

# mioty® - the future of sustainable wireless IOT communication

Josef Bernhard  
Fraunhofer Institute for Integrated Circuits IIS

12/10/2022



# mioty® - the future of sustainable wireless IOT communication

## Outline

---

- Low Power Wide Area Networks - Overview
- mioty® – Technical Overview
- Smart metering as most demanding application example
- Summary & Outlook

# Introduction

## LPWAN Overview

---

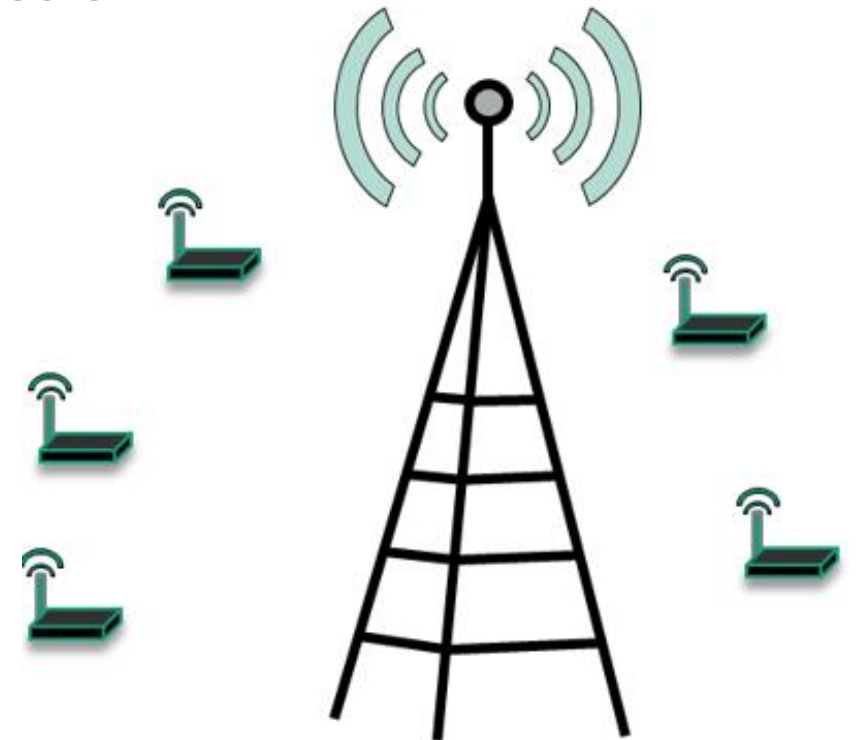
### Low Power Wide Area Networks (LPWAN) - a new class of radio communications for the Internet of Things (IoT)

