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OPEN DAY 2018

فرص غير مستغلة للتطبيقات الذكية LPWAN /5G

LPWAN/5G: Untapped Opportunity for Smart Applications

Dr. Ali Al Sherbaz
Research and Innovation Leader and Associate Professor at the University of Northampton-UK
Chair of BCS British Computer Society

Waterside Campus 2018
University of Northampton

#STUDYABROADWITHESCC

TRANSFORMING LIVES .... INSPIRING CHANGE

Outlines

- **AIoT: When AI Meets the Internet of Things**
- **AI + IoT = Superpowers of Innovation**
- **The Future of Connectivity**
- **LPWAN Cloud Services**
  - **AWS**
  - **IBM**
  - **Azure**
- **Think ahead (LPWAN vs 5G)**
- **Case Studies**
- **Iraqi Technologists Boards: ITB**
- **Q&A**

IoT is empowered by

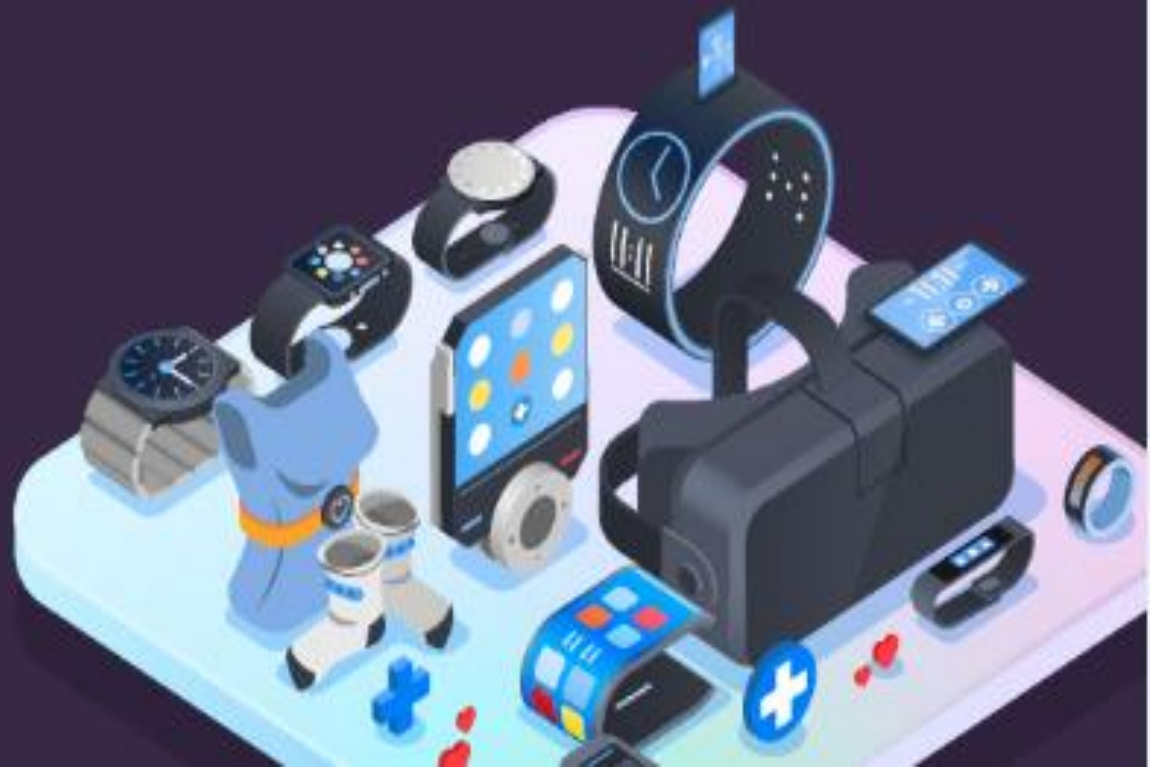
three key technologies:

AIoT: When AI Meets the Internet of Things
AI + IoT = Superpowers of Innovation

The 4 Major **AIoT** Segments

1 Wearables

Wearable devices continuously monitor and track user preferences and habits. Applications include fitness and health trackers, heart rate monitoring, wireless headphones, and AR/VR devices.



2 Smart Home

Smart home devices such as thermostats, coffee makers, lights, and smart TVs learn a user's habits to develop automated home "support" for everyday tasks. Applications include energy efficiency, safety, entertainment, access control, and personal comfort.

Smart speakers

IoT appliances

Smart thermostats

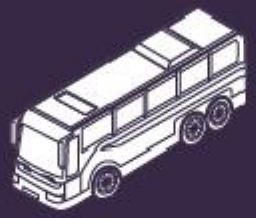
3

Smart City

Smart cities that integrate all levels of municipal services are becoming safer, more convenient places to live. Applications include open data for better urban planning, optimized energy consumption, and increased public safety through smart traffic surveillance.

Smart energy grids

Smart streetlights



Smart public transportation

4 Smart Industry

Smart industry devices—the Industrial Internet of Things (IIoT)—use real-time data analytics and machine-to-machine sensors to optimize operations, logistics, and supply chain. Data generated from these devices helps industries foresee challenges—preventing costly errors and workplace injuries.

