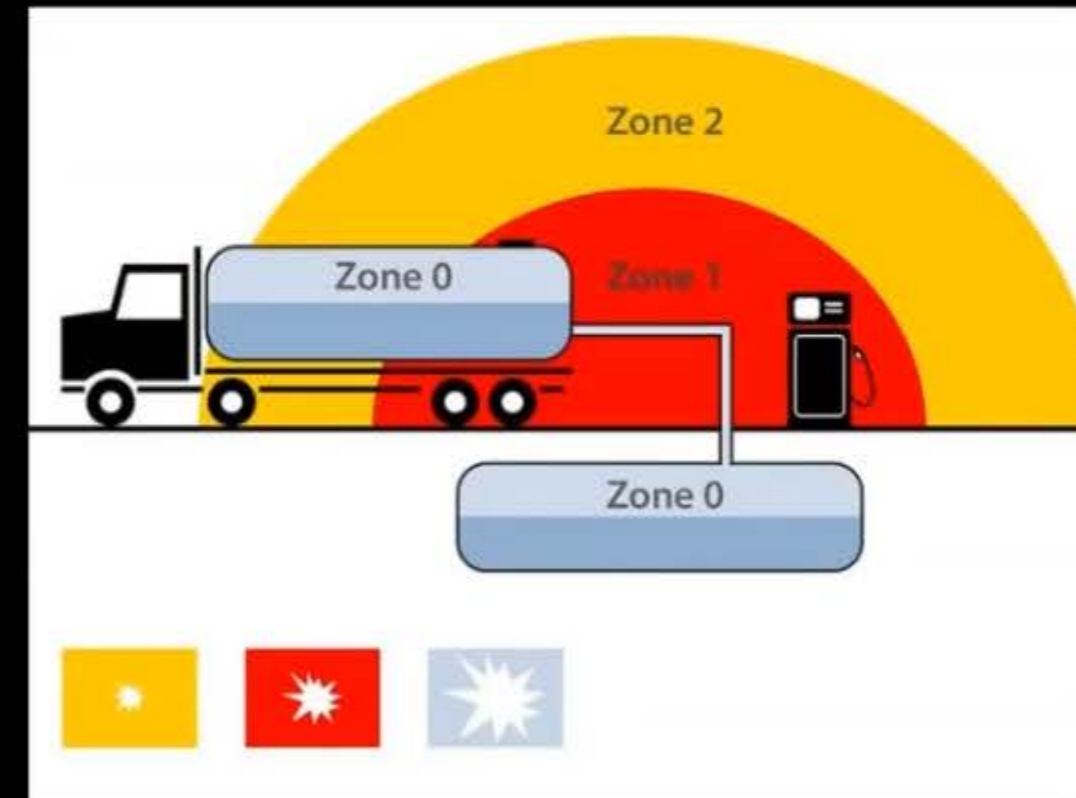
The DS-01 Family is certified to the following ATEX/IECEX class:

- **Ex II 2G Ex ib IIC T4 Gb**
  - 2G Ex ib
    - Zone 1, gas
  - IIC
    - Acetylene
    - Hydrogen
    - Ethylene
    - Propane
  - T4
    - Surface temperature up to 130 C
  - Gb
    - Protection up to zone 1 gas
- $-40\text{ }^{\circ}\text{C} \leq T_a \leq 80\text{ }^{\circ}\text{C}$ 
  - Operating temperature

**Zone 0:** Risk of explosive atmosphere for more than 10% of operational time

**Zone 1:** Risk of explosive atmosphere for 0.1% to 10% of operational time

**Zone 2:** Risk of explosive atmosphere for less than 0.1% of operational time



# Intrinsic safety Modular design

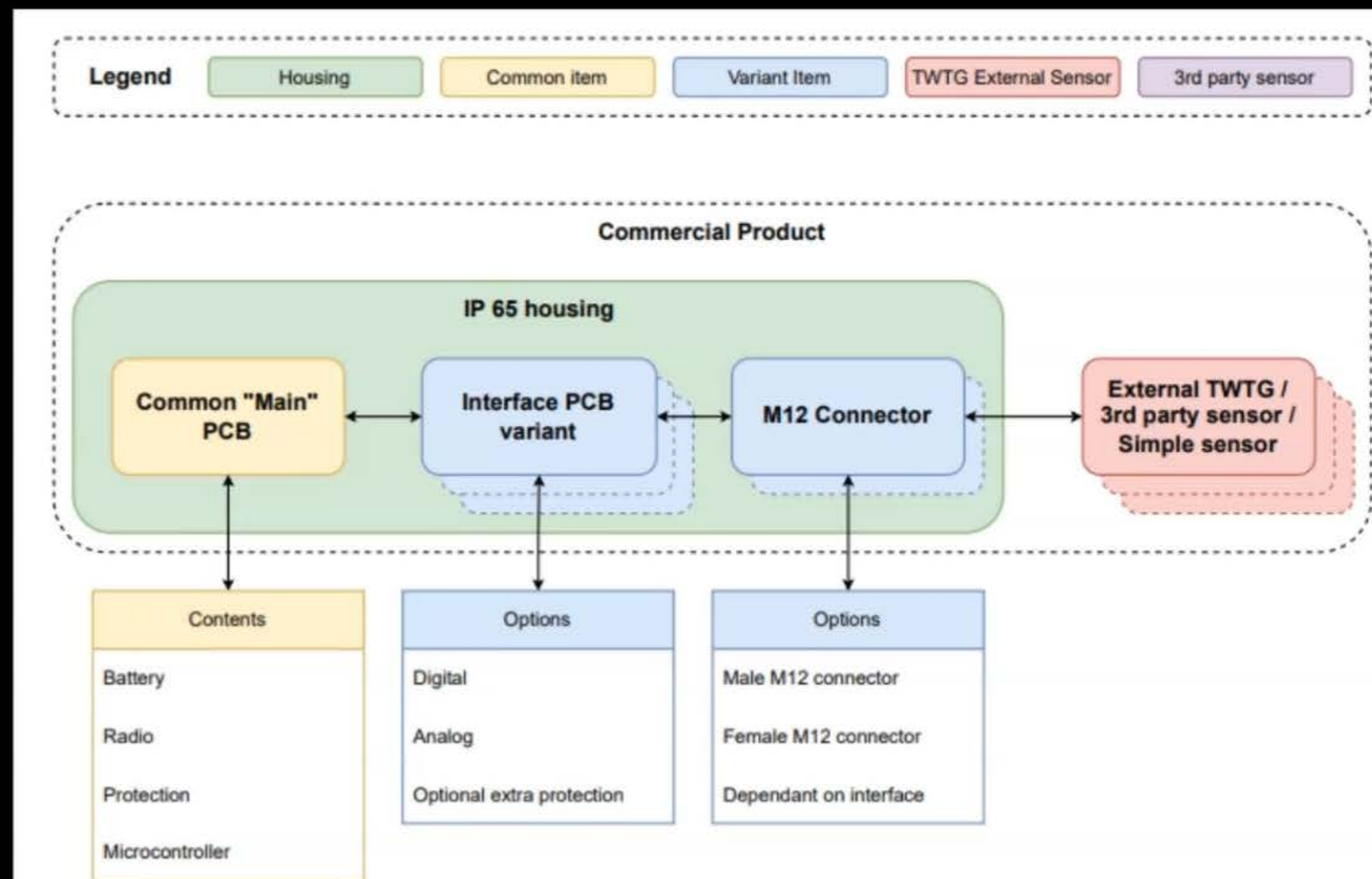


Figure 1: Overview of internals of DS-02 product family

# The Current Situation

## 10,000+ Assets



What are my emissions?

