Fraunhofer MIOTY® - The new communication standard for the Internet of Things
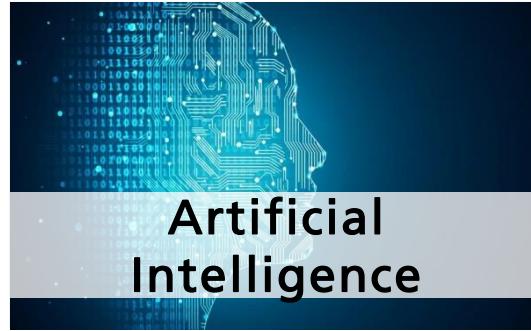

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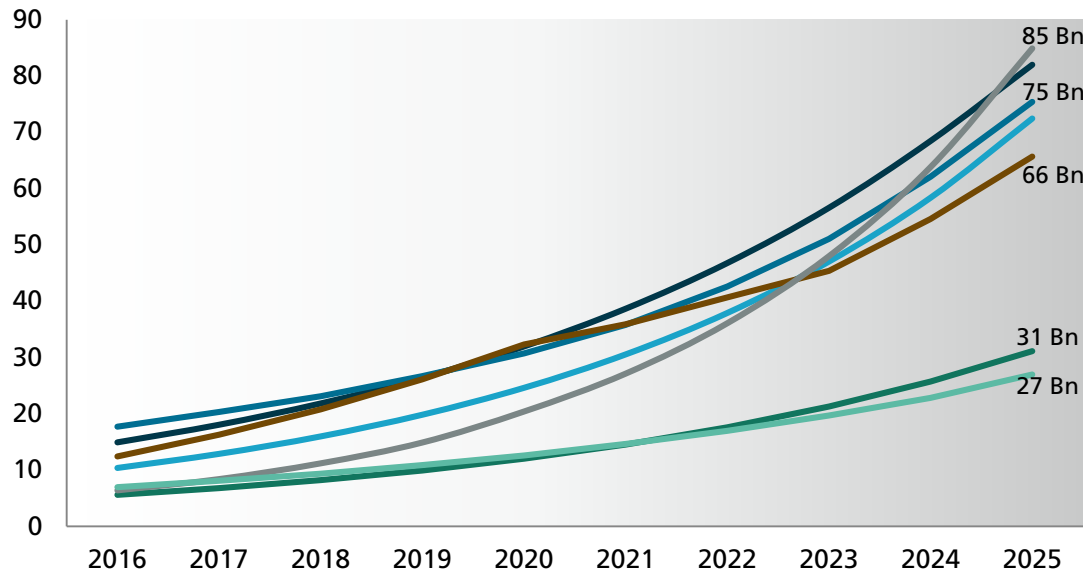IIS

Digitalization
Disruptive Trends

Internet of things

Artificial Intelligence

Augmented Reality

Energy Harvesting

Blockchain

Drones

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Global IoT Landscape
Projected exponential increase of IoT devices

Number of IoT devices (in billions)

	Source	Date	CAGR
	Gartner	2017	33,6%
	IDC	2017	20,9%
	IHS Markit	2016	17,5%
	ABI Research	2016	24,1%
	Frost & Sullivan	2017	20,3%
	Ericsson	2017	21%
	Machina Research	2016	16%

How to connect the objects with the internet?

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Low-Power Wide-Area Networks (LPWAN)
Wireless IoT technology perspective