Autonomous manufacturing robots

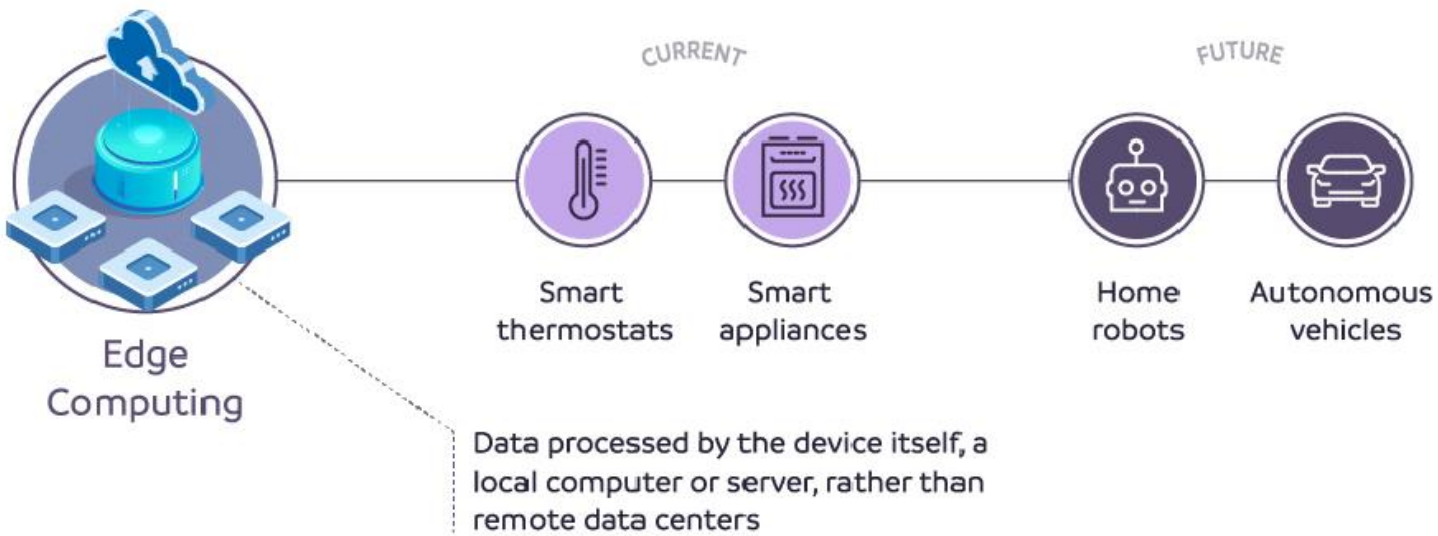
Automated supply chain management

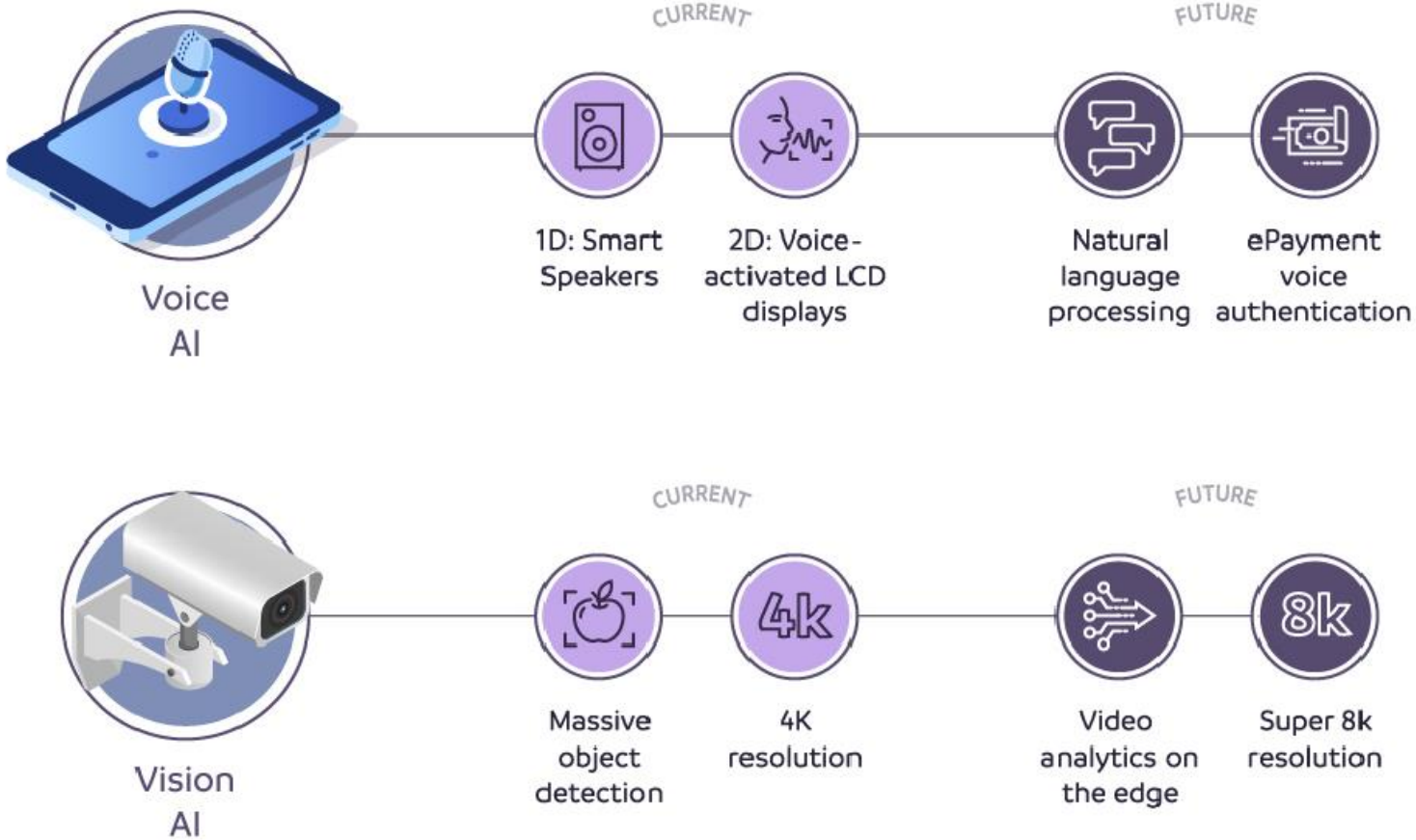
Predictive maintenance sensors

Future AIoT Technologies

AIoT innovation ***shows no signs of slowing down.***

AIoT will test how much data our devices can process, future advancements will push the boundaries of processing and learning.





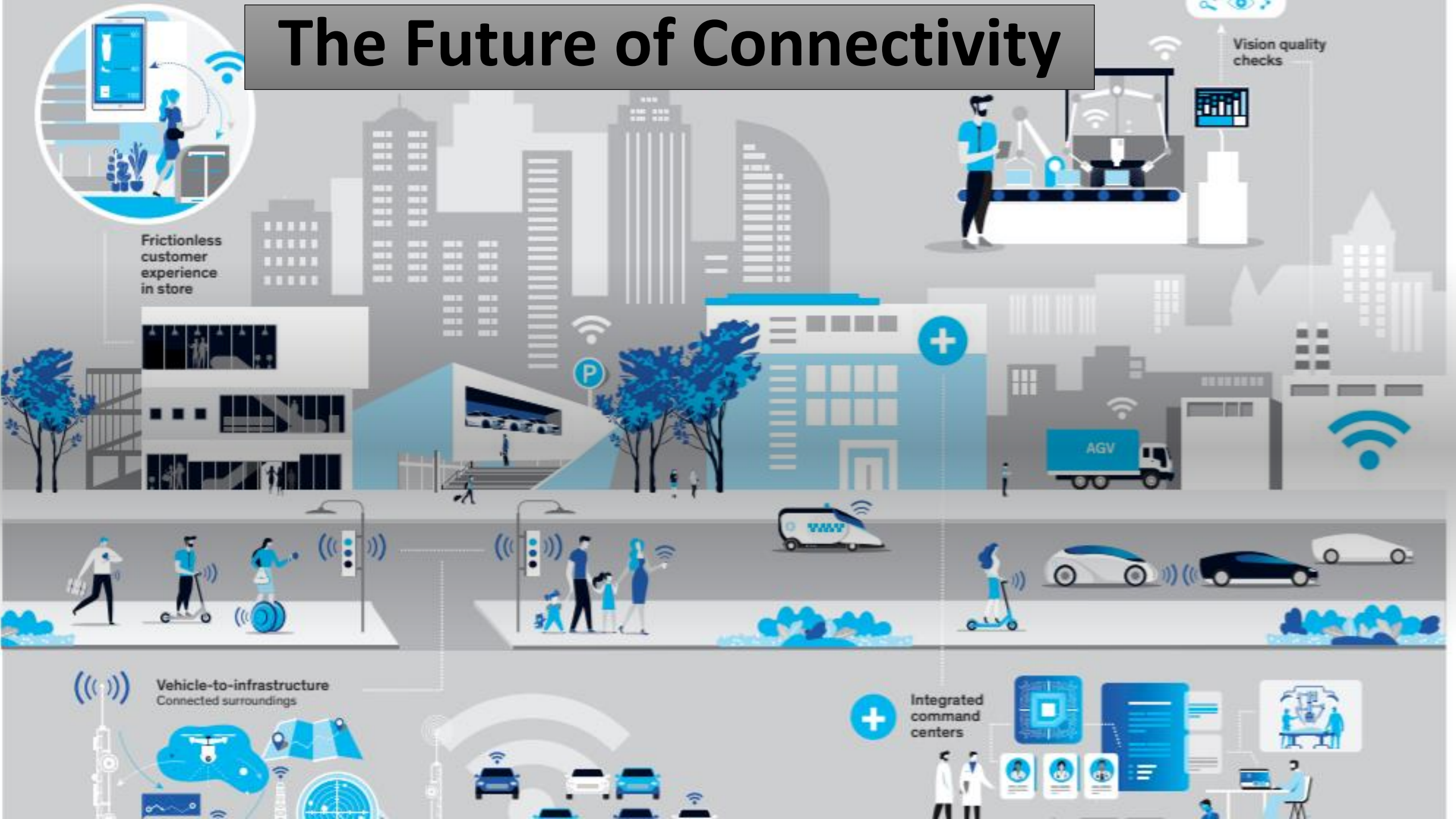
AIoT promises to radically transform how we interact with our homes, offices, and cities every day.