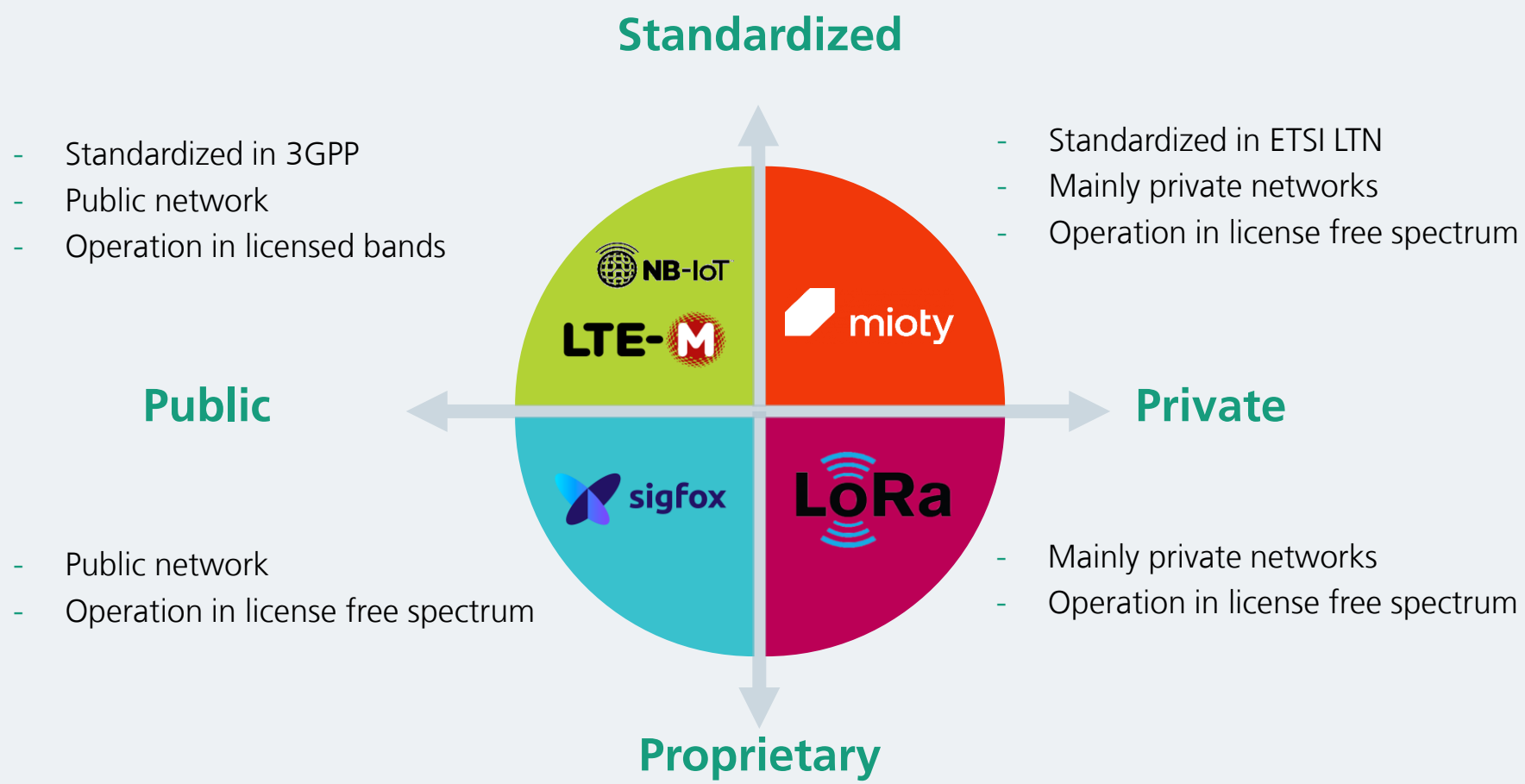
#### LPWAN are characterized by

- Star topology network with long communication range and distances of several kilometers
  - Alternatives are 'Walk by' or 'Drive by' or Meshed Networks
- Operation mainly in unlicensed spectrum for cost saving
  - but also solutions from cellular network operators
- Energy autarkic sensor nodes
  - with small amount of data
  - several years of autarkic operation from a battery

#### Challenges

- Keep the energy consumption low even at long communication range
- Handle the increased number of interfering signals and the massive number of network devices in a large coverage area