Strategic Positioning of LPWAN Technologies
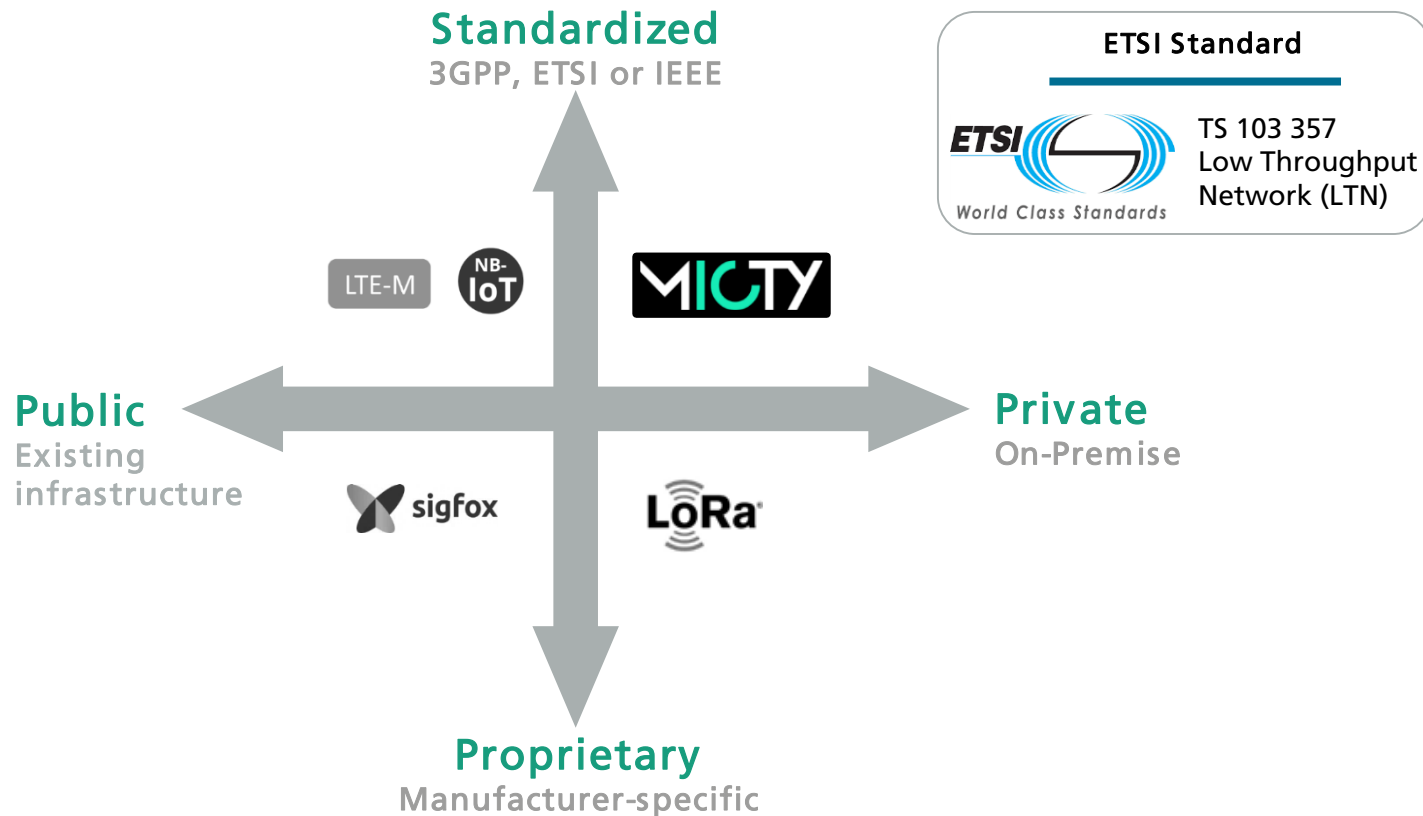
LPWAN Process Chain