The Untapped Potential of AI & IoT

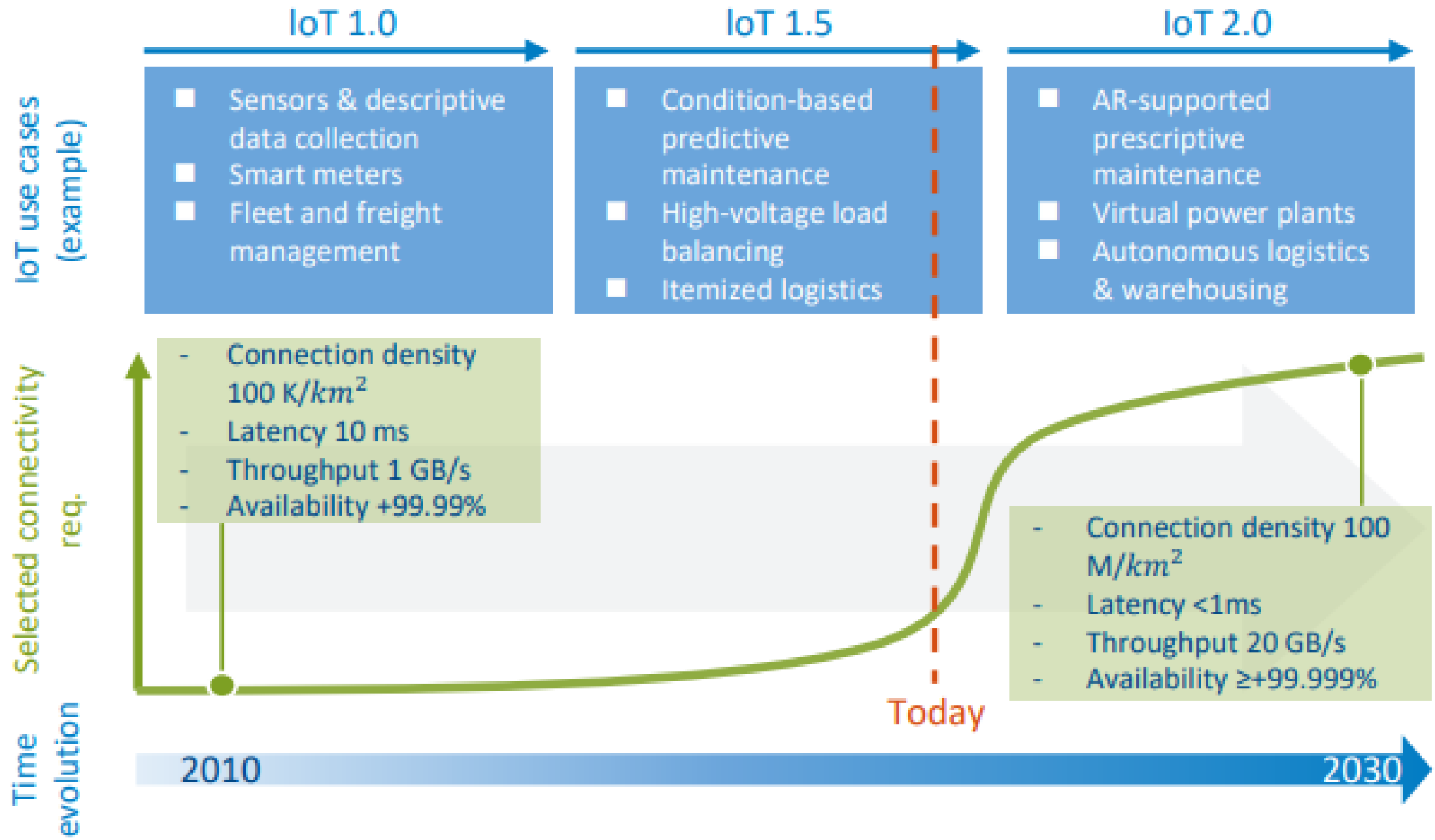
AIoT innovation is only accelerating, and promises to lead us into a more connected future.

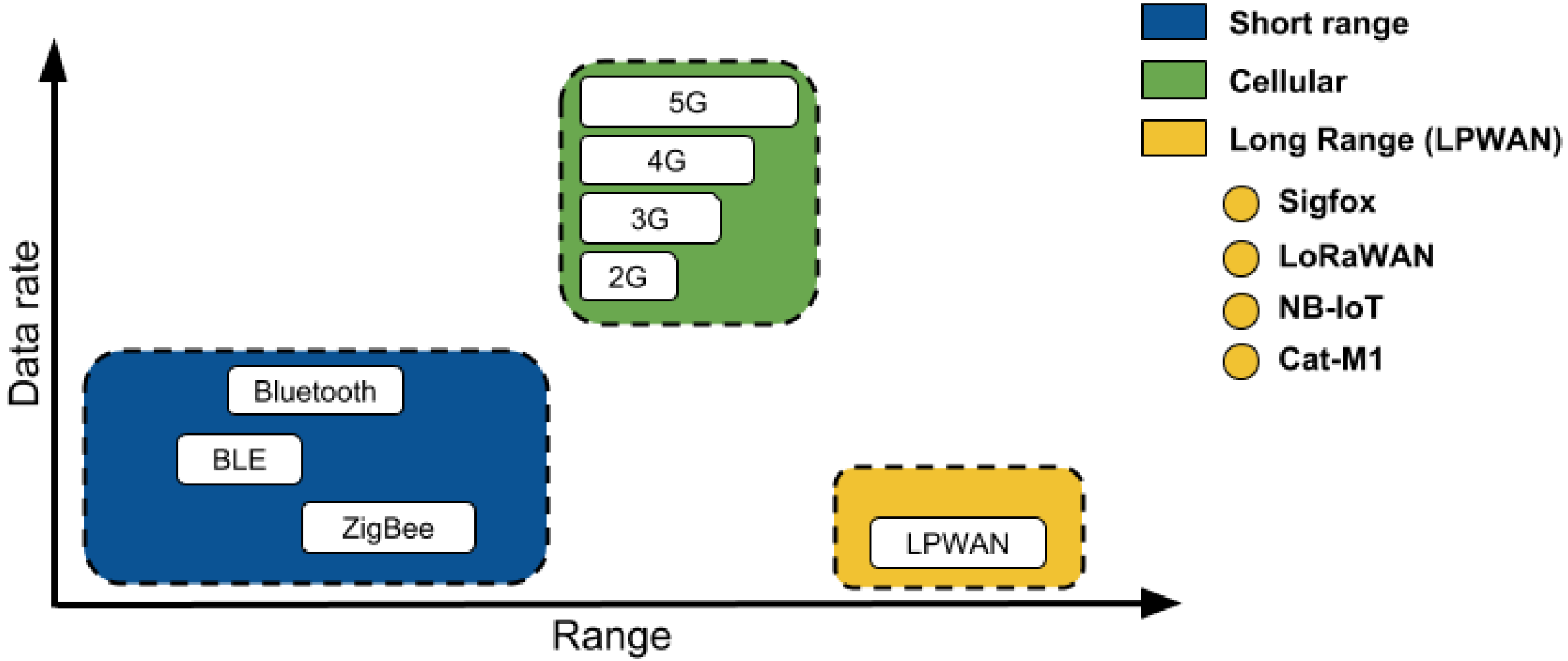
Category	Today	Tomorrow
Edge computing	Smart thermostats Smart appliances	Home robots Autonomous vehicles
Voice AI	Smart speakers	Natural language processing (NLP) ePayment voice authentication
Vision AI	Massive object detection	Video analytics on the edge Super 8K resolution

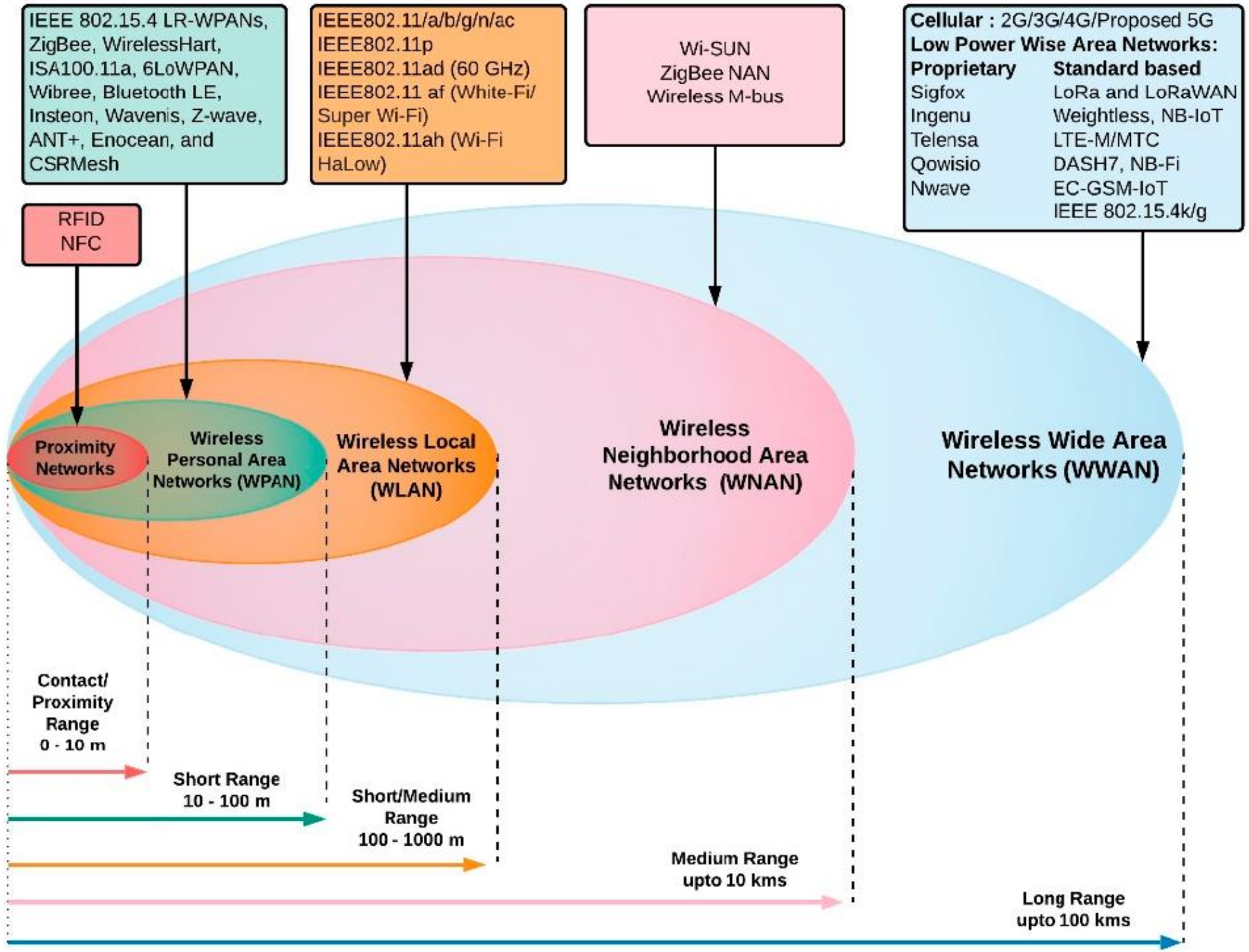
The Future of Connectivity



The IoT evolution roadmap




Short range
Cellular
Long Range (LPWAN)
Sigfox
LoRaWAN
NB-IoT
Cat-M1
5G
4G
3G
2G
Bluetooth
BLE
ZigBee
LPWAN
Data rate
Range


