



STRIJ TELEMATICS

INNOVATIVE LPWAN TECHNOLOGY SOLUTIONS
FOR RAILWAY INFRASTRUCTURE MONITORING

COMPANY PRESENTATION

October 2016

РЖД Partnership & cooperation



Remote infrastructure monitoring solutions based on LPWAN wireless technology support the implementation of the Digital Railway program initiated by RZD



СТРИЖ



ПКТЬ ЦКИ

Проектно-конструкторско-технологическое
бюро по системам информатизации

Designing and Technological Office
on Informatization Systems

Experimental testing of LPWAN solutions on the RZD sites

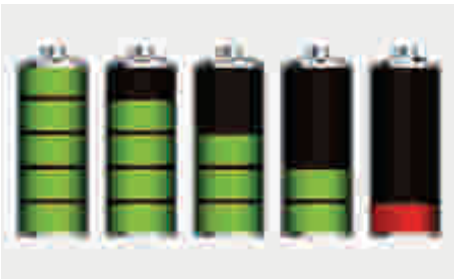
Digital
railway
program



Major issues with the IoT industry



- ü Mass-market Internet of Things is about **very simple telemetry objects**: miscellaneous meters, sensors, microcontrollers, etc.



- ü **No cheap and effective technology existed** till recently to provide the autonomous and highly scalable connection to **the Internet**



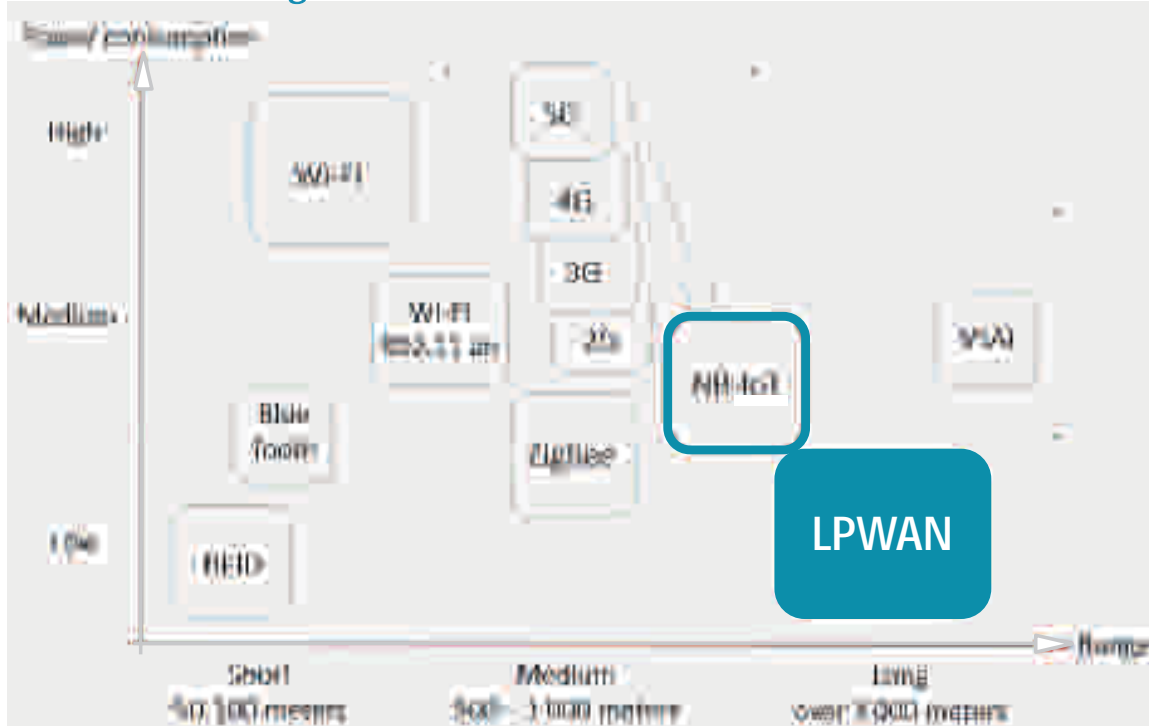
- ü Wi-Fi, Bluetooth, ZigBee, MBus, GSM – ensure the high **installation and maintenance cost** aligned with the low reliability due to mesh architecture