What is the current status?

What is the current temperature?

Does it need maintenance?

Does the cooling work?

Is this valve closed?

?

?

?

?

?



# Typical I-IoT Devices



**NEON  
Vibration  
Sensor**

Bearing Faults  
Cavitation  
Lubrication  
Monitoring  
IECEX I



**NEON  
Temperature  
Devices**

Steam Trap  
Heat Exchanger  
Monitoring  
IECEX I



**NEON  
Pressure  
Sensor**

Steam Trap  
Heat Exchanger  
Monitoring  
IECEX I



**NEON  
Contact  
Sensor**

Safety Shower  
Cabinet door  
Monitoring  
IECEX I



**NEON  
Valve Position  
Sensor**

Line Up  
Second pair of  
eyes  
IECEX I



**NEON  
NFC  
tag**

Asset tags  
inventory  
management  
IECEX I





# Industrial Use Cases



# Steam Trap Monitoring Temperature Transmitter Use Case



## The Challenge:

Steam Traps failure, usually caused by a simple blockage, is a common and frustrating problem. With thousands of steam traps operational at a facility, relying on manual inspections means a trap could be blocked for weeks before being noticed, leading to wasted energy and increased cost.

## The Solution:

Two PT100 temperature probes attached to a single NEON Temperature Transmitter compare the upstream and downstream temperatures of the steam trap. Any significant difference would point to a failure, and would immediately alert an engineer taking them directly to the problem.

## Products Used:

- NEON Temperature Transmitter
- PT100 probe

## Key Benefits

- Eliminating failures reduces energy bills by up to 20% per annum
- The NEON solution offers a comfortable ROI of 1 or 1.5 years
- Avoiding hundreds of man hours per month in unnecessary routine manual inspections

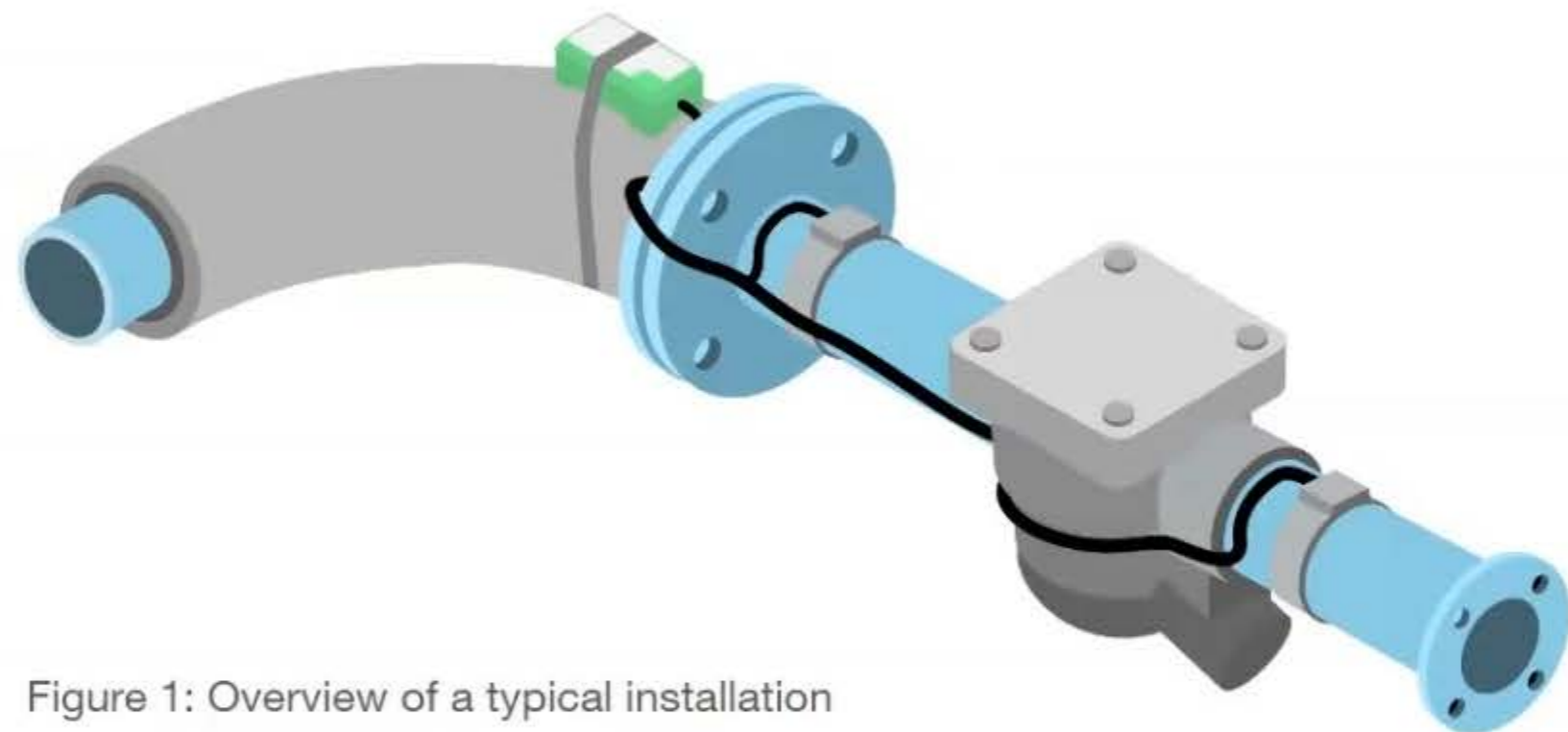


Figure 1: Overview of a typical installation

situation	$T_a$ (°C)	$T_b$ (°C)
Normal	110 - 120	70 - 80
Leakage	100 - 110	90 - 100
Blockage	90 - 100	60 - 70

Table 1: Failure modes and expected Temp readings

# Detect and prevent Lubrication Faults

## Vibration Sensor Use Case



### The Challenge:

Traditionally, determining the correct lubrication scheme is exceptionally challenging for engineers, as levels vary depending on the demands and use of equipment. Incorrect lubrication levels contribute significantly to unnecessary damage. SolidRed provides reliable guidance to engineers.