IEEE 802.15.4 LR-WPANs, ZigBee, WirelessHart, ISA100.11a, 6LoWPAN, Wibree, Bluetooth LE, Insteon, Wavenis, Z-wave, ANT+, Enocean, and CSRMesh
IEEE802.11/a/b/g/n/ac
IEEE802.11p
IEEE802.11ad (60 GHz)
IEEE802.11 af (White-Fi/ Super Wi-Fi)
IEEE802.11ah (Wi-Fi HaLow)
Wi-SUN
ZigBee NAN
Wireless M-bus
Cellular : 2G/3G/4G/Proposed 5G
Low Power Wise Area Networks:
Proprietary
Sigfox
Ingenu
Telensa
Qowisio
Nwave
Standard based
LoRa and LoRaWAN
Weightless, NB-IoT
LTE-M/MTC
DASH7, NB-Fi
EC-GSM-IoT
IEEE 802.15.4k/g
RFID
NFC
Proximity Networks
Wireless Personal Area Networks (WPAN)
Wireless Local Area Networks (WLAN)
Wireless Neighborhood Area Networks (WNAN)
Wireless Wide Area Networks (WWAN)
Contact/ Proximity Range 0 - 10 m
Short Range 10 - 100 m
Short/Medium Range 100 - 1000 m
Medium Range upto 10 kms
Long Range upto 100 kms

High-level overview of current LPWAN technologies

LPWAN technologies

Licensed spectrum

Low-power technologies that operate in the licensed spectrum

NB-IoT

LTE-M

EC-GSM-IoT

THINGSTREAM

Unlicensed spectrum

Low-power technologies that operate in the unlicensed spectrum

sigfox

LoRa

RPMA

WEIGHTLESS

nwave

Telensa

NB-Fi

СТРИЖ

helium

SAT4M2M

MIOTY

hiber

Adjacent / comparative technologies

Unlicensed spectrum

Technologies that are not classified as LPWAN but have similar features and/or target similar use cases. They all use the unlicensed spectrum.

wi SUN

WIREPAS

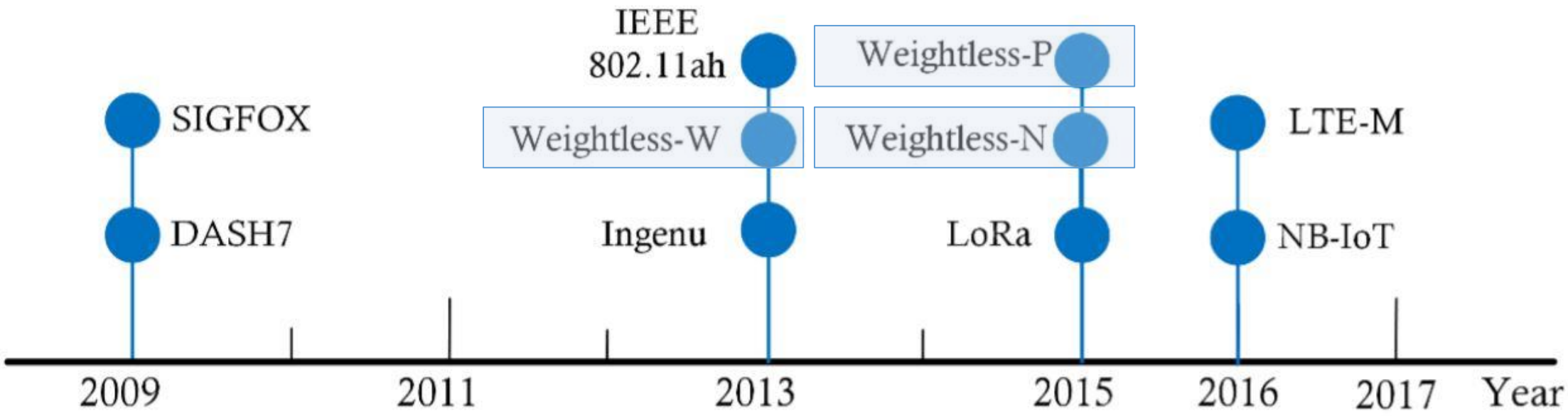
Silver Spring NETWORKS

Wi Fi HaLow

JupiterMesh

DASH7

Overview of technical feature of the LPWAN Technologies :Timeline



PhD Thesis : Dr. Riyadh Abbas – Wasit University

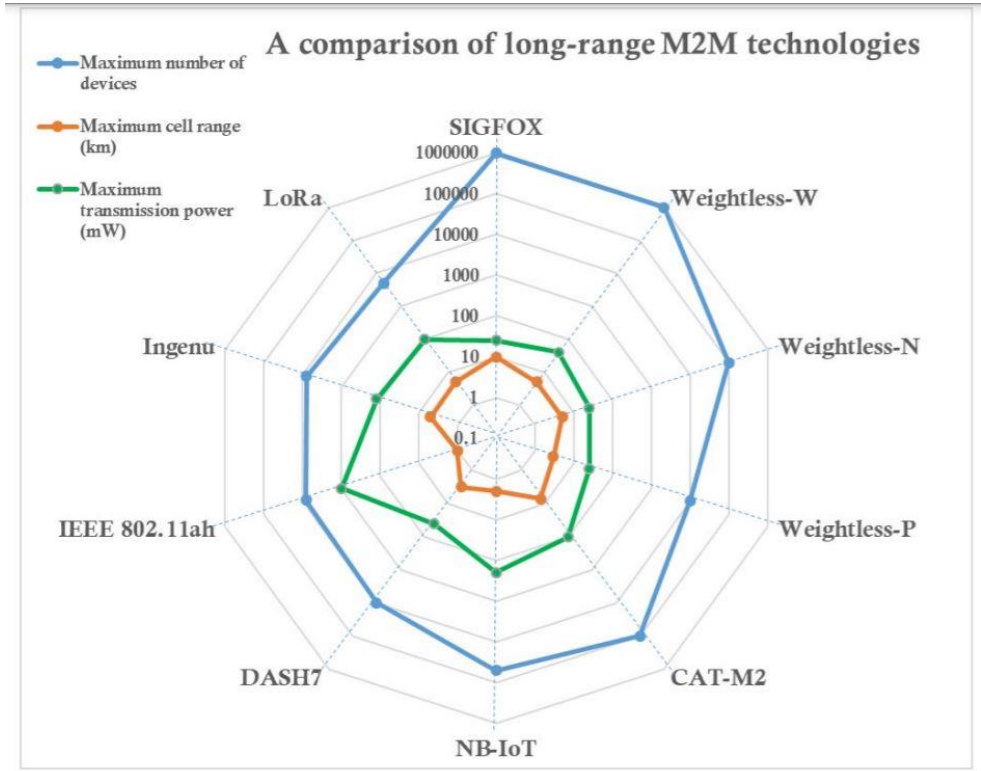


Figure 2.37: A comparison of long-range M2M technologies in terms of the number of connected devices, the coverage range, and the transmission power.