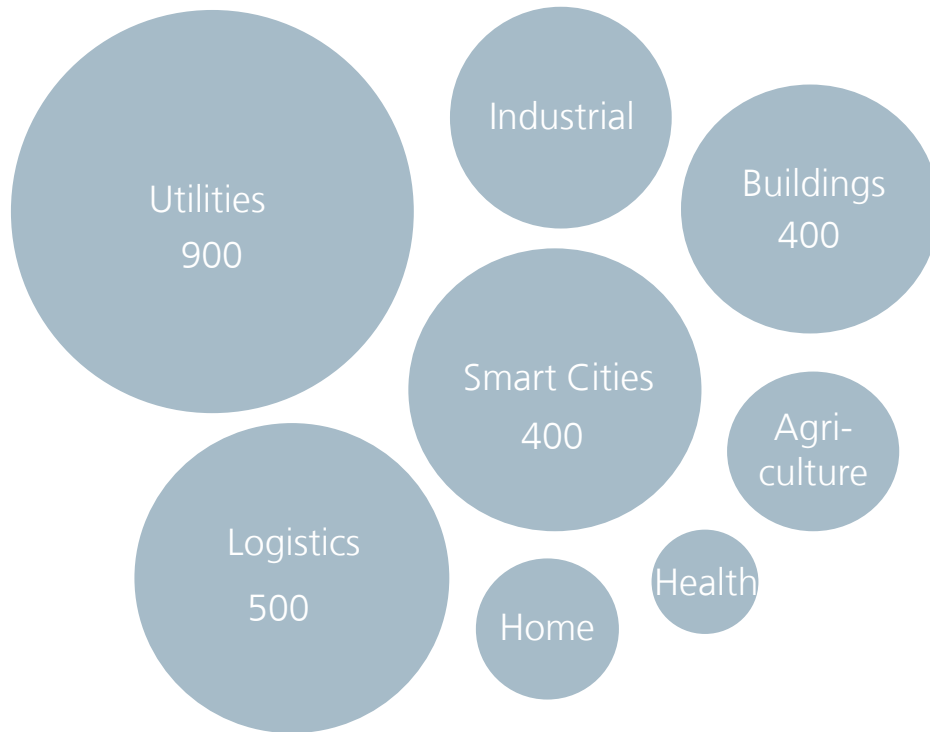
LPWAN Solutions  
Categorization of technologies

# Low Power Wide Area Networks

Growing number of connections

## Up to 3 Bn LPWAN Connections in 2026

Worldwide LPWAN connections by verticals (in millions)



Figures: based on IoT Analytics, Analysis Mason and own estimations of the mioty alliance

## Implications for LPWAN

Situation in 2026

- Billions of devices will send data in parallel
- High density of devices

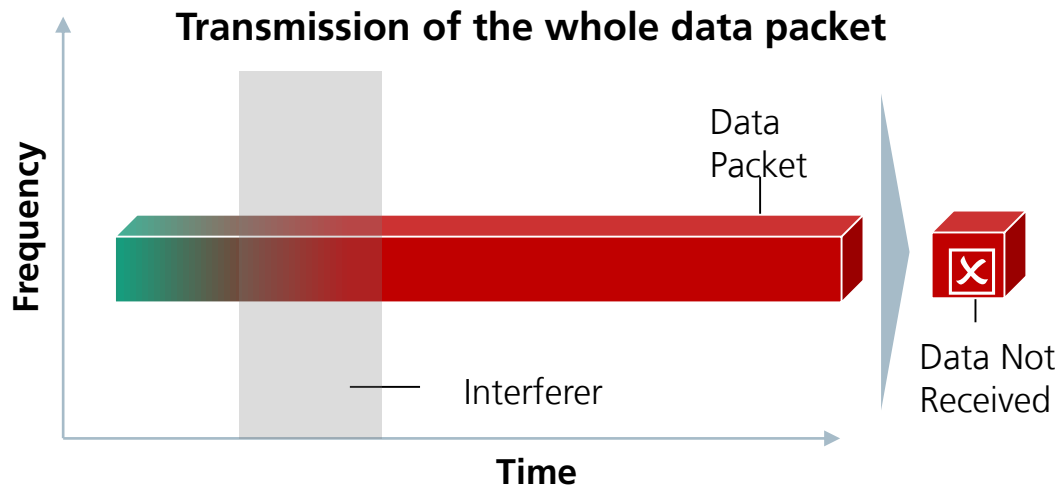
Impact

- Frequency spectrum will become crowded
  - Licensed spectrum shared between different services  
→ service priorities
  - Unlicensed spectrum shared between technologies  
→ interference problems will become worse
- Loss of information and data