### The Solution:

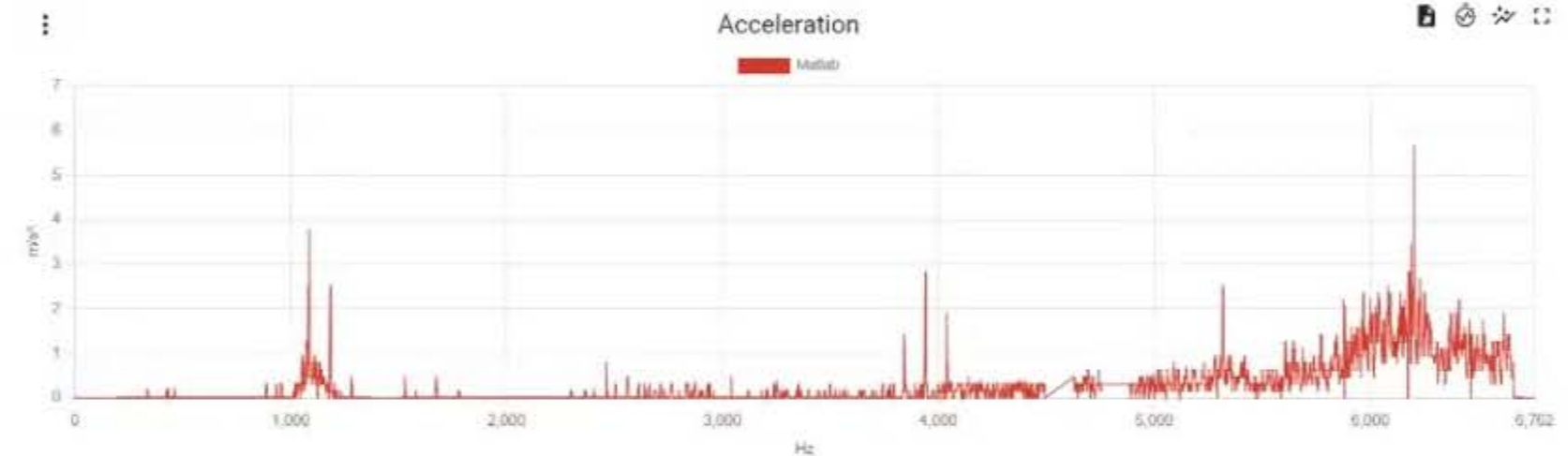
With a NEON vibration sensor and SolidRed analytics, engineers can spot, via the acceleration spectrum, the immediate signs of metal-to-metal wear, indicating that an asset is incorrectly lubricated. Also, by identifying any abnormal behaviour, SolidRed helps engineers correct lubrication schemes.

### Products Used:

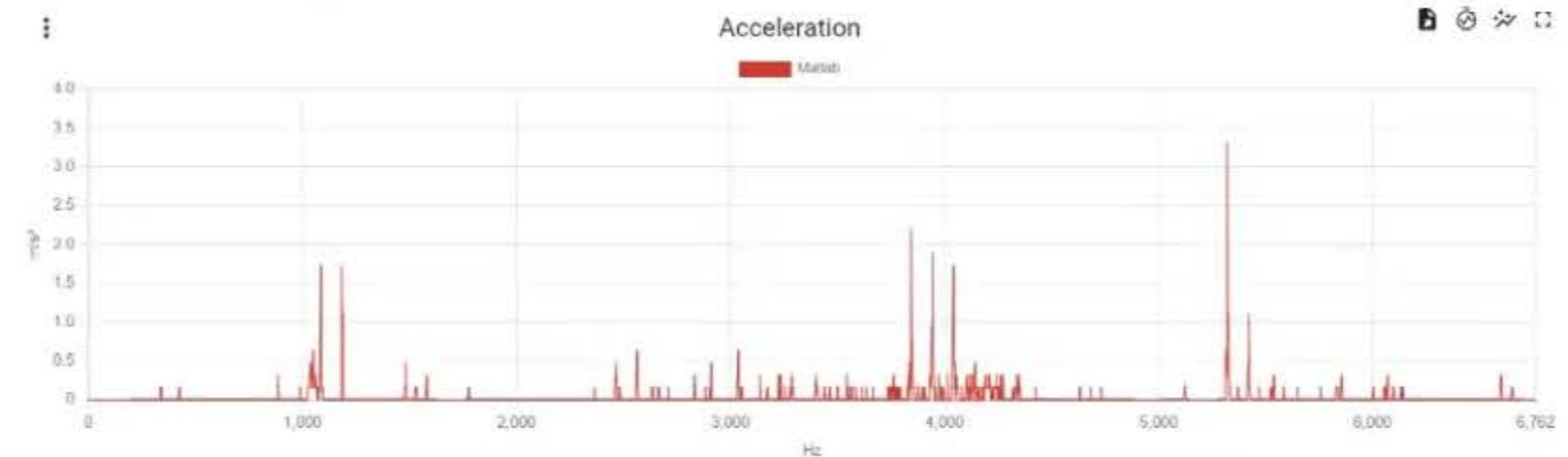
- NEON Vibration Sensor
- SolidRed Software Suite

### Key Benefits

- Insight into optimum lubrication levels extends the lifetime of assets
- Full FFT measurement for deeper analysis and micro-level insights
- 5Hz to 6.6 KHz bandwidth unique in preventative solutions



Data Insight 1: Before, large haystack at the end of the spectrum indicating over-lubrication



Data Insight 2: After, lubrication correction clearly visible in SolidRed



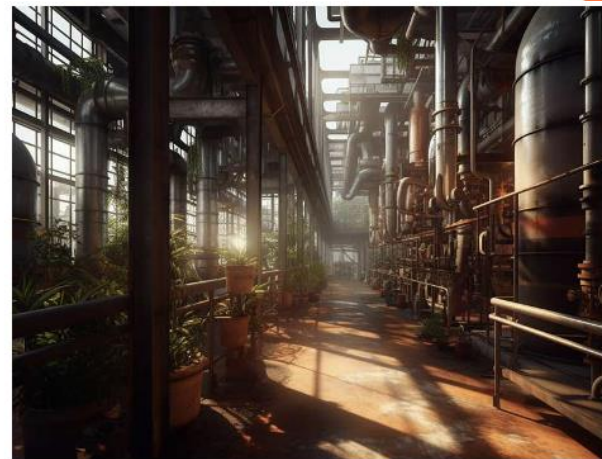
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# Asset Tracking in Hazardous Environments with Abeeway's ATEX/IECEx-Certified Trackers

Rohit Gupta



# A versatile catalogue of trackers to match a wide variety of vertical applications



## Industrial tracker

Large battery, hardened casing, high-precision tracking : designed to last *IP65, 19Ah type D battery.*  
*Up to 3 years battery life in motion tracking mode at 120 position per day.*



## Compact tracker

Solid and lightweight, built for heavy-duty tracking.  
*Asset tracking and management, even in the harshest environments.*  
*3xAAA 2.7Ah replaceable batteries, IP 68, ATEX/IECEX Zone 0/2 certified, temperature & motion sensors*  
*Up to 4 years battery life in LP GPS at 24 fix per day.*



## Micro tracker

Light, handy, yet powerful. Enables you to track and protect things (or people and pets) of value.  
*IP65, 450mAh rechargeable battery*  
*Buzzer, multimode button.*

### Battery life :

- *Proximity mode : 5 days to 2 weeks depending on data precision*
- *Location mode : 90 days battery life at 40 fix per day with indoor/outdoor positioning.*



## Smart Badge

Sleek, smart, and multi-functional.  
ideal for worker protection and zone alerts  
*IP65, ATEX Zone 2 certified, Zone 1 certification (in progress) Buzzer with 70dB high volume, industrialized magnetic connector, 1300mAh rechargeable battery, multimode button.*

### Battery life :

- *Proximity mode : 1 to 2 months depending on data precision*
- *Location mode : 120 days battery life at 60 fix per day with indoor/outdoor positioning.*



# COMPACT TRACKER

Microsoft

Azure  
Certified  
Device



ATEX/IECEX Zone 0-20  
ATEX Zone 2-22



Marketplace Ordering link: [here](#)

LoRa™  
Alliance  
Certified

## Geolocation technology



GPS



A-GPS



WiFi sniffer



BLE

## LoRaWan Specifications

LoRa class A; 16 dBm for EU; 21.5dBm EIRP max; CE;

## HW configuration

Size : 112mm x 66mm x 33mm, very modular fixation

Waterproof enclosure (IP68); IK08, tropicalised PCB.