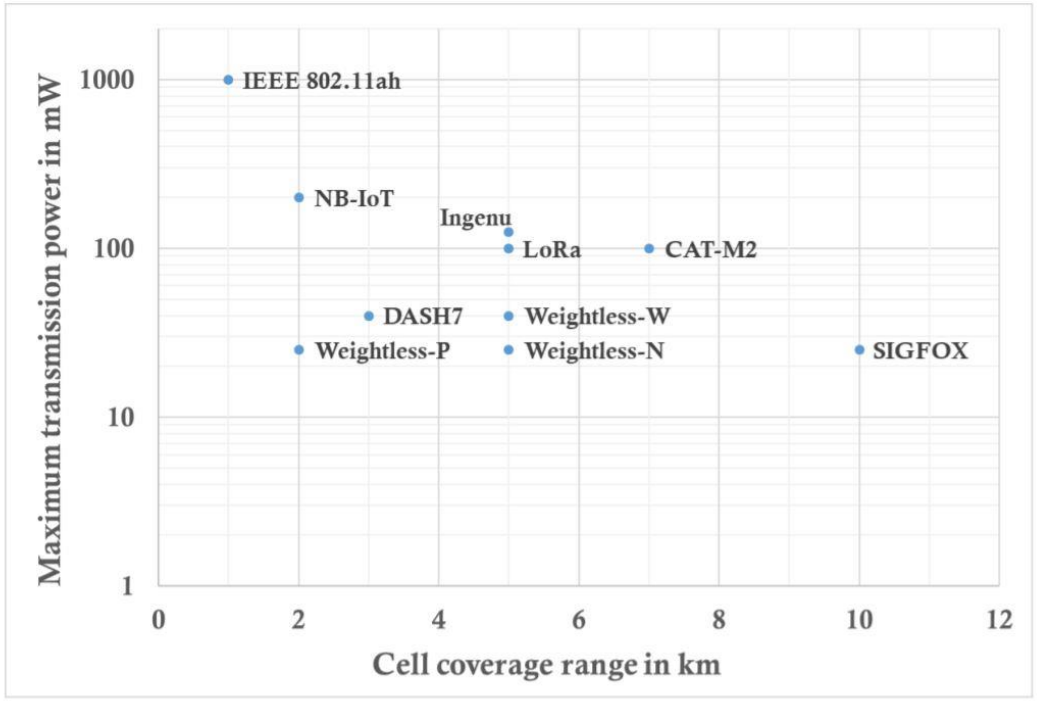
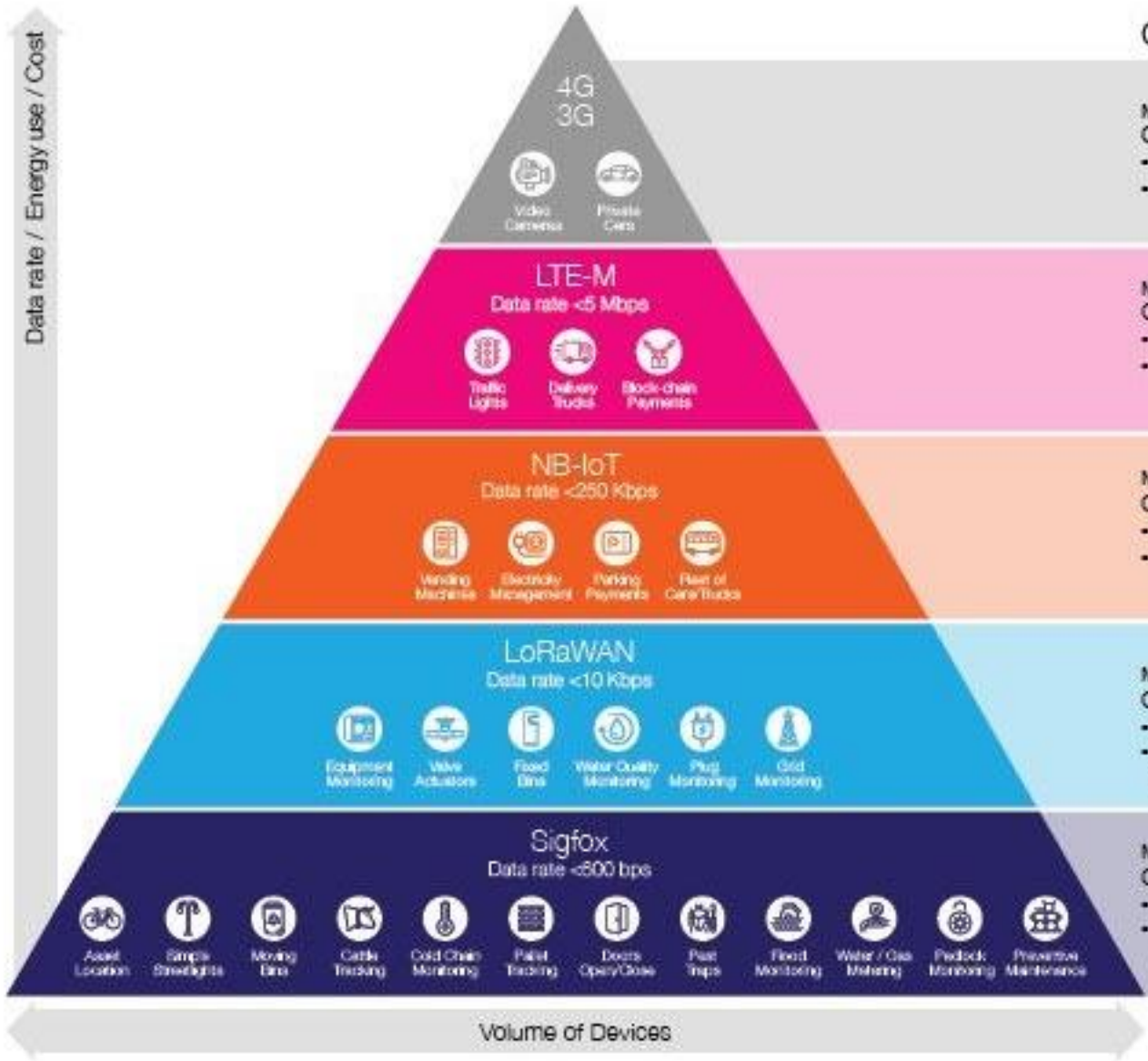


Figure 2.35: Long-range M2M technologies coverage range in km versus the transmission power in mW.

Overview of technical feature of the LPWAN Technologies

	LORA-WAN	SigFox	NBIoT	CATM1	RPMA	NWave	Weightless-P
Modulation	DSS with chirp	UNB/GFSK/ BPSK	OFDMA/ SC-FDMA	OFDMA/ SC-FDMA	RPMA	DBPSK	FDMA+TDMA
Frequency	868/ 902-928Mhz	868/915 MHz	In band LTE, guard band, stand alone	In band LTE	2.4GHz	315/433/ 470/868/ 915MHz	169/433/470/780/ 868/915/923MHz
Coverage	153-161 dB	149-161 dB	164dB	155.7dB	168-172dB	166dB	n/a
Bandwidth	125kHz	100Hz (EU)	180kHz	1.08MHz	1Mhz	n/a	12.5Khz
Data rate	0.3 to 50 kbps	100bps	0.5-200kbps	1Mbps	624 Kbps DL 156 Kbps UL	100bps	0.2 to 100kps
Max msg / day	unlimited	140 UL 4 DL	n/a	unlimited	n/a	unlimited	n/a

WHICH LONG RANGE CONNECTIVITY FOR IOT?



	Customer Costs	Advantages	Limitations
4G 3G	Module cost: $30 Connectivity cost: • OPEX: $60/year • CAPEX: $0	• Existing national coverage • High data rate • Large ecosystem of solutions	• Too pricey & too power hungry • Limited rural (off road) coverage • Limited extension of coverage
LTE-M Data rate <5 Mbps	Module cost: $20 Connectivity cost: • OPEX: $30/year • CAPEX: $0	• Strong data transfer • Real two-way communication • Potential national coverage	• Limited ecosystem • Early stage, to be rolled out H2 2017 • Costly & high power consumption • Limited rural (off road) coverage
NB-IoT Data rate <250 Kbps	Module cost: $10 Connectivity cost: • OPEX: $20/year • CAPEX: $0	• Strong data transfer • Real two-way communication • Potential national coverage • Designated for cities	• Networks still in trials with uncertain commercial deployment • Standard immature, subject to change • No real ecosystem • Costly & medium power consumption • Limited rural (off road) coverage • Roaming problems between operators
LoRaWAN Data rate <10 Kbps	Module cost: $5 Connectivity cost: • OPEX: backend: $2/year • CAPEX: $200-$2000/base station	• Community & private networks • Modular network: Make your own • Open back-end via API	• Semtech is the only chipset option • Scalability limitation / base station • Complex backend integration • No SLA with sporadic coverage • Roaming unlikely to work due to numerous small network operators
Sigfox Data rate <600 bps	Module cost: $2 Connectivity cost: • OPEX: $2/year • CAPEX: $0	• Global coverage & gobal contract • Mature technology • Open back-end via API • Simple & lowest cost • Predictable battery consumption • Lowest power consumption • Large ecosystem of chipsets/devices	• 12 bytes Uplink messages • Downlink triggered by device • Not suitable for real time applications