Market Demand

- Reliable and robust communication solution that can handle the future growth of IOT devices

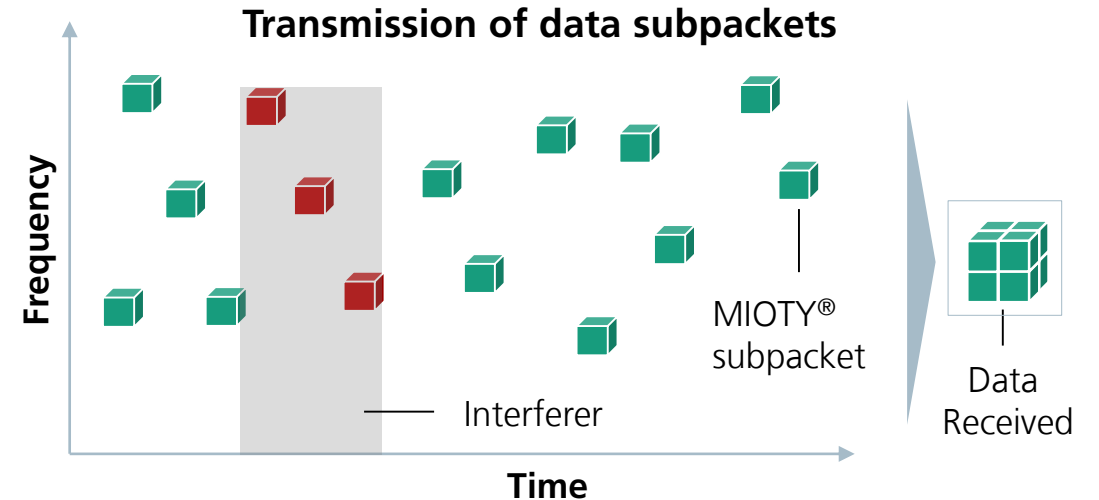
### Traditional Wireless Solutions



- The whole data packet is affected by interferer
- Lack of scalability due to Interference issues and coexistence problems with other radio networks
- Packet Error Rates (PER) over 10% are common
- Battery life is severely limited due to inefficient transmission methods

**Limited suitability for massive IoT-deployments**

### mioty: Telegram Splitting



- Only sub-packets affected by interferer
- Forward error correction affords up to 50% loss
- Telegram Splitting Multiple Access (TSMA) scheme with random subpacket distribution for high network capacity
- Transmission free periods allow battery recovery

**Achievement of unrivaled scale, density & reliability**

# The mioty® technology

## What makes it sustainable?

---

### Ultra Low Power

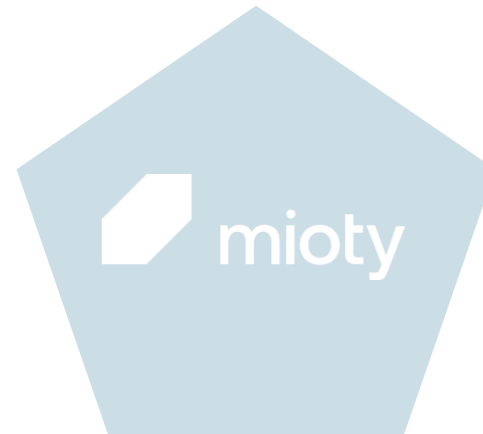
---

- Efficient modulation & coding for short transmission time
- Lightweight radio protocol
- Only 1,2 mJ per radio burst, 35 mJ for 10 Byte data (3x lower than other LPWAN)
- Transmission free period for battery recovery

### Superior Coexistence

---

- Efficient modulation & coding for low spectrum occupancy
- Short radio bursts of 15 ms with transmission free periods for polite spectrum access
- Robustness against any type of interferer for improved coexistence with growing number of inband radio services