Functional temperature range -20°C à + 65°C

Temperature sensor, 3D Motion sensor ; Magnetic switch (option)



## Power management

Designed for long Battery life time 8Ah Battery (Type AA/3.6V Li-SOCl<sub>2</sub>)

Low stand-by current

Supports high peak current For high output power (20dBm mode)

## Programmable Functionalities

Motion Tracking / Permanent track/ Start & Stop / Activity Tracking / Standby

Geofencing: Send notification when leaving/entering a specified zone

Activity rate: Monitor operating period with on board sensors

## ATEX/IECEX

ATEX/IECEX Zone 0-20 and ATEX/IECEX Zone 2-22 certified for use in hazardous/explosive environments

A tracker designed for asset tracking/management in industrial environment

**NEW**

Low power ATEX/IECEX BLE beacon manageable over LoRaWAN

# Industrial Manageable ATEX Beacon

Availability: NOW



Microsoft

Azure  
Certified  
Device



LoRa  
Alliance  
Certified



Marketplace Ordering link: [here](#)

## Beaconing Formats

Eddystone

iBeacon

AltBeacon

Quappa

## LoRaWAN® Specifications

LoRaWAN class A; 16 dBm for EU; 21.5dBm EIRP max; CE; FCC

## HW specification

Size : 112mm x 66mm x 33mm, very modular fixation  
Waterproof enclosure (IP68); IK08, tropicalised PCB.  
Functional temperature range -20°C to + 65°C  
Temperature sensor, Magnetic switch (option)



## Power management

Designed for long Battery life 8Ah battery (Type AA/3.6V Li-SOCl<sub>2</sub>)  
Supercapacitor to protect against battery passivation  
Low stand-by current  
Supports high peak current for high LoRaWAN Tx power (20dBm mode)

## Programmable Functionalities

Programmable using Abeeway app or over LoRaWAN

## ATEX/IECEX

ATEX/IECEX Zone 0 and ATEX/IECEX Zone 2 certified for use in hazardous/explosive environments

A BLE beacon designed for asset tracking in industrial environment

**NEW**

Low power ATEX/IECEX BLE beacon manageable over LoRaWAN

# Abeeway Smart Badge

Availability: NOW



Microsoft

Azure  
Certified  
Device



LoRa  
Alliance  
Certified



Marketplace Ordering link: [here](#)

## Beaconing Formats

Eddystone

iBeacon

AltBeacon

Quappa

## LoRaWAN® Specifications

LoRaWAN class A; 16 dBm for EU; 21.5dBm EIRP max; CE; FCC

## HW specification

Size : 104mm x 68 mm x 11 mm

Waterproof enclosure (IP65);

Functional temperature range -10°C to + 55°C

Temperature sensor,



## Power management

Rechargeable 1.3Ah battery (Rechargeable Li-Po)

## Programmable Functionalities

Programmable using Abeeway app or over LoRaWAN

## ATEX/IECEX

ATEX/IECEX Zone 1 (In progress) and ATEX/IECEX Zone 2 (certified) for use in hazardous/explosive environments

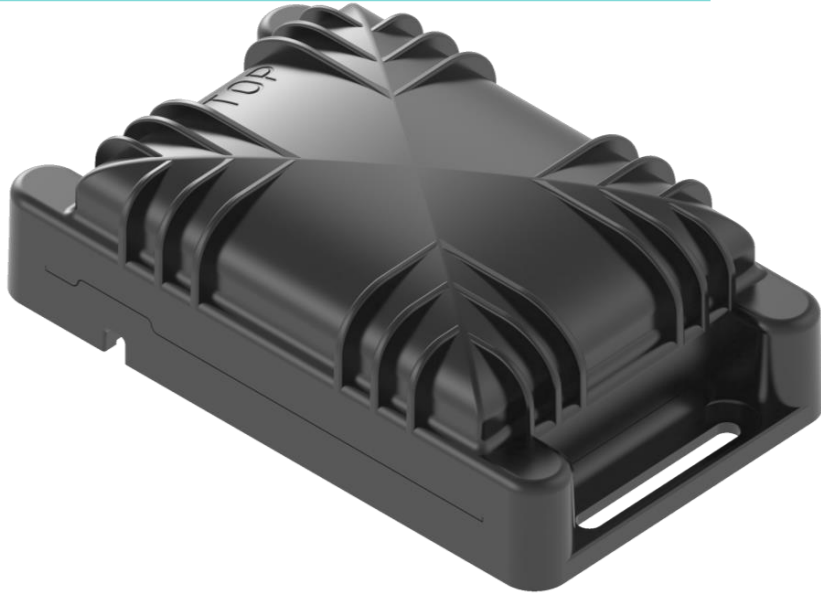
A BLE beacon designed for asset tracking in industrial environment

# Combo LPWAN Compact Tracker

Availability: H1'2023

**NEW**

Compact Tracker combining  
LoRaWAN, LTE-M & NB-IOT



## Geolocation technology



GPS



A-GPS



Wifi sniffer



BLE

## LoRaWAN® Specifications

LoRaWAN class A; 16 dBm for EU; 21.5dBm EIRP max; CE

## Cellular Specifications

LTE-M and NB-IOT

Supported bands: 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 18, 19, 20, 25, 26, 28, 66, 70, 71, 85);

Total Radiated Power (TRP) = 18dBm

## HW specification

Size : 112mm x 66mm x 33mm, very modular fixation

Waterproof enclosure (IP68); IK08, tropicalised PCB.

Functional temperature range -20°C to + 65°C

Temperature sensor, 3D motion sensor, Magnetic switch (option)



## Power management

Designed for long Battery life 8Ah battery (Type AA/3.6V Li-SOCl<sub>2</sub>)

Supercapacitor to protect against battery passivation

Low stand-by current

## Programmable Functionalities

Motion Tracking / Permanent track/ Start & Stop / Activity Tracking / Standby

Geofencing: Send notification when leaving/entering a specified zone

Activity rate: Monitor operating period with on board sensors

Leverages [Sequans GM02S module](#)  
and [Abeeway-Murata 1WL](#)  
[Geolocation module](#)



For more information: [here](#)

ATEX Certification: In progress

A tracker designed for asset tracking/management in industrial environment

# LoRaWAN Relay

Availability: Q1'2023

**NEW**

Compact Tracker configurable as LoRaWAN Relay



Leverages [Abeeway-Murata 1WL Geolocation module](#)



## Use Case

Reduce infrastructure CAPEX to ensure target coverage at the edge

## LoRaWAN® Specifications

LoRaWAN class A; 16 dBm for EU; 21.5dBm EIRP max; CE  
LoRa Alliance Relay specification (TS011-1.0.0 Relay)

## HW configuration

Size : 112mm x 66mm x 33mm, very modular fixation  
Waterproof enclosure (IP68); IK08, tropicalised PCB.  
Functional temperature range -20°C to + 65°C  
Temperature sensor, Magnetic switch (option)



## Power management

Designed for long Battery life 8Ah battery (Type AA/3.6V Li-SOCl<sub>2</sub>)  
Supercapacitor to protect against battery passivation  
Low stand-by current  
Supports high peak current for high output power (20dBm mode)