INTERNET OF THINGS ECOSYSTEM

Postscapes

INTEGRATE

ANALYZE

ACQUISITION

INTERACTION

CONTEXT

SERVICE

ENTERPRISE APPS

MACHINE INTELLIGENCE

CLOUD PLATFORMS

BUSINESS

CUSTOMER SERVICE
SDK / INTERNAL & EXTERNAL APIs
CRM, ERP, PLM, MES
BILLING & PAYMENTS
BLOCKCHAIN & DATA MARKETPLACES

SERVICE DELIVERY

DEVICE & DATA MANAGEMENT

ANALYTICS

DASHBOARD & TOOLS

DATA

EDGE INTELLIGENCE

SENSORS & ACTUATORS

CORE COMPONENTS

SOFTWARE

CONNECTIVITY

GATEWAYS

DEVICE COMPONENTS

Automated

Ambient

Active

ASSET

MARKET

LIVING

RETAIL / OFFICE

HEALTH

TRANSPORT

INFRASTRUCTURE

INDUSTRY

ENVIRONMENT

STANDARDS

FRAMEWORKS & DISCOVERY: Healthkit, Homekit, Thread, Weave, IoTivity, Hypercat, Lemonbeat
TRANSPORT: 6LOWPAN, RPL, IPV6 SESSION: DDS TELNET, XMPP, COAP, MQTT, DDS, AMQP
COMMS: Enocean, Ethernet, Modbus, RS-232, RJ45, Powerline, Bluetooth, WiFi, 802.15.4 LPWAN (Sigfox, RPMA), Cellular 2-5G