### Network Capacity

---

- TSMA random channel access with very high throughput even in interfered and crowded bands
- Increased network capacity of 3,5 million connections per day in a 200 kHz Band

### Standardized Ecosystem

---

- TS-UNB invented by Fraunhofer IIS and specified by a group of radio experts within ETSI LTN
- mioty alliance, a group of industrial companies driving the technology for different markets

### Hardware Agnostic

---

- Use of standard MSK modulation supported by most commercial Sub-GHz chipset
- Software defined solution with small footprint on processing power and memory size
- Currently implementations for chipsets of four different semiconductor vendors available, more will come



# The mioty® technology

## ETSI Low Throughput Networks as baseline

### Low Throughput Networks (LTN) is the LPWAN standardization framework within ETSI

- First standardization activity on low power wide area networks starting in 2013
- Future oriented machine to machine communication where data volume is limited and low latency is not a strong requirement

### The LTN specification consists of three documents

1. TR 103 249: LTN use cases and system characteristics published 2017-10
2. TS 103 358: LTN architecture published 2018-06
3. TS 103 357: LTN protocols for radio interface published 2018-06  
Part "TS-UNB radio protocol" of this document is the baseline for mioty®

### ETSI IPR policy ensures technology access

- Patent licenses for TS-UNB are available from patent pool managed by SISVEL INTERNATIONAL S.A. (<https://www.sisvel.com/licensing-programs/wireless-communications/mioty/introduction>)

ETSI TS 103 357 V1.1.1 (2018-06)



Short Range Devices;  
Low Throughput Networks (LTN);  
Protocols for radio interface A



# The mioty alliance e.V.

## Overview



Association of industrial companies and research organizations to promote mioty® as the global standard for massive IoT

### Goals:

- Create an interoperable ecosystem along the entire IoT value chain based on ETSI Low Throughput Networks specification
- Product certification for usage of mioty® logo
- Enhancing the technology towards new verticals and applications

### Members:

- Research and technology leaders driving an open, interoperable and standardized ecosystem
- Leveraging leading edge technologies e. g. in the field of AI, Energy Harvesting or Localization

<https://mioty-alliance.com/>

## Full Members

DIEHL  
Metering

Fraunhofer  
IIS

TEXAS  
INSTRUMENTS

STACKFORCE  
embedded connectivity solutions

WIKAI

RAGSOL

ifm

SWISSPHONE

WEPTTECH

LORIO T

## Associated Members

AST-X

Friendcom

Radiocrafts  
Embedded Wireless Solutions

codecentric

cpm-t-ac  
Let things talk

LANSEN

SILICON LABS

W!