MIOTY = Connectivity

1 Sensors	2 Communi-cation	3 Base Station	4 Platform & Services	5 Visualization	6 Customer
Sense data	Transmit data	Receive data	Analyze data	Visualize data	Improve Process
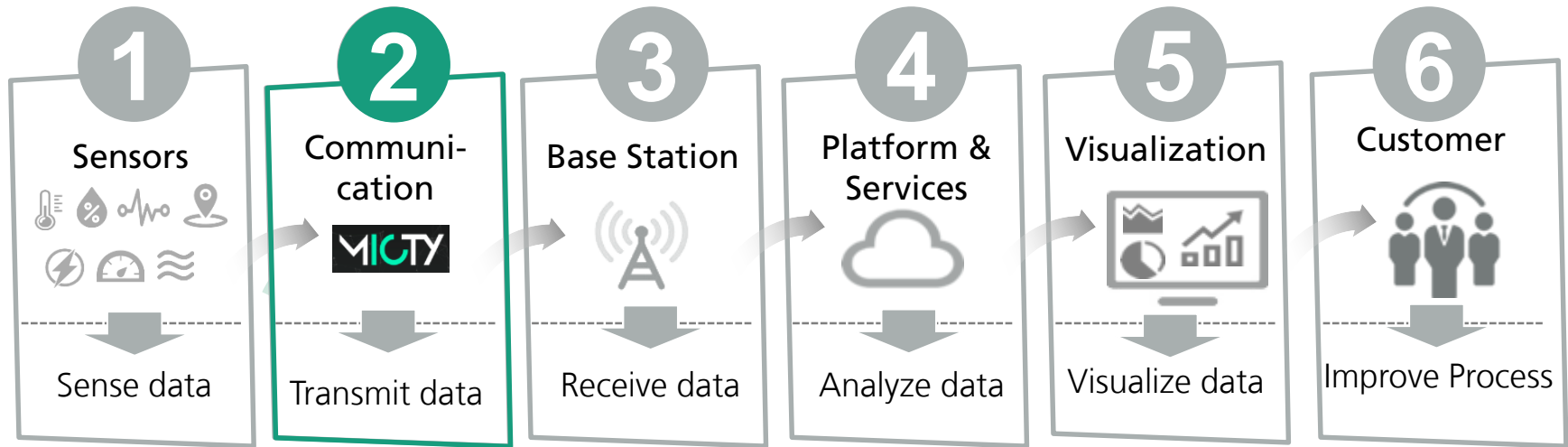
Big Data Aggregation | **Big Data Storage, Analytics & Visualization**

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MIOTY® - A unique LPWAN communication standard leveraging Fraunhofer's Telegram Splitting technology

MIOTY™ Telegram Splitting

Transmission of data subpackets

Interferer

MIOTY™ Subpacket

Frequency

Time

Traditional LPWANs

Transmission of the whole data packet
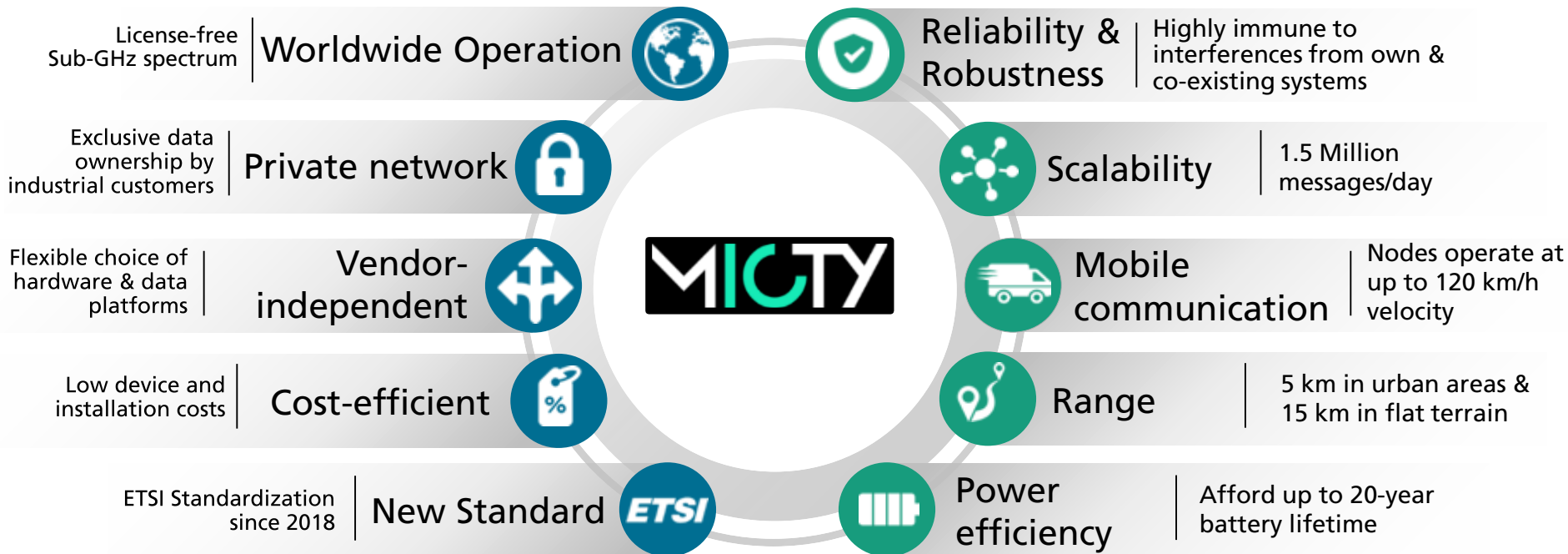
Interferer