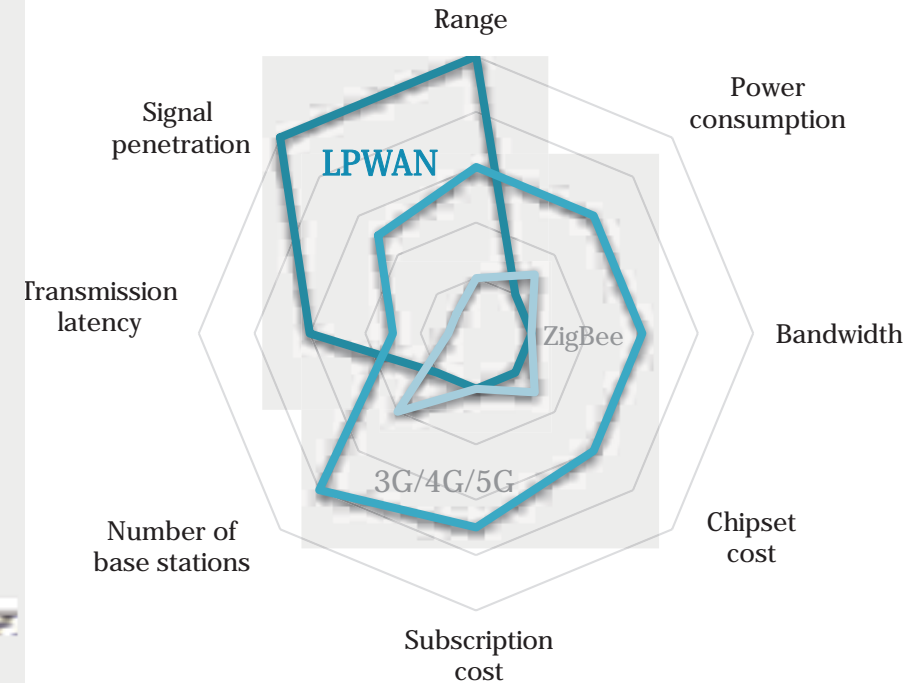
- ü Gartner, IDC and Machina Research, expect the booming IoT growth with in the next decade to reach **30-50 billion of connected devices**