ATEX Certification: In progress

A Relay designed for asset tracking/management in industrial environment

# ThingPark X Location Engine

Because there is no single-size-fits all geolocation technology

**Multi-technology** geolocation algorithm to the optimal location information.

Driving power efficiency one step further with our **Patented LP-GPS algorithm**

**Not only a point on a map** : Value-added capabilities like geofencing , DA-GPS, or alerting capabilities.

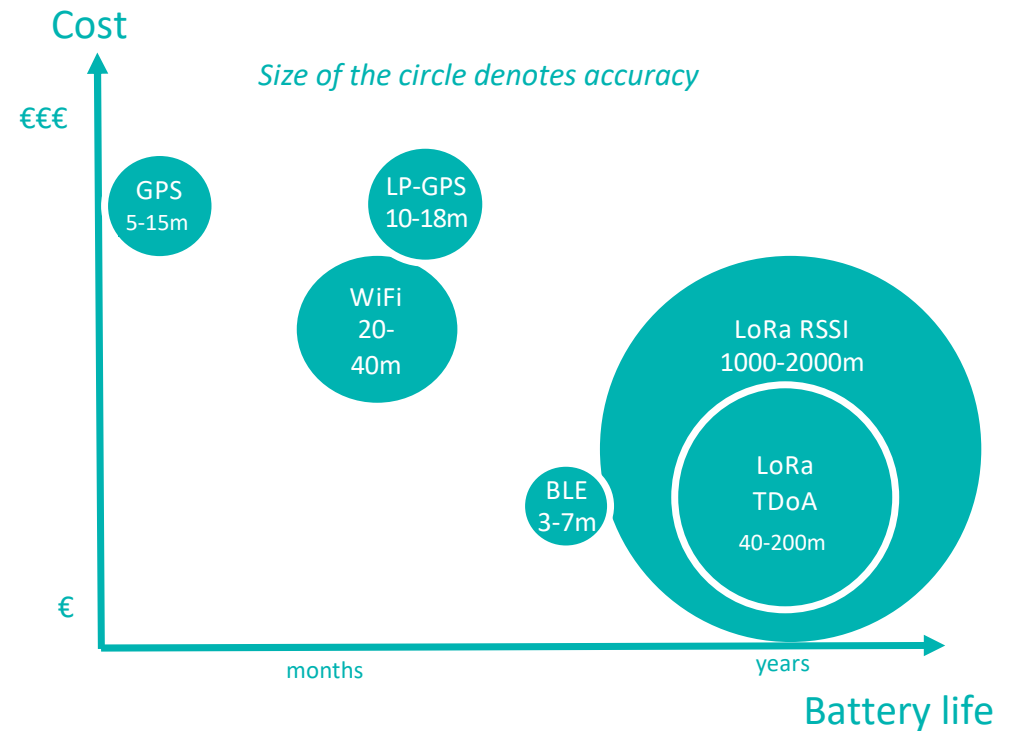
**Abeway Device Management**, to administor efficiently your fleet of trackers

**API Driven** framework to smoothly integrate with any application

Integrated with major **location database**



Finding continuously the optimal balance between power efficiency, accuracy, costs



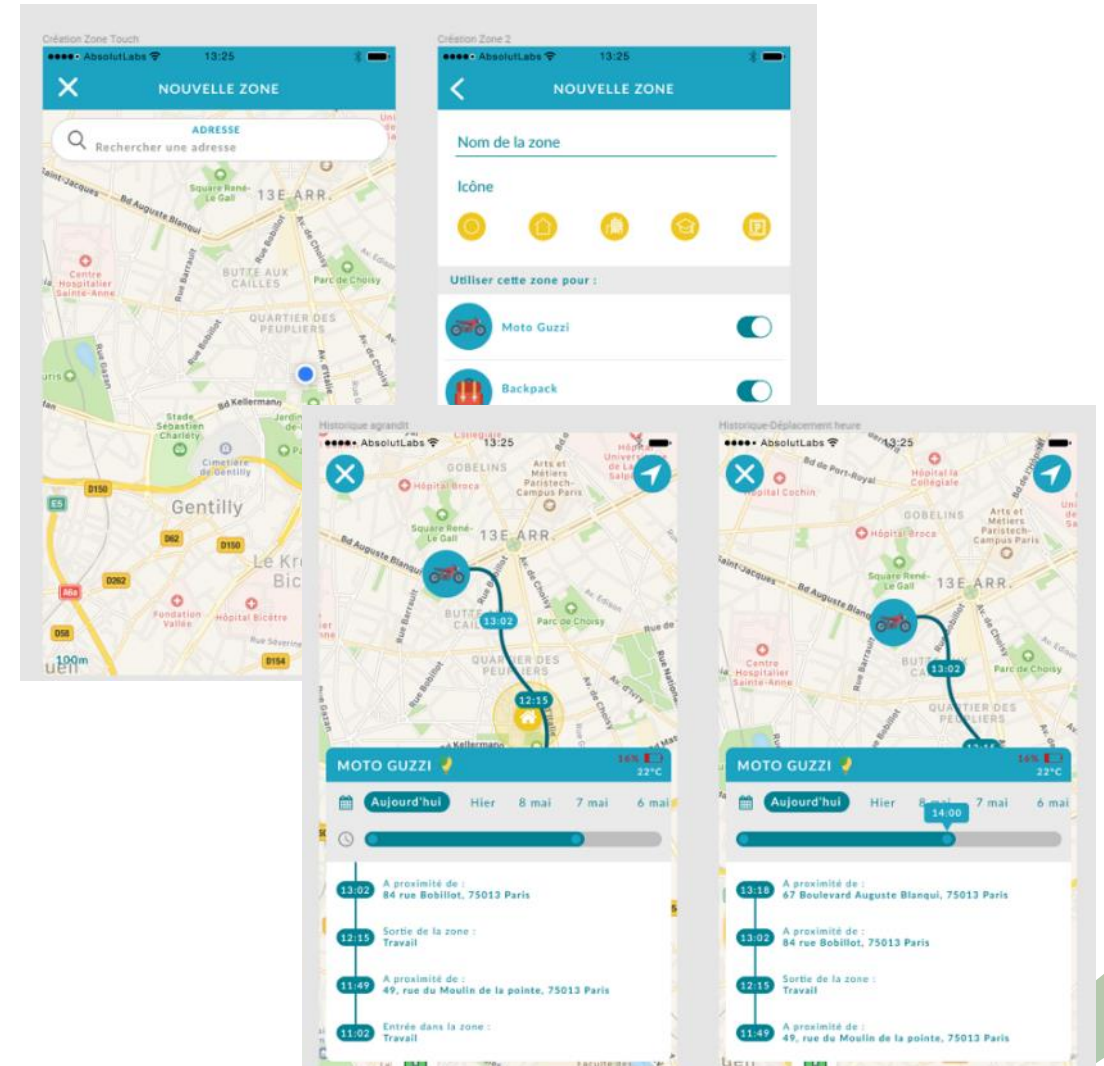


# Helping our customers to address the consumer market with the **Abeeway Mobile Application**

## User-friendly mobile app enabling multi-purpose consumer tracking

- Feature set : manage and customize your tracker, locate it on demand anywhere anytime, view its detailed motion history, set up alerts, change modes, share it with our users, update your tracker's firmware....
- Native apps on iOS and Android

*Designed to be easily customizable to fit any brand identity and particular needs under white label scenario*