ALLIANCES & CONSORTIA

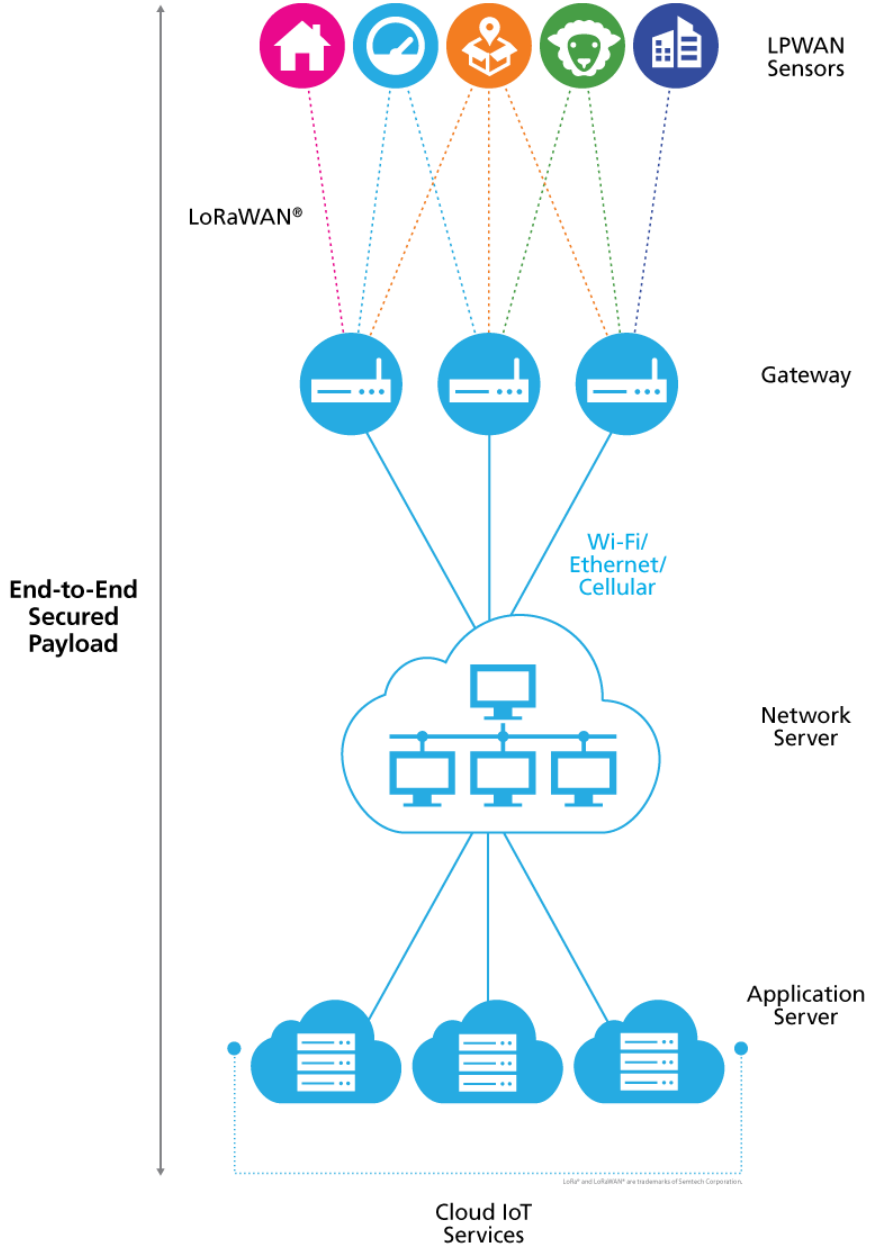
BUSINESS ECOSYSTEM

SECURITY

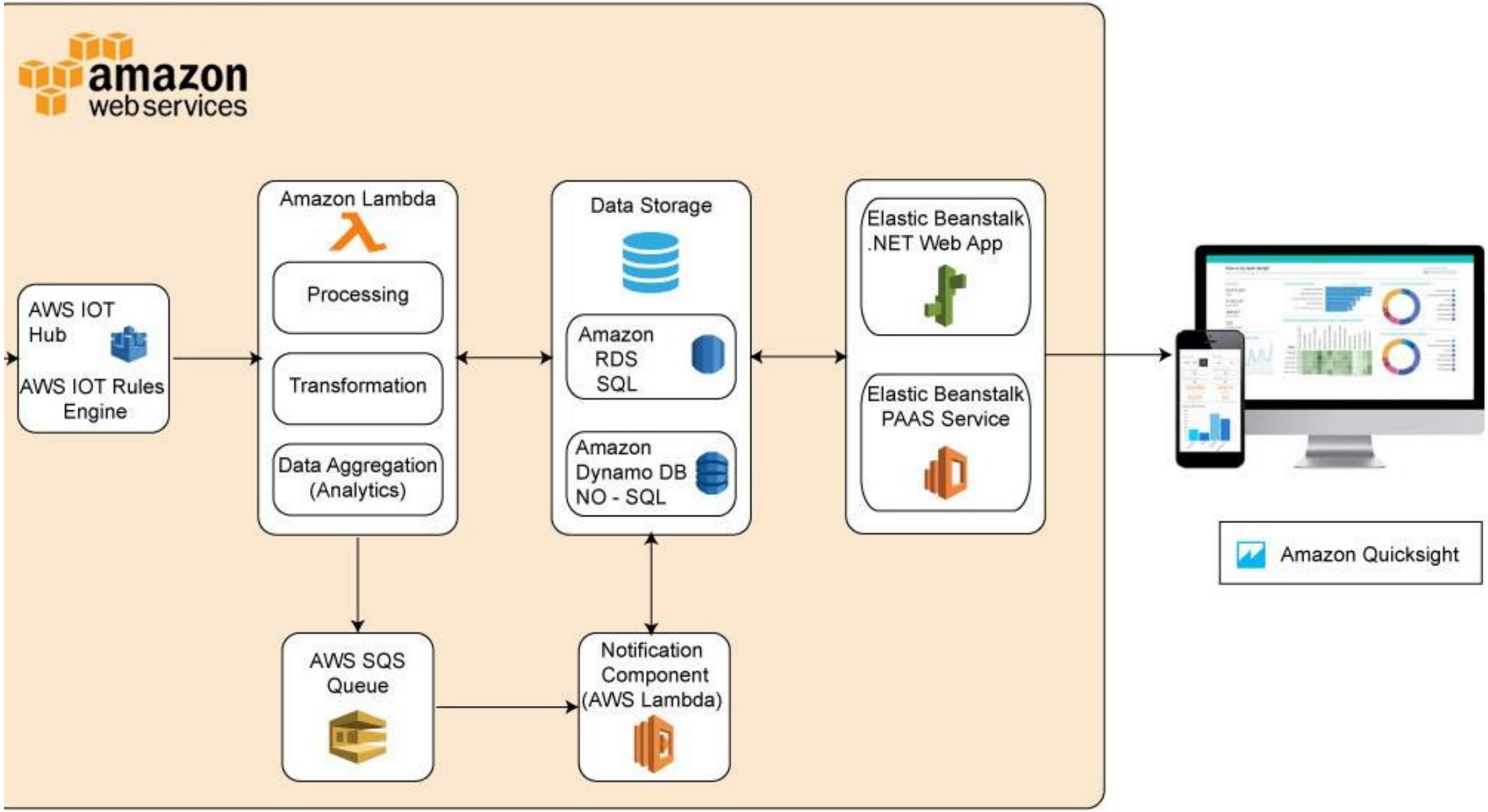
PRIVACY

REGULATIONS

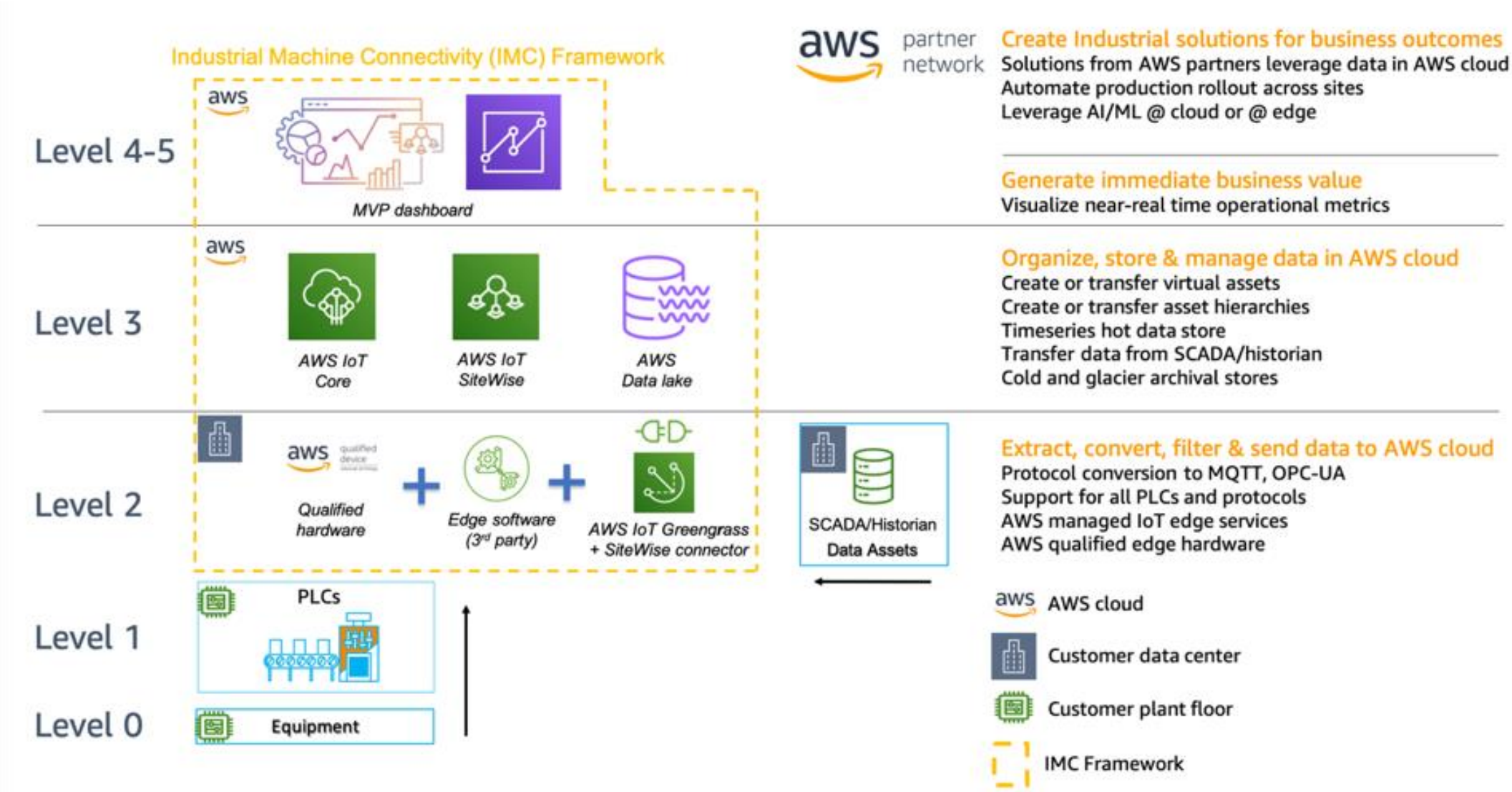
LPWAN Cloud Services



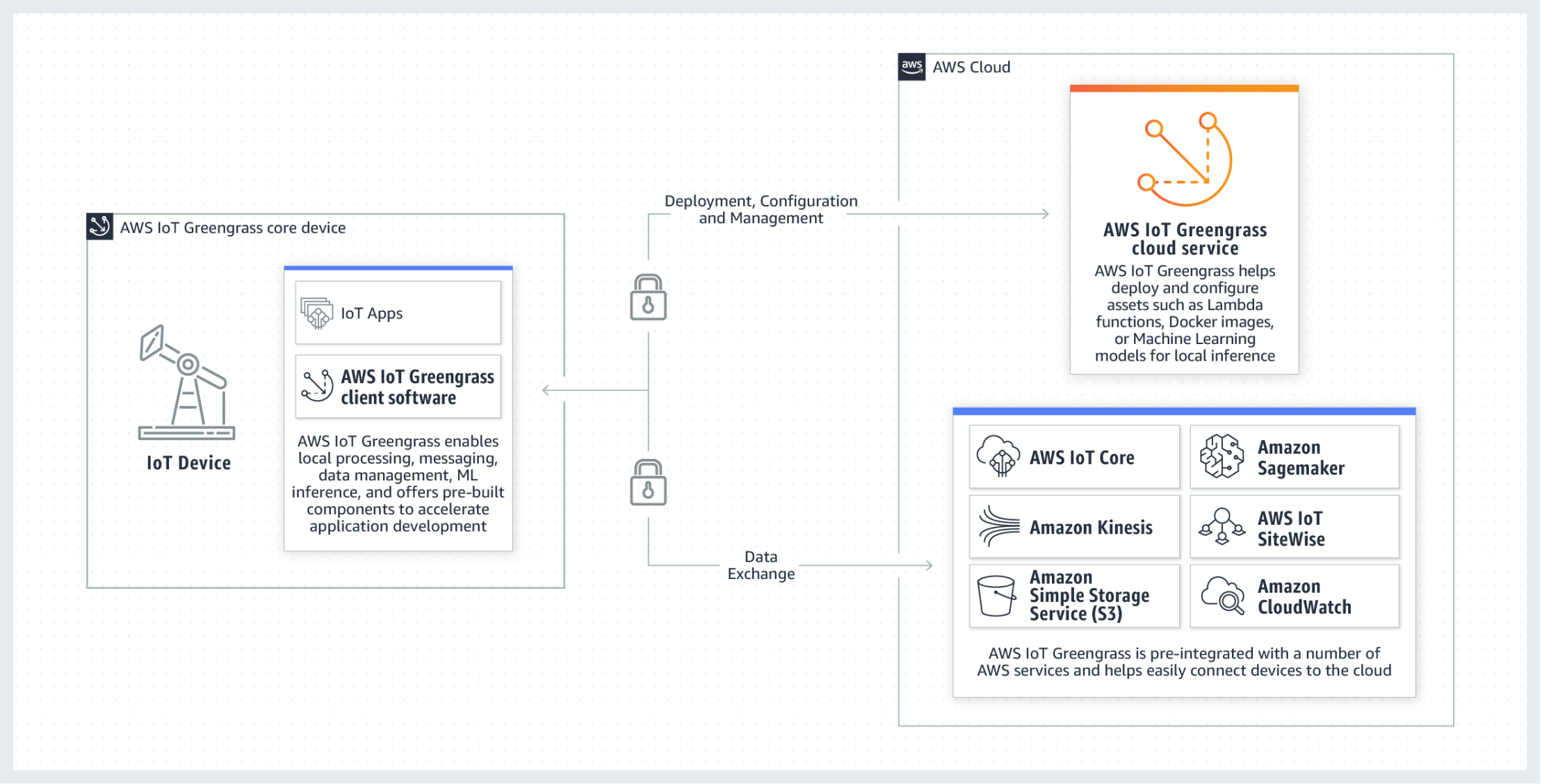
Building an Industrial IoT platform using AWS IoT



The Connected Factory Solution with AWS IoT



AWS IoT Greengrass:
Bring local compute, messaging, data management, sync, and ML inference capabilities to edge devices