LPWAN technology overview

Wireless technologies universe



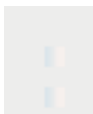







Factor analysis for IoT connectivity solutions



Source: strij.net

Source: Analysis Mason

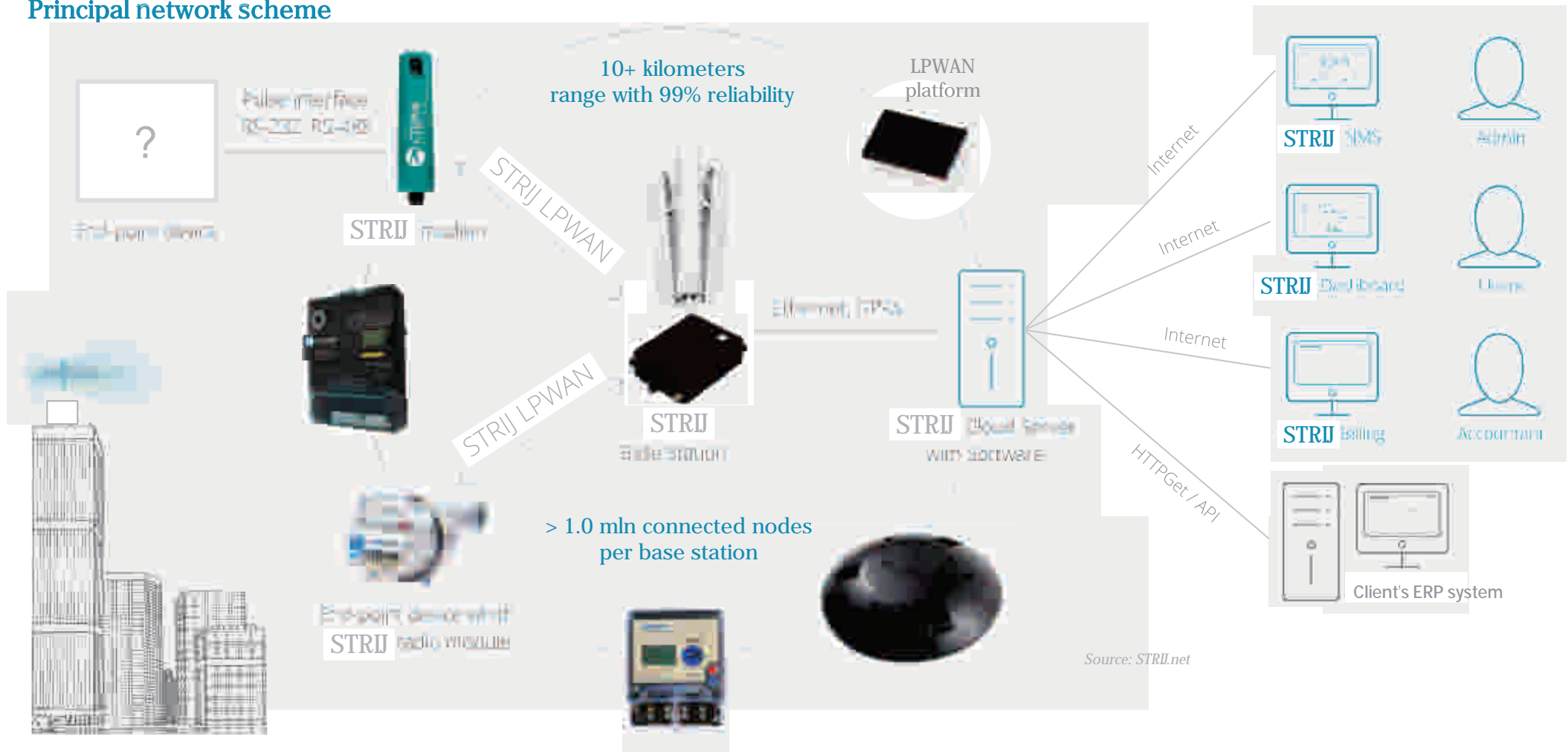
Key advantages of the technology

- 
No GSM or Internet connection needed – all devices work autonomously within the cover range of the base station
- 
Long range connectivity of 10+ km in the city and 25+ km in the countryside is available with highly reliable STRIJ solution
- 
Energy efficient solution – up to 10 years of autonomous work without power connection or recharges
- 
High penetrating power of the signal enables long range transmission from basements and through concrete walls
- 
Multi-functional – telematics data may be collected from various sensors or microcontrollers in any industry around the globe
- 
Easy-to-integrate solution – data flow may be easily integrated with the clients' existing ERP / IT system or frontend through HTTPGet / APIs
- 
Low total solution cost is ensured by minimal number of base stations required to cover an area and node cost starting at \$1,99
- 
High level of security is ensured by encrypting bi-directional data from the end point throughout the data system

Turn-key solution for LPWA networks



Principal network scheme



ü **License-free and frequency flexible** – the solution is suitable for worldwide deployments, supporting radio hardware and compliant MAC architectures in 915 MHz, 868 MHz, and 433 MHz ISM bands, as well as other sub-GHz license-free spectrum

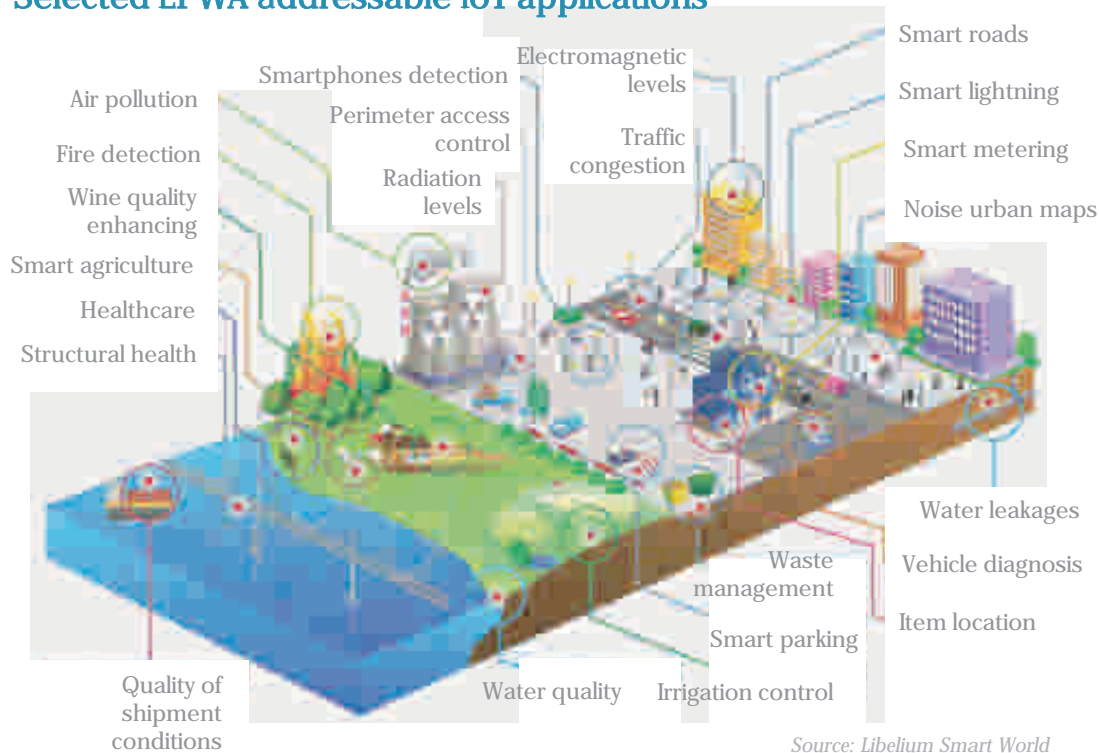
ü **De-centralized reliable architecture** – base stations perform a large portion of network processing inside, this additionally means it continues performing most of functionality through a network blackout

ü **Highly scalable solution** – each base station has enough capacity to operate more than 1 million devices within a 15+ km range installed in harsh urban environment (basements and concrete walls)