Data
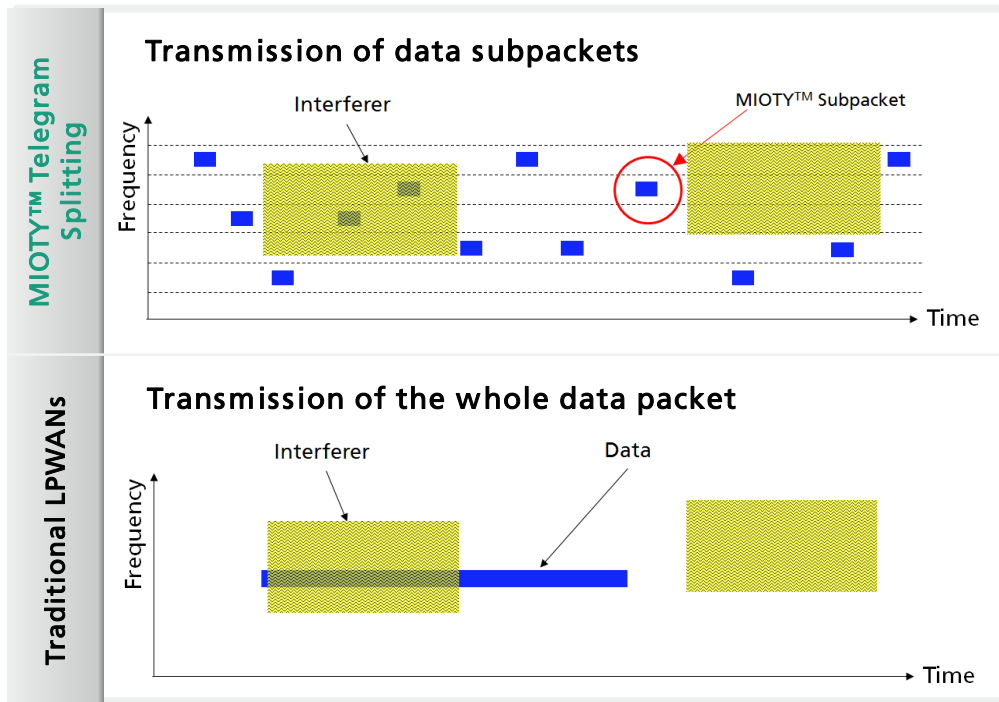
Frequency

Time

Telegram Splitting

- Spreading data packets over time & frequency (subpackets)
- Extremely robust against interferers due to very short "on air" time of subpackets
- Forward error correction (FEC) affords up to 50% loss of subpackets
- Programmable on most common Sub-GHz Chipsets
- Optimized for battery operation

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MIOTY® satisfies further IoT network requirements with diverse operational and technical qualities

Business Benefits

Worldwide Operation — License-free Sub-GHz spectrum

Private network — Exclusive data ownership by industrial customers

Vendor-independent — Flexible choice of hardware & data platforms

Cost-efficient — Low device and installation costs

New Standard — ETSI Standardization since 2018

Technology Features

Reliability & Robustness — Highly immune to interferences from own & co-existing systems

Scalability — 1.5 Million messages/day

Mobile communication — Nodes operate at up to 120 km/h velocity

Range — 5 km in urban areas & 15 km in flat terrain

Power efficiency — Afford up to 20-year battery lifetime

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MIOTY
A Broad Range of IoT Applications