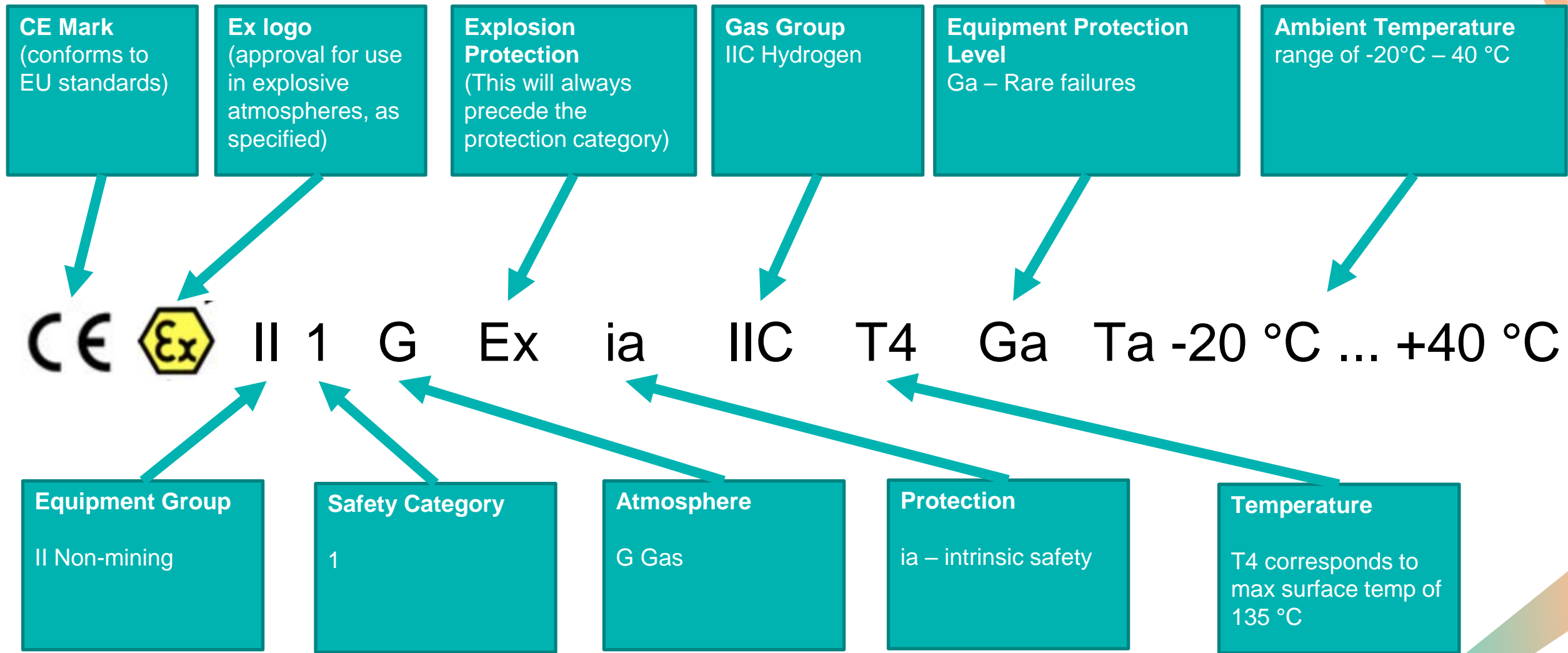
# ATEX/IECEX certification for Abeeway devices



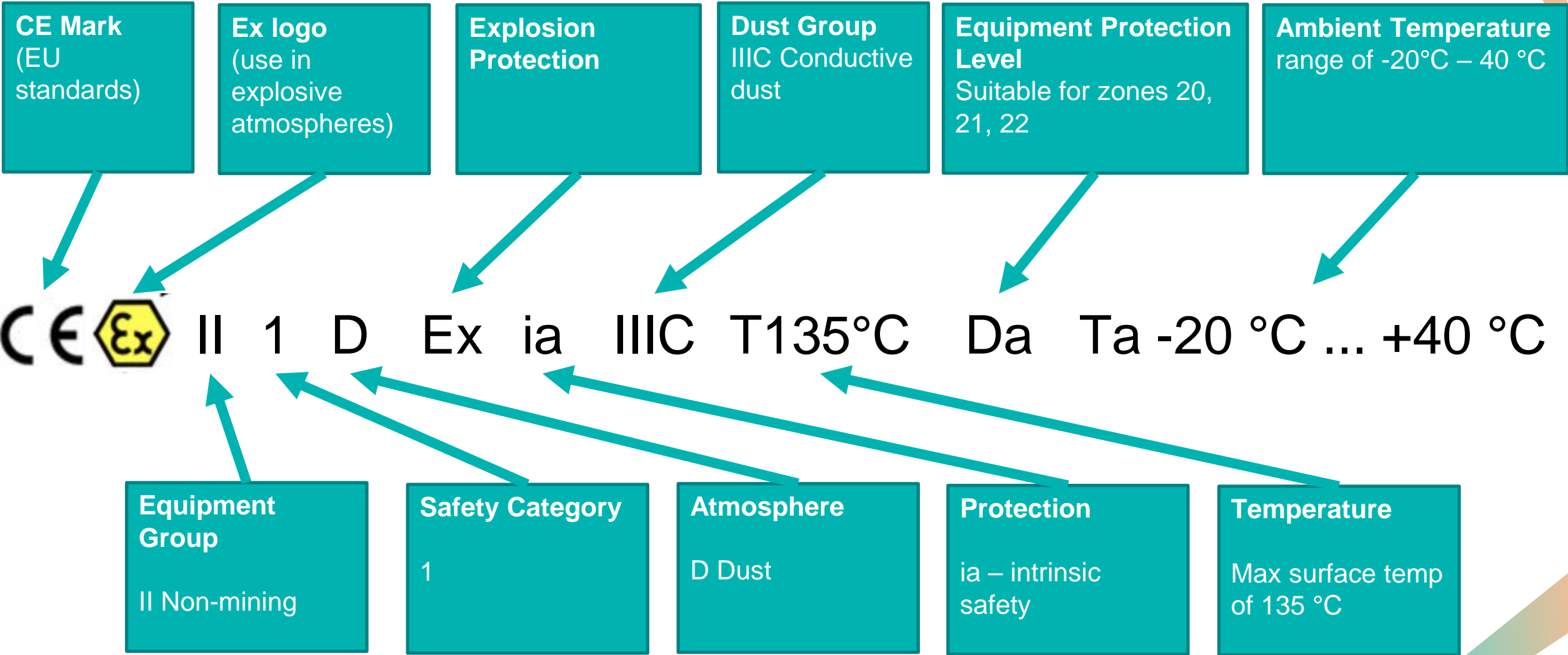
- ATEX/IECEX certification for Abeeway trackers for use in hazardous environments
- Typical Use case: Fixed offshore platforms, petrochemical plants, mines, flour mills, etc.
- Note:
  - Zone 0 includes certification for Zone 1/Zone 2 (Gas)
  - Zone 20 includes certification for Zone 21/Zone 22 (Dust)

	Supported tracker models
ATEX Zone 0-20 IECEX Zone 0	Compact tracker, Industrial Manageable ATEX Beacon
ATEX Zone 2-22	Micro Tracker V2, Smart Badge, Compact tracker, Industrial Manageable ATEX Beacon
ATEX Zone 1-21	Smart Badge

# ATEX Zone 0-20 Marking (Gas) for Compact Tracker (1/2)



# ATEX Zone 0-20 Marking (Dust) for Compact Tracker (2/2)



# ATEX/IECEX certification for Abeeway device

- For more information on ATEX/IECEX markings, see [here](#).