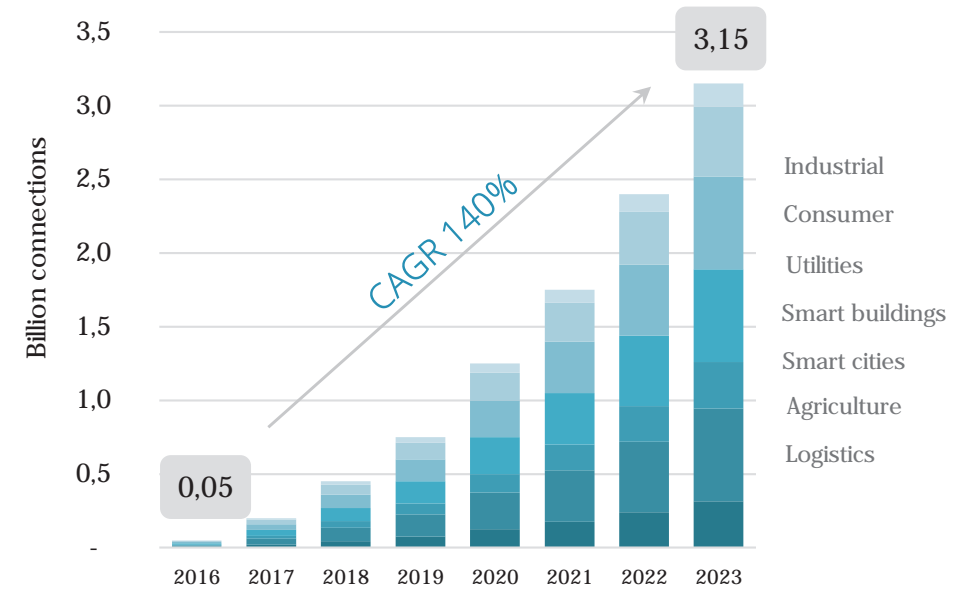
ü **Full duplex with dynamic scheduling** – STRIJ gateways allow full duplex mode. The scheduler decides in real-time how much of the available resources to allocate to downlink and uplink, based on the instantaneous demand and QoS subscriptions

Addressable market size

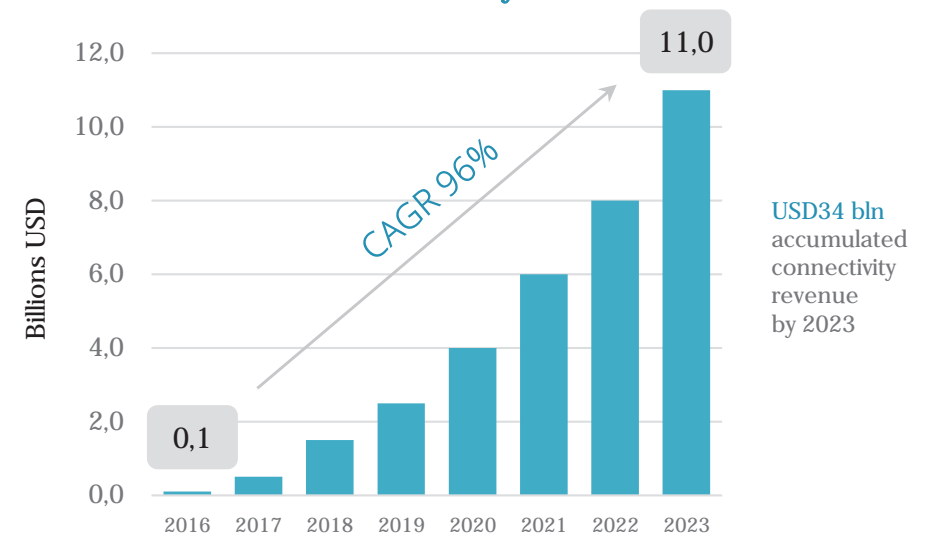
Selected LPWA addressable IoT applications