Industrial IoT

Smart Cities

Buildings

Logistics

Agriculture

Mobility

Health

Consumer

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Mining
Case Study: Norcat

Air Quality Monitoring
Ventilation-on-demand

Monitoring At
Risk Workers

Telemetry of
heavy equipment

Hazard alert warning

Overseeing
machinery status
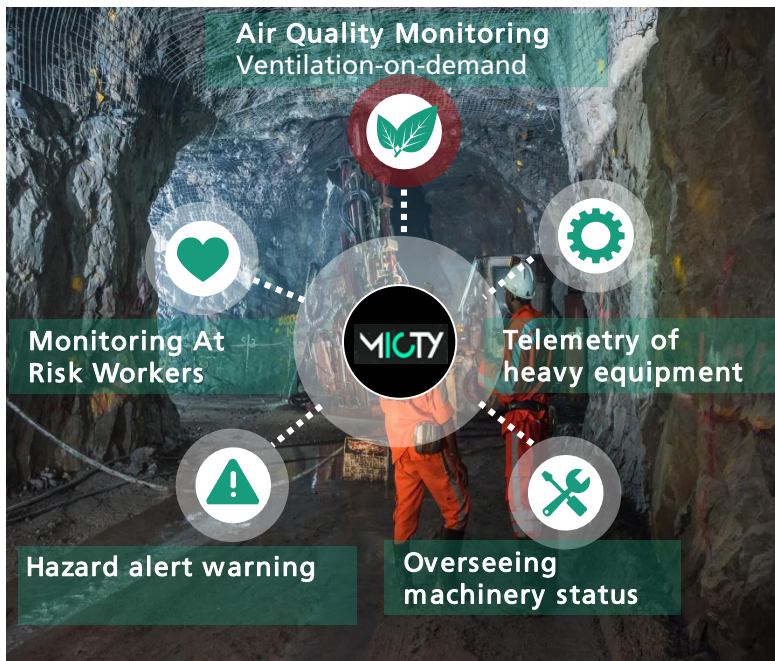
- **Challenge:** Traditional communication systems are expensive to install, have limited coverage, are sensitive to damage & difficult to maintain.

- **Solution:** Deployment of the MIOTY technology with exceptional robustness and deep penetration ability to enable wireless connectivity in the mine.

- **Benefit:**

  - Achieved 100% coverage of entire mine with installation of 2 gateways

  - Successful packet connectivity through extreme conditions

  - MIOTY system is 1/10th the cost of traditional communication systems for better coverage.
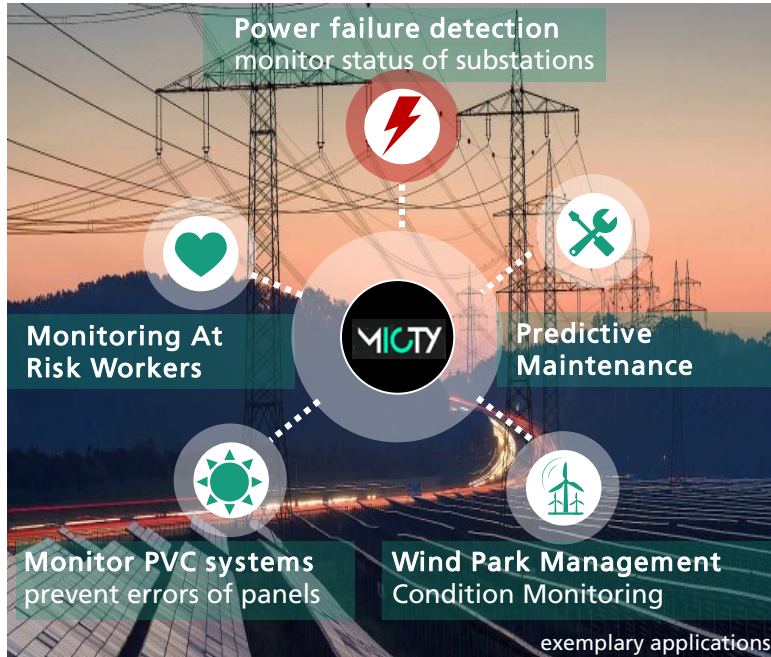
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Agriculture
Case Study: FutureIOT
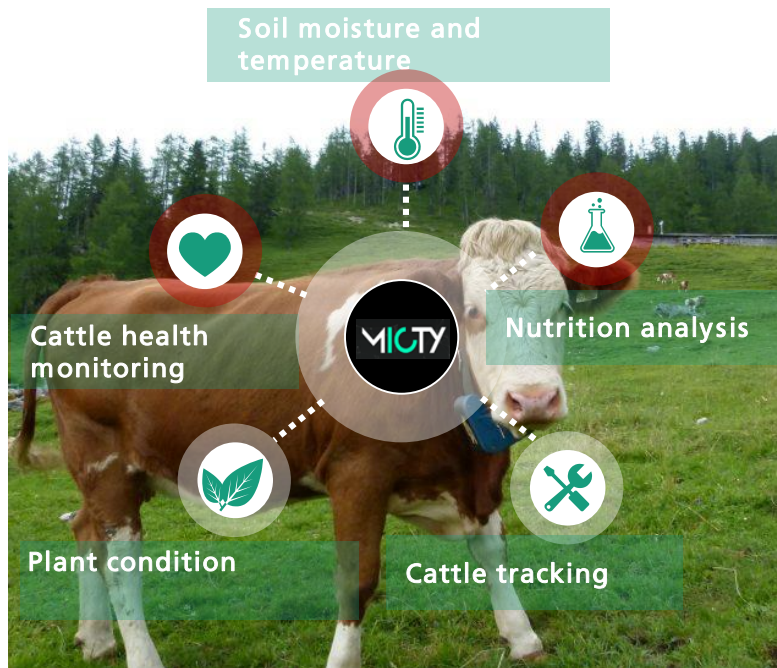
- **Challenge:** Over fertilization, seamless food chain tracking and animal health are the main topics for the todays reputation of farming.