Compact Tracker Industrial Manageable ATEX beacon	<b>ATEX Zone 0:</b> II 1G Ex ia IIC T4 Ga Ta -20 °C ... +40 °C II 1D Ex ia IIIC T135°C Da Ta -20 °C ... +40 °C <b>ATEX Zone 2:</b> II 3G Ex ic nA IIC T4 Gc Ta -20 °C ... +40 °C II 3D Ex ic tc IIIB T135°C Dc Ta -20 °C ... +40 °C <b>IECEX:</b> Ex ia IIC T4 Ga Ex ia IIIC T135°C Da
Smart Badge	<b>ATEX Zone 1:</b> Ex II 2G Ex ib IIC T4 Gc Ex II 2D Ex ib IIIC T135°C Db <b>ATEX Zone 2:</b> Ex II 3G Ex ic IIB T4 Gc Ex II 3D Ex ic IIIB T135°C Dc
Micro Tracker V2	<b>ATEX Zone 2:</b> II 3 G Ex ic IIB T4 Gc (-20 °C ≤ Tamb ≤ +40 °C) II 3 D Ex ic IIIB T135 °C Dc (-20 °C ≤ Tamb ≤ +40 °C)



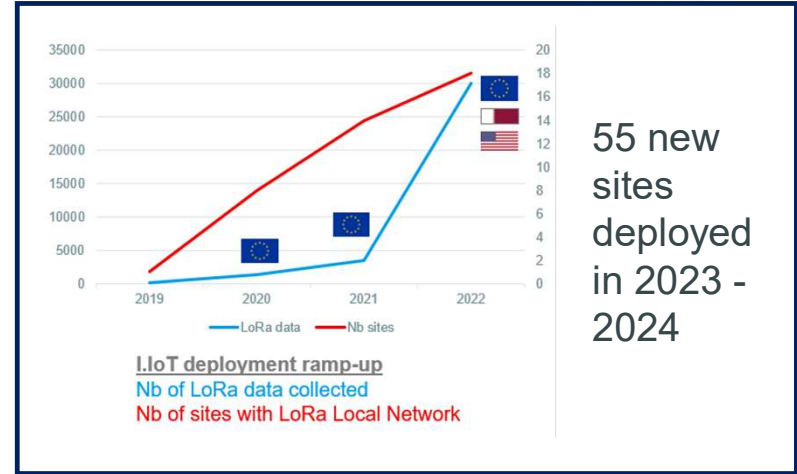
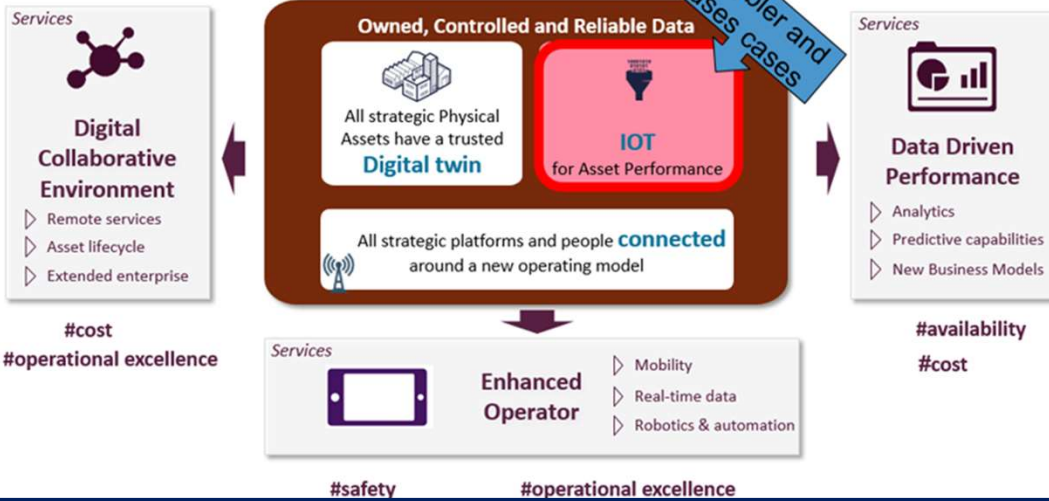
Industrial IoT for operational  
and availability  
excellence

2022-2023

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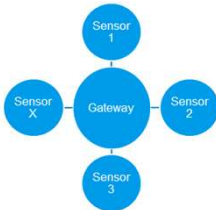
# Why IoT, Why LoRA?

I.IOT is a set of sensors, wireless, with battery, capable to send their data to the TotalEnergies Cloud Data Lake at the required frequency and to communicate between each other.



Private Network everywhere in the world

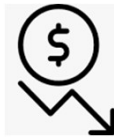
High gateways capabilities: > 5000 sensors



Automatic redundancy of gateways



Gateways coverage > 6 km



Low-cost sensors, Infrastructure and Installation / Hooks ups

Agnostic solution, does not depend on a provider, not a vertical solution !!!



New types of sensors according classic instrumentation



# A large set of sensors available on I.IoT Platform



Pressure



Temperature



Steam trap leakage



Valve Leakage / Real time Flare loss detection



Electrical measurements



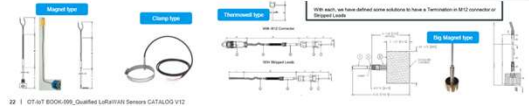
Building monitoring (T°c, Hygro, Motion, Voc, CO2, Noise,...)



Environmental conditions measurements (indoor/outdoor)



Vibration



Inclinometer / seismic sensors



Methane, HC, H2, NH3 Tracker



Switchboard monitoring (partial discharge, temperature)