LPWA annual connections forecast



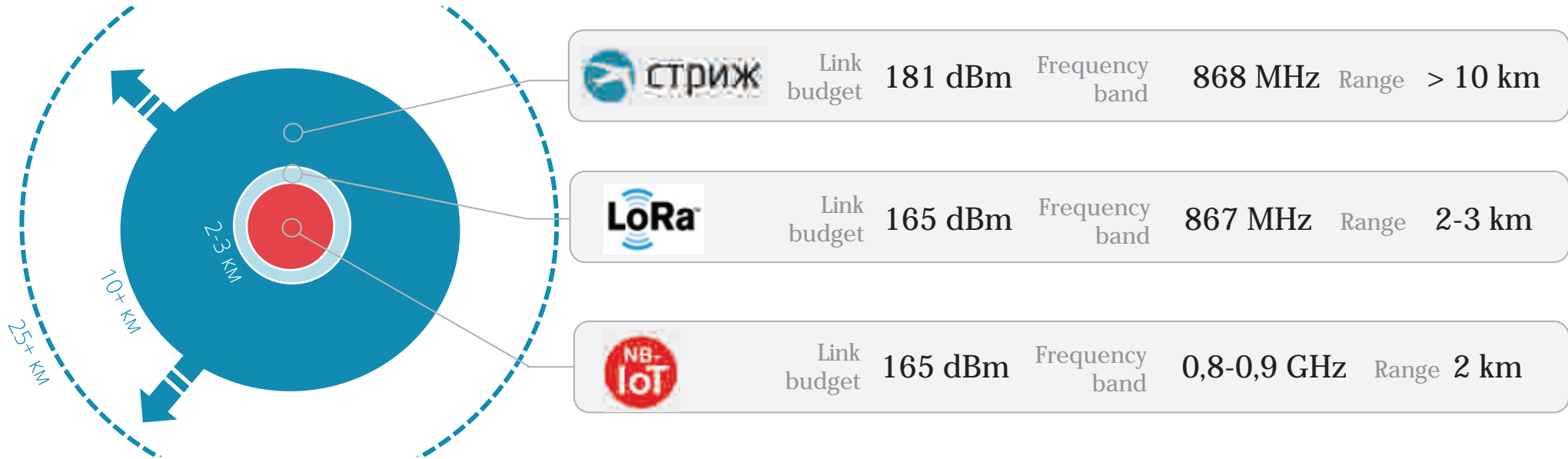
Forecast of LPWA connectivity revenues



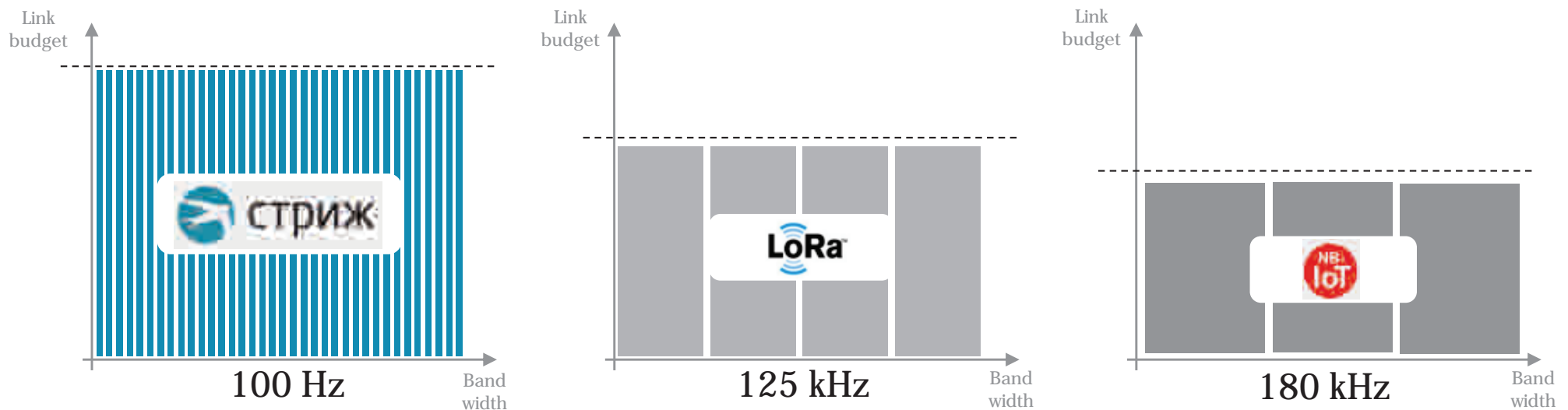
- **Strong demand exists for Low Power Wide Area networks** according to Analysys Mason since it opens new market opportunities for three main reasons: **low cost, no mains power source required, strong propagation**
- LPWA technologies have the potential to significantly transform existing M2M markets by variously **reducing the price of connectivity and increasing the attractiveness of M2M** connected solutions
- The potential is significant, Machina Research says, with an addressable **market of 15.5 billion connections**. Analysys Mason believes that the total addressable market may be close to 14 billion devices by 2023
- No specific vertical sector will dominate the opportunity for LPWA services, unlike traditional cellular M2M market. Most widely spread applications would likely represent **smart metering, smart city and smart agriculture**