- **Solution:** In the FutureIOT project, the MIOTY technology with low-energy consumption and long-distance ability is combined with different agricultural sensors.

- **Benefit:**

  - Farmland gets the exact amount of fertilization and at the exact place. Long-standing laboratory examinations can be skipped.

  - Imminent illness of cattle's can be predicted and individually treated.
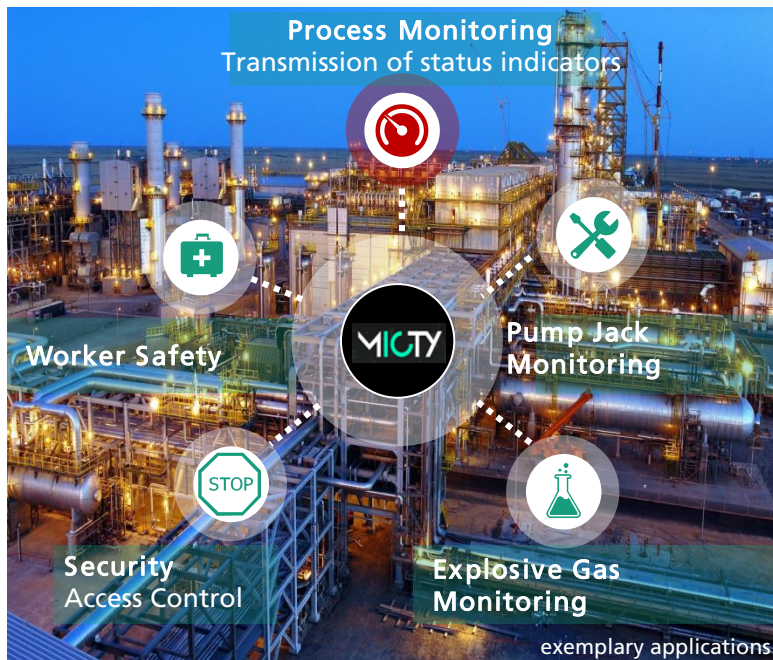
Energy
Case Study: Netze BW

Power failure detection
monitor status of substations

Monitoring At
Risk Workers

MIOTY

Predictive
Maintenance

Monitor PVC systems
prevent errors of panels

Wind Park Management
Condition Monitoring

exemplary applications

- **Challenge:** Network operators incur enormous costs in the event of power outages .