roundSolutions  
For A Wireless World

AncudIT

AGVOLUTION

FAU

tecnun  
Universidad de Navarra

Sentinum  
FORGING FUTURE

STADTWERKE  
GARBSEN

www.iot-shop.de

SAF

ST  
life.augmented

PAESSLER  
THE MONITORING EXPERTS

ResIoT

safactory

LZE

RELISTE  
Wir liefern Lösungen

ex|cellent  
solutions

BEHRTECH

EasyMeter

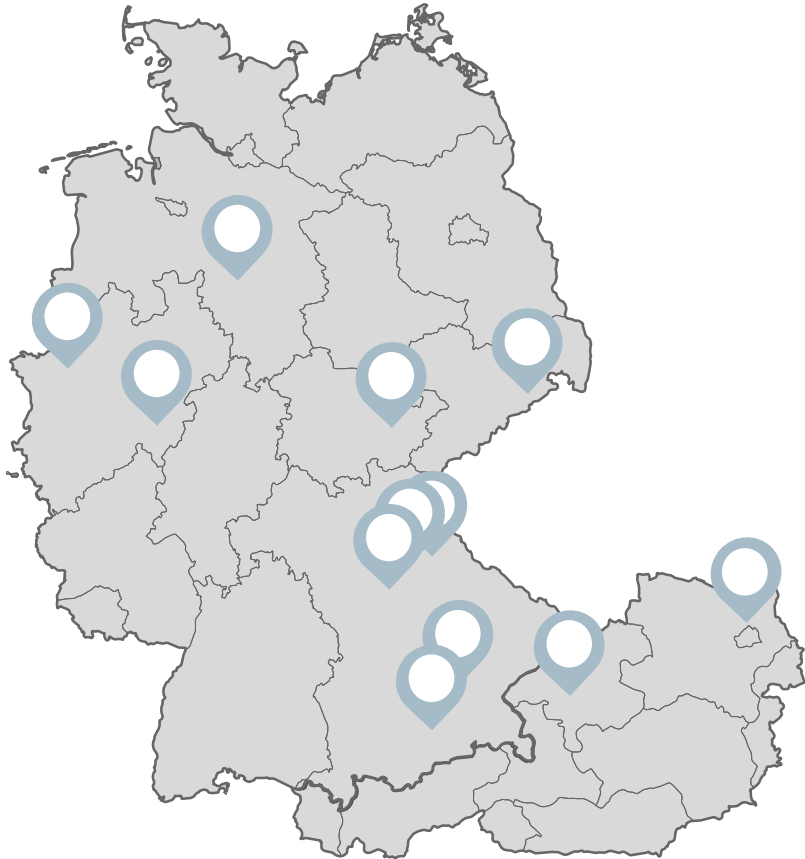
HELIOT  
EUROPE

MIROMICO

# Smart Metering / Smart City

The most demanding application

## Exemplary Projects in Europe



## Requirements

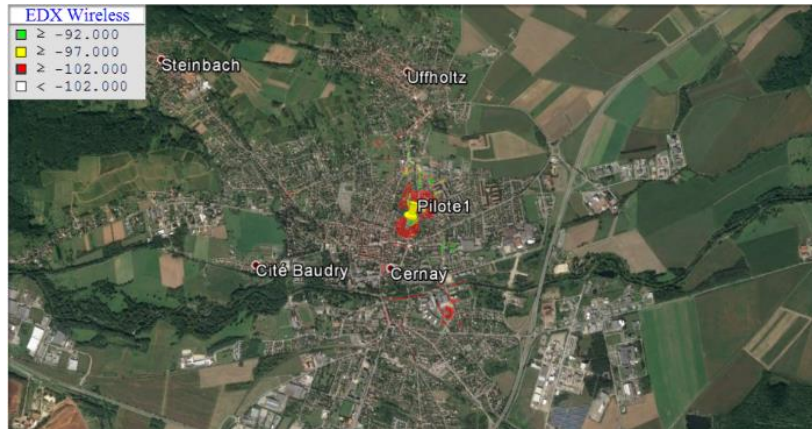
- High number of meter devices in dense urban area
- Robust radio transmission for high quality of service
- Long battery lifetime of 10+ years
- Integration of devices from different vendors
  - standardized solution
  - support of different hardware platforms
- Long range and scalability for optimized network infrastructure

**Perfect fit for mioty®**

# Long Range and Scalability

With a high density of devices mioty achieves a significantly higher range compared to existing LPWAN