Operational range and scalability

Range of reliable transmission



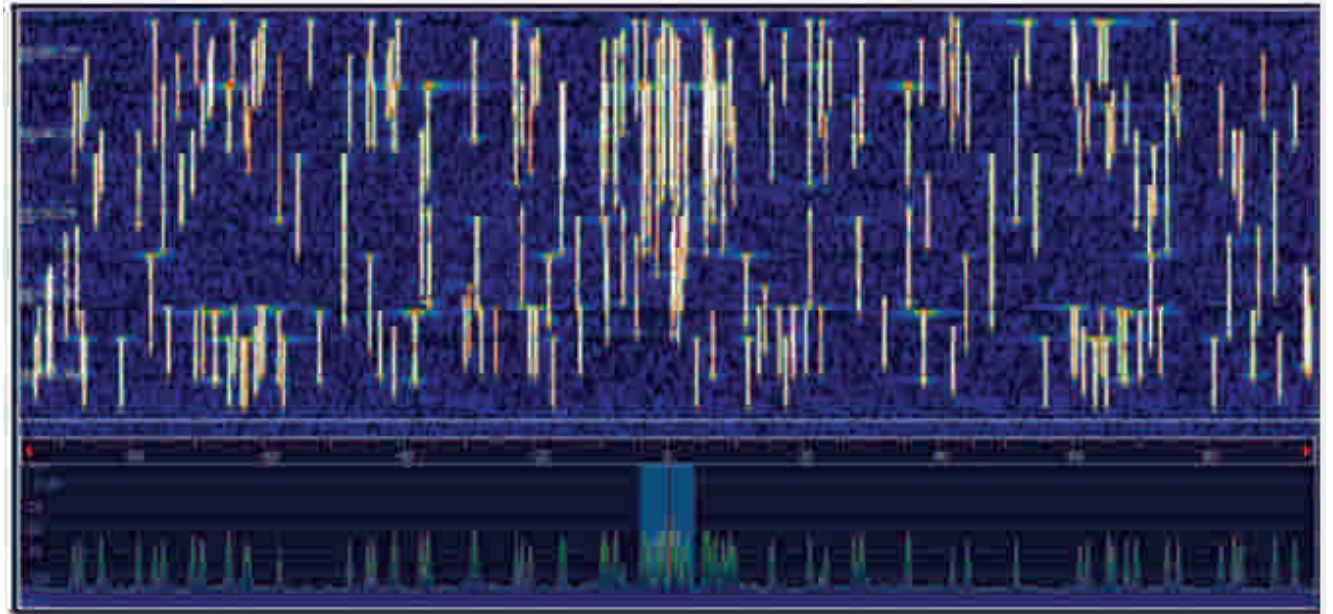
Channel allocation and link budget



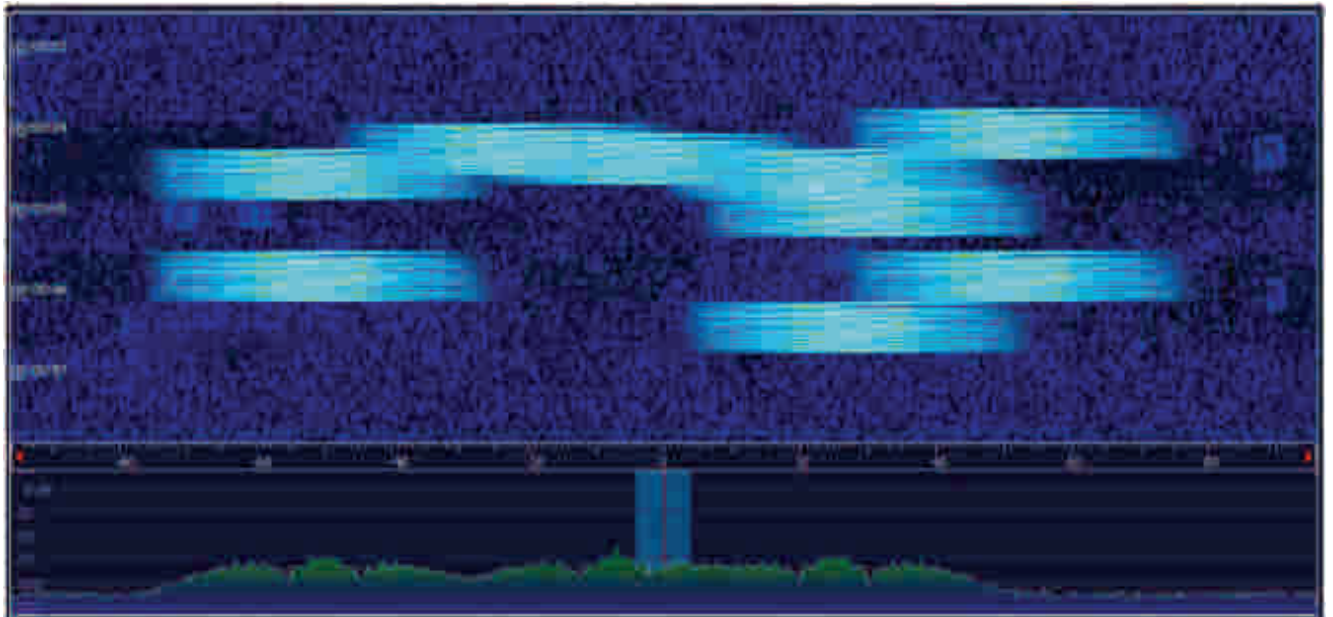
Spectrum utilization efficiency



- ü Minimal bandwidth 100 Hz
- ü 5 000 channels in the 500 kHz license-free band @ 868 MHz
- ü Automated smart time and frequency slot allocation
- ü On the picture: more than 200 narrowband signals, less than <5% of frequency band capacity is used, no collisions



- Minimal bandwidth 125 kHz
- 4 channels in the 500 kHz license-free band @ 868 MHz
- Hardware binding to the protocol, easy to spam design
- On the picture: less than 10 spread spectrum signals, more than >30% of capacity is used, numerous collisions observed