- **Solution:** Continuous monitoring of the network stations and power failure detection with MIOTY

  - Wireless transfer of short-circuit/earth-fault messages over mountainous & rough terrain

  - Automatic notification of malfunctions are sent to the control centre

- **Benefit:**

  - Up to 16 km connectivity range identified in the test despite challenging conditions

  - Almost 100% successful data reception from all transmitters

Oil & Gas
Case Study: Neptune Energy

Process Monitoring
Transmission of status indicators

Worker Safety

Pump Jack Monitoring

Security
Access Control

Explosive Gas Monitoring

exemplary applications

- **Challenge:** Lack of cellular coverage on site and poor visibility of equipment status

- **Solution:** Deployment of the private MIOTY-LPWAN for the acquisition of process-relevant data

  - Existing sensors (e.g. PT100) were retrofitted with MIOTY in order to transmit data wirelessly and visualize the information on end devices

  - Vehicles were equipped with mobile GPS-trackers to test asset tracking scenarios

- **Benefit:** Creation of a reliable, private network in a challenging environment – without a required cellular subscription, which reduces the total connectivity and overall communication costs
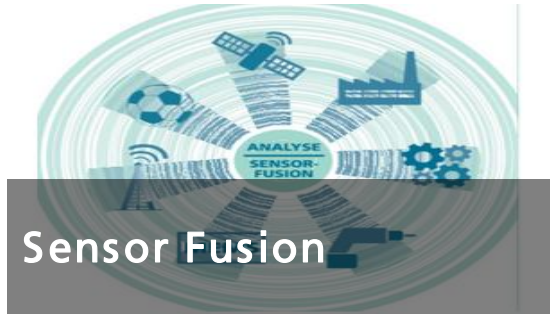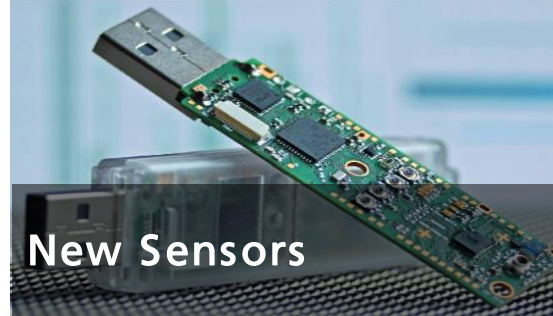
Automotive
Case Study: BMW

Predictive Maintenance
Detection of malfunctions

Indoor Climate
Monitoring (HVAC)

Facility
Management

Air Quality Monitoring
Ensuring workers' safety

Asset Tracking
Locating of AGVs & paletts

exemplary applications

- **Challenge:** Malfunctions of filling machines, which can be caused by changes in temperature, lead to delays or downtime in car production.

- **Solution:** Deployment of MIOTY enabled sensors on filling machines, located at the assembly line

  - Environmental parameters (e.g. humidity and temperature) are gathered and sent wirelessly with MIOTY to an on-premise cloud

  - Machine learning algorithms detect mal-functions via predictive maintenance

- **Benefit:** Improvement of the production efficiency with an reliable (packet error rate < 1%), cost effective and future-proof IoT-connectivity solution

Challenges and future research directions
Low-Power Wide-Area Networks (LPWAN)

Energy Harvesting

New Sensors

Indoor Localization

Sensor Fusion

Higher Data Rates
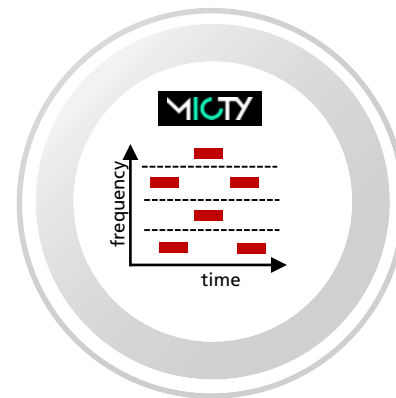

Security

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Summary

MIOTY Solution

- Powerful features satisfying critical IoT network demand:

  - High interference immunity

  - Up to 15 km range

  - < 20 year battery lifetime

  - 1.5 million messages/day

  - Mobile communication

- Providing worldwide standardized cross industry / cross market IoT connectivity

Telegram Splitting – spreading packets over time & frequency

What are we looking for

- Cooperation with commercialization **partners** and **integrators** in order to establish MIOTY networks and develop products.

- **End-users**: Understand their needs in order to focus our future research or in order to connect with our partner network.

Demonstration
Evaluation Kit

The MIOTY technology is built as a software solution to support many hardware platforms:

- Device protocol stack is running on low performance, low power microcontroller

- Many commercial available Sub-GHz chipset supporting MSK modulation can be used

- MIOTY base station SW stack is running on Intel based IOT gateways in combination with software defined radio frontend

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