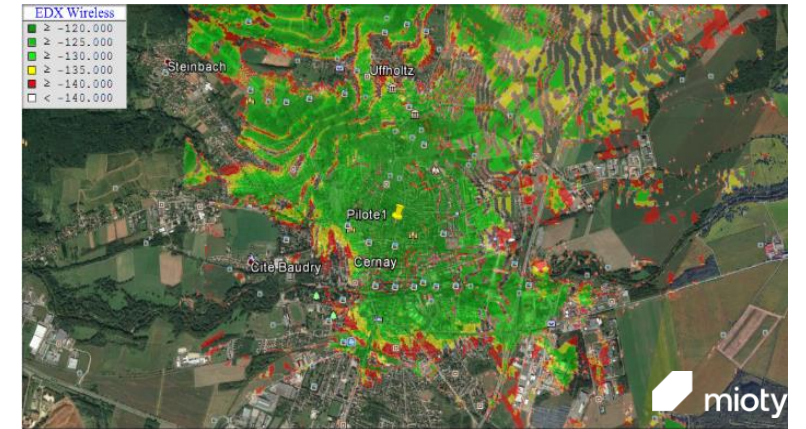
## OMS



## Existing LPWAN



## mioty



### Scalability (Network Capacity)

**between** 5,000 to 150,000 messages per day per base station

### Scalability (Network Capacity)

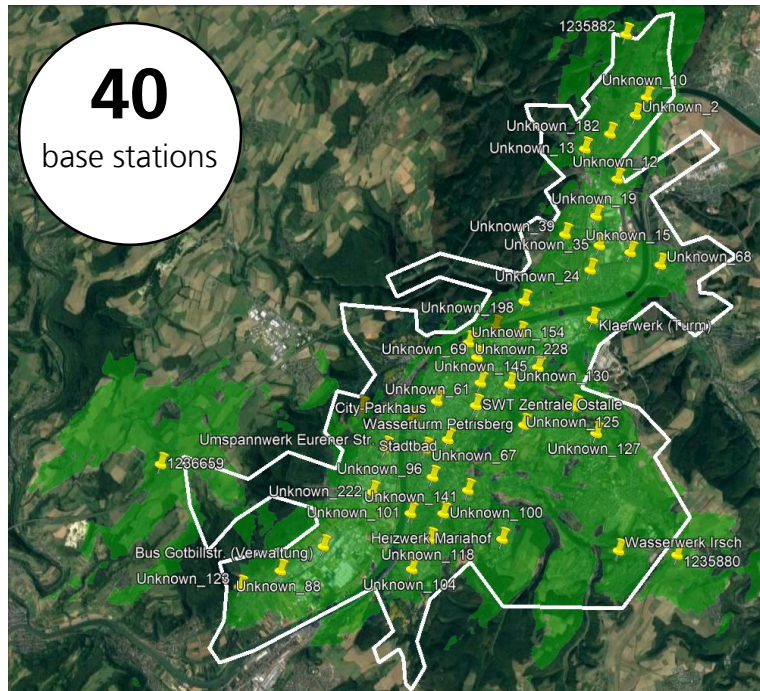
3.5 Mio. messages per day per base station



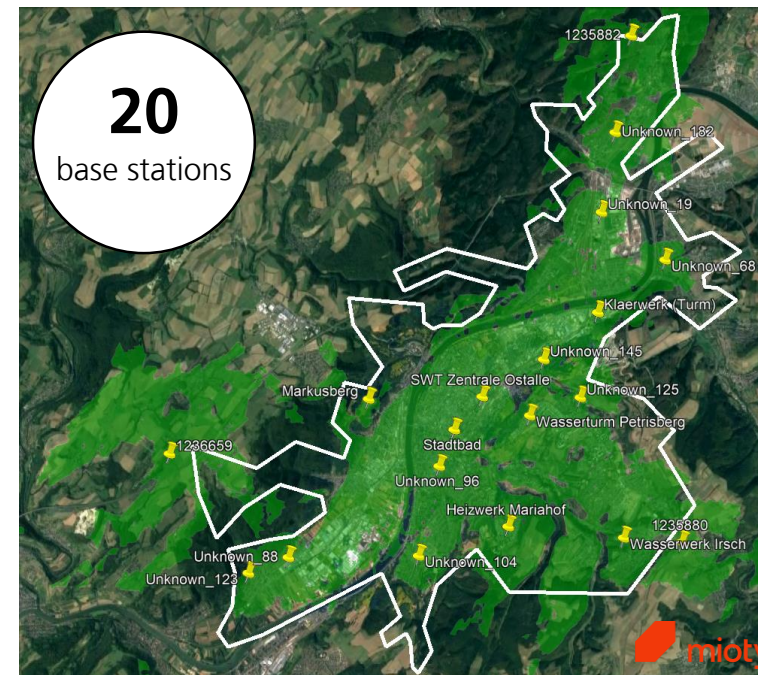
# Cost Efficiency

CAPEX and OPEX can be drastically reduced through lower installation and maintenance costs