Comparison of LPWA technologies



Technology	СТРИЖ NB-Fi	Huawei NB-IoT	Link labs LoRa	Sigfox UNB	Ingenu RPMA
Frequency	Any Sub-GHz ISM band	800-900 MHz	915, 867 MHz	867 MHz	2.4 GHz
Maximum range with 99% reliability in the city	10 km	2 km	3 km	5 km	2 km
Maximum link budget, dBm	181	164	165	161	162
Receiver sensitivity, dBm	151	129	137	135	142
Node bandwidth	100 Hz	180 kHz	125 kHz	200 Hz	1 MHz
Spectrum efficiency	High	High	Very Low	Low (aloha)	Medium
Data rates	50 – 25 000 bps	> 60 000 bps	300 – 37 500 bps	100 bps	> 300 bps
Gateway mode	Full Duplex	Full Duplex	Half Duplex	Half Duplex	Half Duplex
Scalability	High	High	Very Low	Low	High
Simultaneous demodulation capacity	120 000	64	8	25	4 000
Security	128-256	128-256	32	16	128
Minimum node cost, USD	1.99	4.99	10.99	2.99	5.00
Battery lifetime	10 years	> 3 years	10 years	10 years	10 years
First commercial project	2011	Exp. 2017-18	2014	2010	2010

LPWAN product portfolio of STRIJ



Software	<p>Back-end</p>	<p>Front-end</p>	<p>Billing</p>	<p>Corporate web-site</p>
Telecom	<p>Base stations</p>	<p>Sector antennas</p>	<p>Mini-gateways</p>	<p>Modems</p>
Meters	<p>Water meters</p>	<p>Electricity meters</p>	<p>Heat allocators</p>	<p>Gas meters</p>
Sensors	<p>Movement sensors</p>	<p>Agriculture sensors</p>	<p>Temperature sensors</p>	<p>Cattle monitoring</p>
Development	<p>Development kit</p>	<p>LPWAN headset</p>	<p>Radio modules</p>	<p>LPWAN chipset</p>

Selected applications and use-cases

Utility smart metering: water, electricity, gas



**AUTONOMOUS WORK:
10 YEAR BATTERY LIFE**



**MORE THAN 10 KM WITHOUT
WIRES AND RETRANSLATORS**



**5-10 TIMES CHEAPER
THAN OTHER SOLUTIONS**



**EASY INTEGRATION AND
THOUSANDS OF APPLICATIONS**

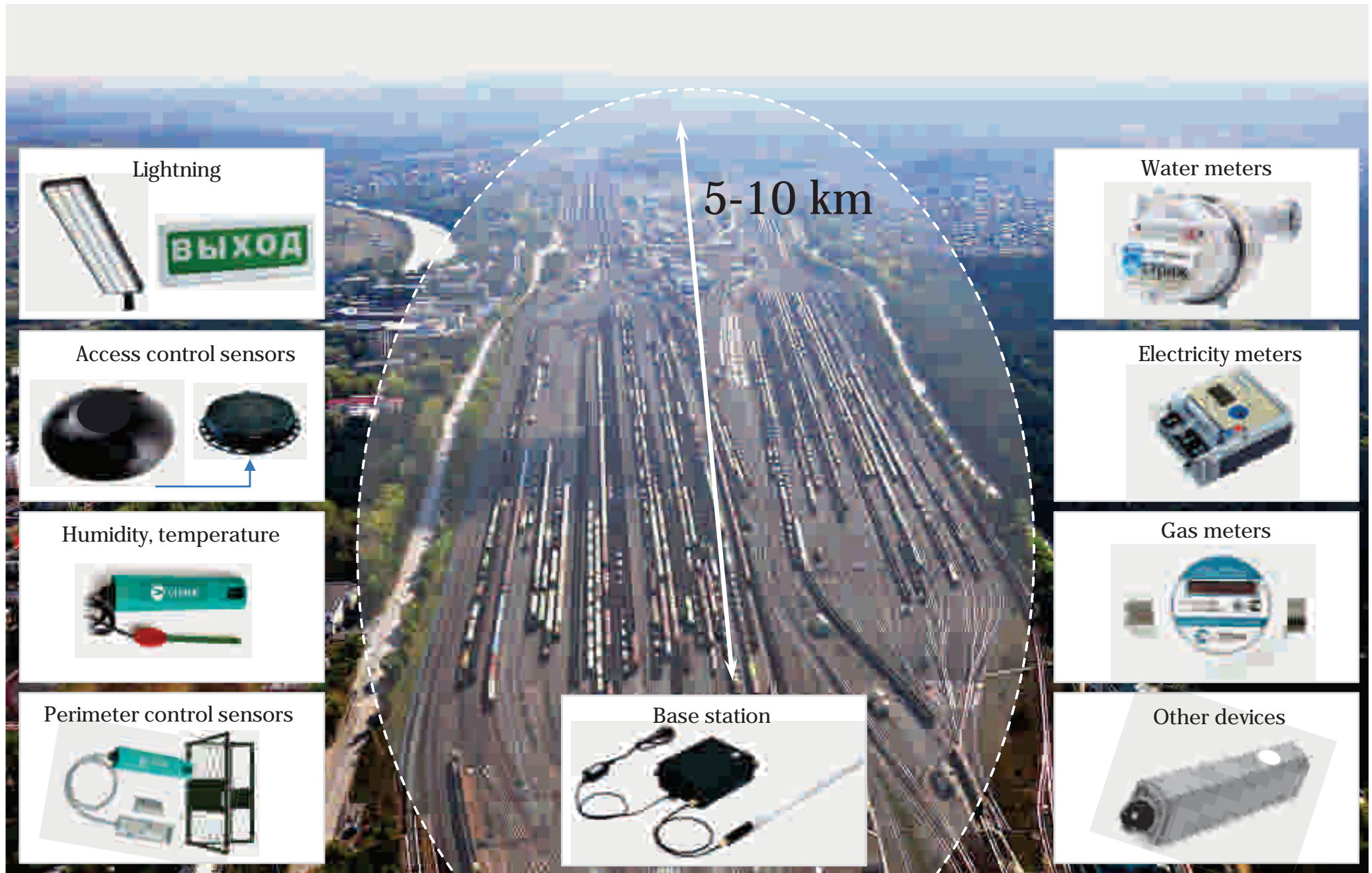
Smart agriculture: moisture, fertilizers, etc.