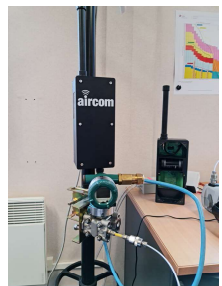
Corrosion



GPS (Outdoor) for asset tracking



Modbus /4-20mA convertor



Valve position



Radar level



Duct dust level measurement



Padlock



Explosive area certification

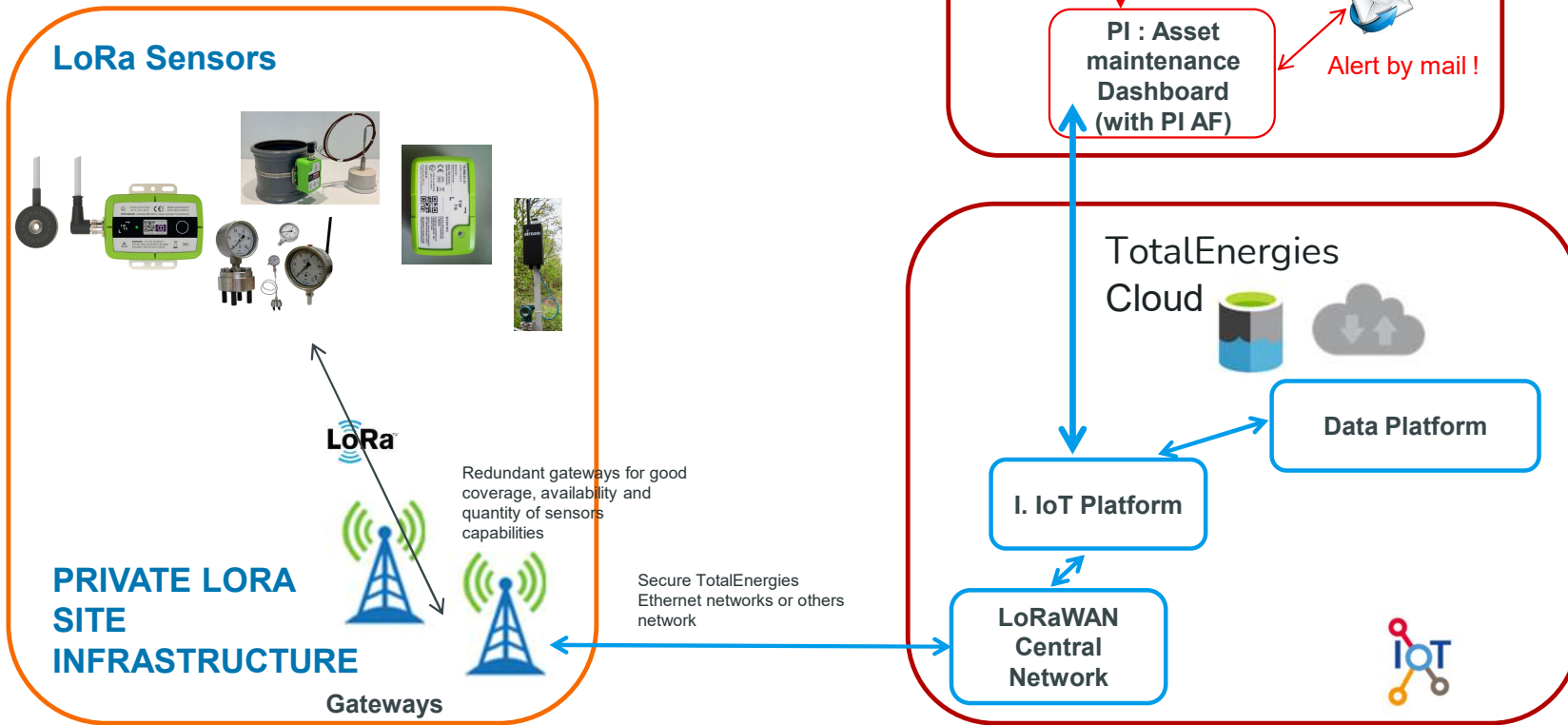
ATEX

IEC EX

UL / CSA



# I.IoT LoRa Infrastructure



CLOUD END USERS

# Use cases implementation ?



1

## PRODUCTION OPTIMIZATION

Pressure, temperature, flow... for data analytics



2

## AVAILABILITY / PREDICTIVE MAINTENANCE

Vibration, Temperature, acoustic on rotating equipment, electrical board, controlled valve....

3

## PRODUCTION LOSS PREVENTION

Leak detection (vibration, acoustic or delta temp. on Pressure Relief valve, drain and purge devices...), manual valves position...

4

## HSE / INTEGRITY

Environmental data, Connected padlocks, Thickness or Constraint measurements...

5

## LOGISTIC

Asset Tracking, Warehousing, Supply Chain...



6

## ENERGY EFFICIENCY

Power and water consumption management



## Use case examples



**A lot of uses cases to reduce unavailability, to have early detection, to have predictive approach, to have program for energy efficiency or carbon footprint reduction**






- **Power Monitoring Device (Consumption cartography, bad actor tracking, electrical model validation...)**
- **Flare monitoring, leakage to flare monitoring, valve leakage monitoring**
- **Machine monitoring (Early deep diagnostic to avoid failure and trip )**
- **Frozen detection (Avoid trip and flaring due to this topic)**
- **Steam trap leakage detection**
- **Sensors monitoring by discrepancy alert (compare existing sensor with IoT to avoid trip due to bad deviation)**
- **Early detection for process and operation**
- **Steam Heater cocking monitoring for tube (reduce time of unavailability)**
- **HDS heater casing high temperature detection for corrosion topic**
- **Electrical Heat cable or switchboard monitoring**
- **Technical room monitoring / Office monitoring**
- **.....**

# Anticipation of rotating machines' degradation

ONGOING

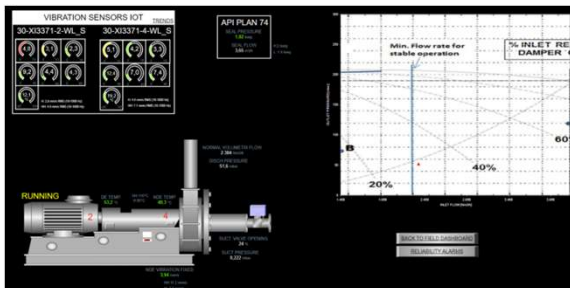
A solution for optimizing maintenance intervention plan and preventing flaring events / equipment shutdown via vibration monitoring or combination of temperature/vibration monitoring of rotating machinery (relying on IOT sensors).



- BRANCH**  
EP, RC, MS
- AFFILIATE**
-  TEP Italy
-  TEP Angola
-  TEP Nigeria
-  TEP Qatar
-  TEP UK
- RC NOR,  
TERA, TOA, FZN,  
TRM, DGS
- MS GEN
- DOMAIN**  
Operational  
Excellence  
Predictive  
maintenance
- USERS**  
Offshore  
Maintenance Team
- Onshore  
Maintenance CBM  
Engineer

## CHALLENGE

- Unplanned shortfalls / flaring events or unplanned maintenance interventions due to unplanned rotating machine degradation and/or unavailability.



## TECH CAPABILITIES



## SOLUTION

- Rotating machines have been equipped with IOT-Based Vibration Monitoring combined to temperature monitoring sensors in some affiliates. IOT has been selected as it is a quick- to-deploy, flexible and low cost solution.
- With FFT (Fast Fourier Transform) and others Spectrum Analysis solution, quick identification of abnormal behaviors such as : unbalance, resonance, misalignment, cavitation, lack of lubrication, bearing / gear defects, mounting / clearance / frictions... .
- Real time monitoring of IOT data from a collaborative environment (Smart Room)

## SCALABILITY

High scalability to all Assets

Investment into an IOT LORA infrastructure allowing low costs additional use cases relying on IOT sensors

## BENEFITS

### RESSOURCE OPTIMIZATION / SAFETY

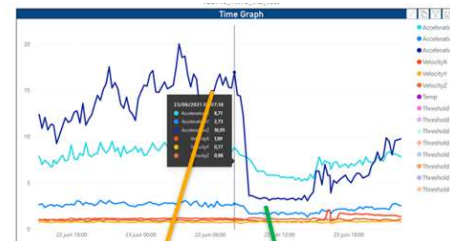
- **Reduction of vibration monitoring field services / of human intervention in hazardous area :**

### SHORTFALLS / GHG / MAINTENANCE OPEX REDUCTION

- **Reduction of production losses:**  
xx % @equipped machine tbc (RC hypothesis)
- **Reduction of unplanned flaring events @machine level.** Estimated XX % of reduction of overall GHG emission
- **Reduction of curative maintenance cost @equipped machine :** -XX %, reduce time-based maintenance routine, contribute to equipment life extension cycle.

# Benefits capability example

- Example from TRA , Franky Ost :”  
*On some motors we have a huge rising from motor bearing temperature but on this motor J 6403 B we had almost no temperature change.*
- *But vibration level at high frequent Accelerations was a little rising.*
- *This can help us in the future for example to reduce the amount of grease consumption.*
- *This Lora sensor will alert us early when something goes wrong with the machine, the process, the lubrication for example water ingress. Etc.*
- *With this sensor we not only have a certain value, we can start also a diagnostic intervention even from home. ( saving time, Traffic, CO2 😊 )*



Vibration Acc. Spectra Before lubrication J6403 B Motor

Vibration Acc. Spectra after lubrication J6403 B Motor