## Existing LPWAN



## mioty



- 50% less base stations needed
- Reduced total cost of ownership

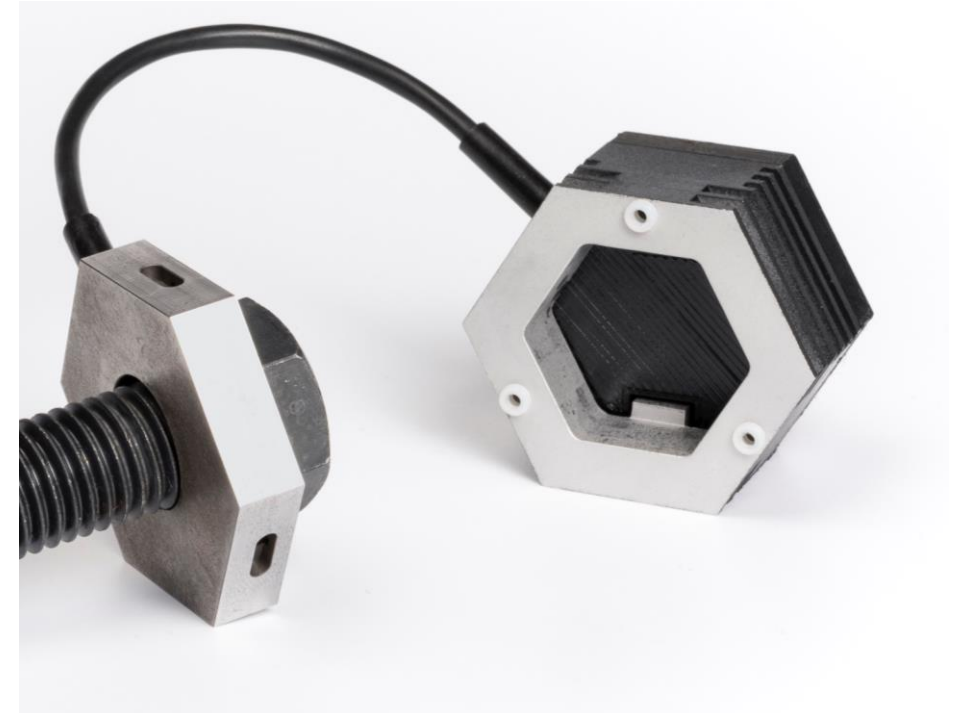
Source: Diehl Metering, Location: Rheinland Pfalz; Population: 110 000 , Area 11,7 km<sup>2</sup>

### **With the innovative Telegram splitting approach mioty® builds a real sustainable solution with**

- Efficient use of spectrum
- Superior coexistence with other services
- High network capacity
- Support of many available chipset platforms
- Ultra low power operation enabling energy harvesting solution

### **It also allows backward compatible enhancements to expand use cases by new features**

- Latency constraint downlink communication (mioty Class B/C) for e.g. building automation
- Multicast / Broadcast communication for e.g. alarm
- Localization for e.g. asset tracking
- mioty is ready for satellite IOT



**Smart Screw Q-Bo:** Energy-self-sufficient sensor for monitoring of assets such as wind turbines

# Contact

---

Josef Bernhard  
Self Powered Radio Systems  
Phone +49 911 58061-3300  
[Josef.bernhard@iis.fraunhofer.de](mailto:Josef.bernhard@iis.fraunhofer.de)

# THANK YOU