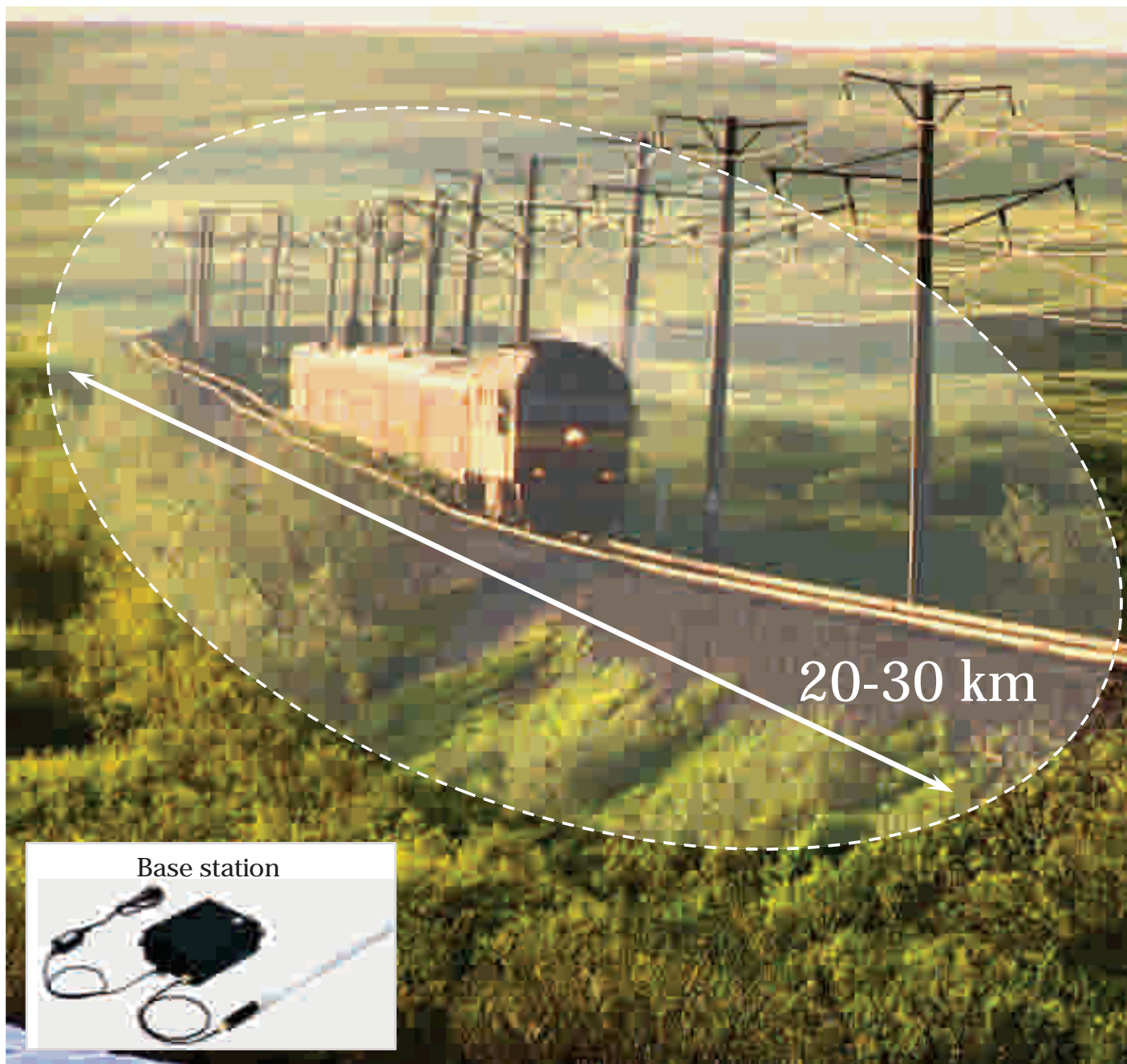
Smart city: parking, lighting, waste bins, etc.



Monitoring and control at the station





Monitoring and control at the railway




Any sensor



Wire break detection



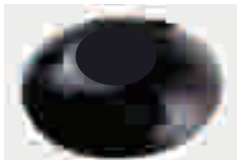

Erosion of bulk railways



Fire detection



Structural health



Base station



Thanks for your attention and initial interest!



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