Building 5G Edge Clouds for Containers with OpenNebula and AWS Wavelength

Open Nebula

Discover Use Contribute Engage Enterp

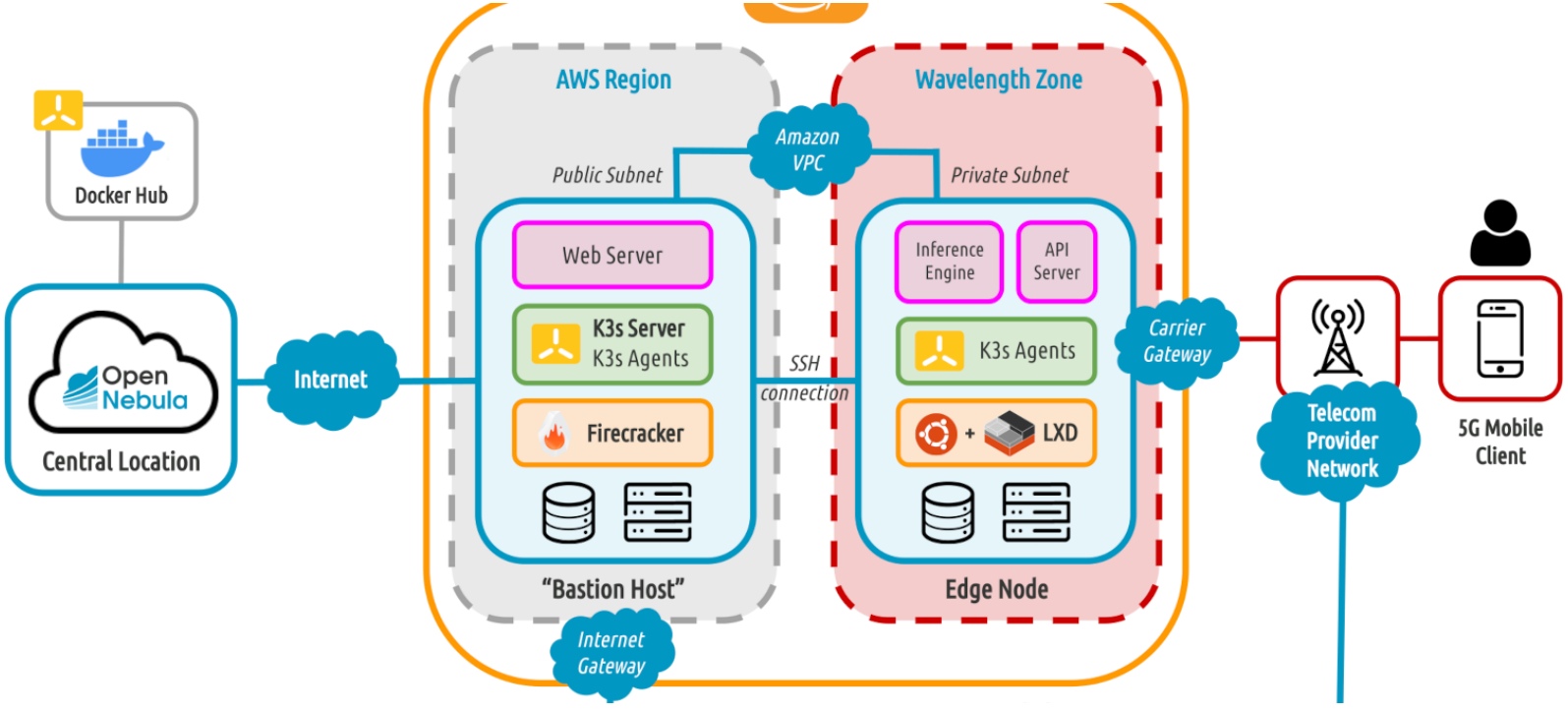
DECEMBER 10, 2020
COMPUTING, EXPERIENCES

ANNOUNCEMENTS, BLOG, CONTAINERS, EDGE

Share article

Building 5G Edge Clouds for Containers with OpenNebula and AWS Wavelength

Since the release of version 5.8 'Edge' in February



AWS IoT

Monitor
Activity
▶ Onboard
▶ Manage
▶ Greengrass
▼ Wireless connectivity
Intro
Gateways
Devices
Profiles
Destinations
▶ Secure
▶ Defend
▶ Act
Test

AWS IoT

AWS IoT Core for LoRaWAN

Connect and manage LoRaWAN gateways and devices with AWS cloud

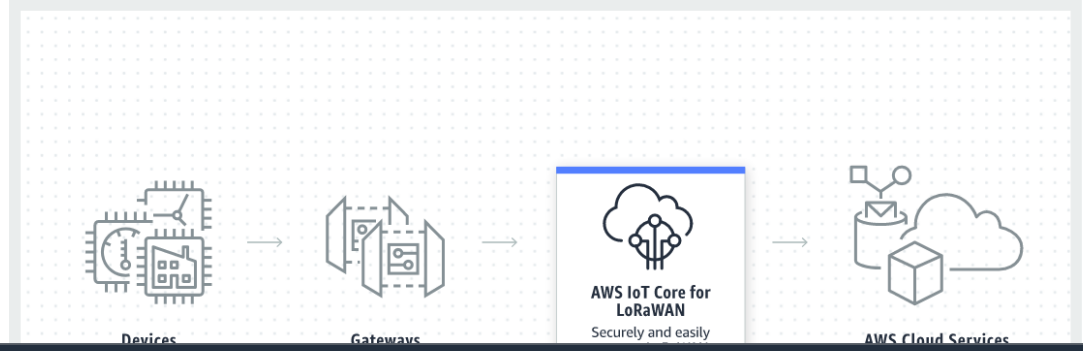
Setup a private LoRaWAN network by connecting your own devices and gateways with no LoRaWAN Network Server setup required.

Get started with AWS IoT Core for LoRaWAN

Register your LoRaWAN gateways and devices

Get started

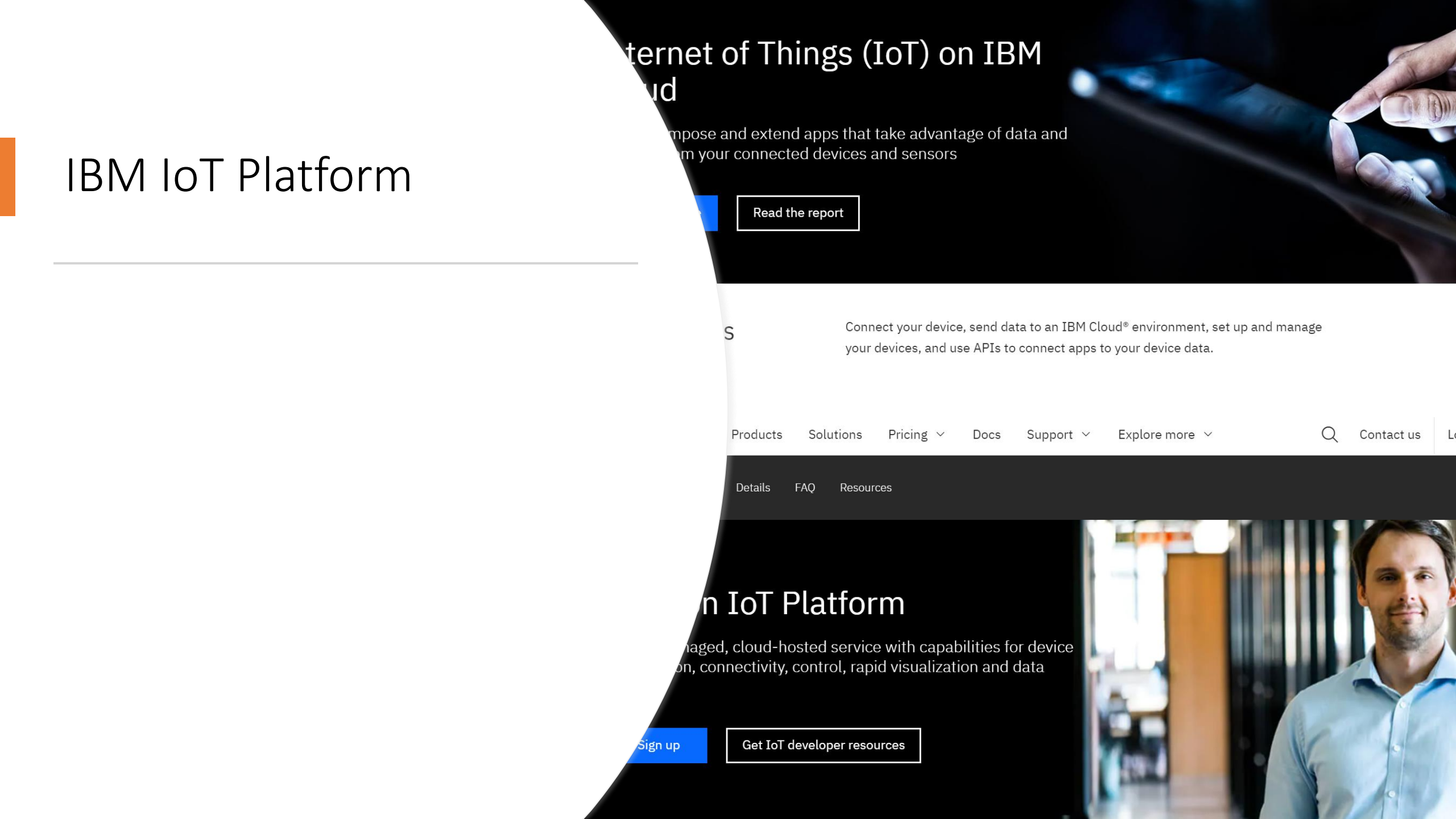
How it works



More resources

- API reference
- Documentation
- FAQs
- Support forums
- Partner Catalog

IBM IoT Platform



Azure IoT Hub

Managed service for bidirectional communication between IoT devices and Azure

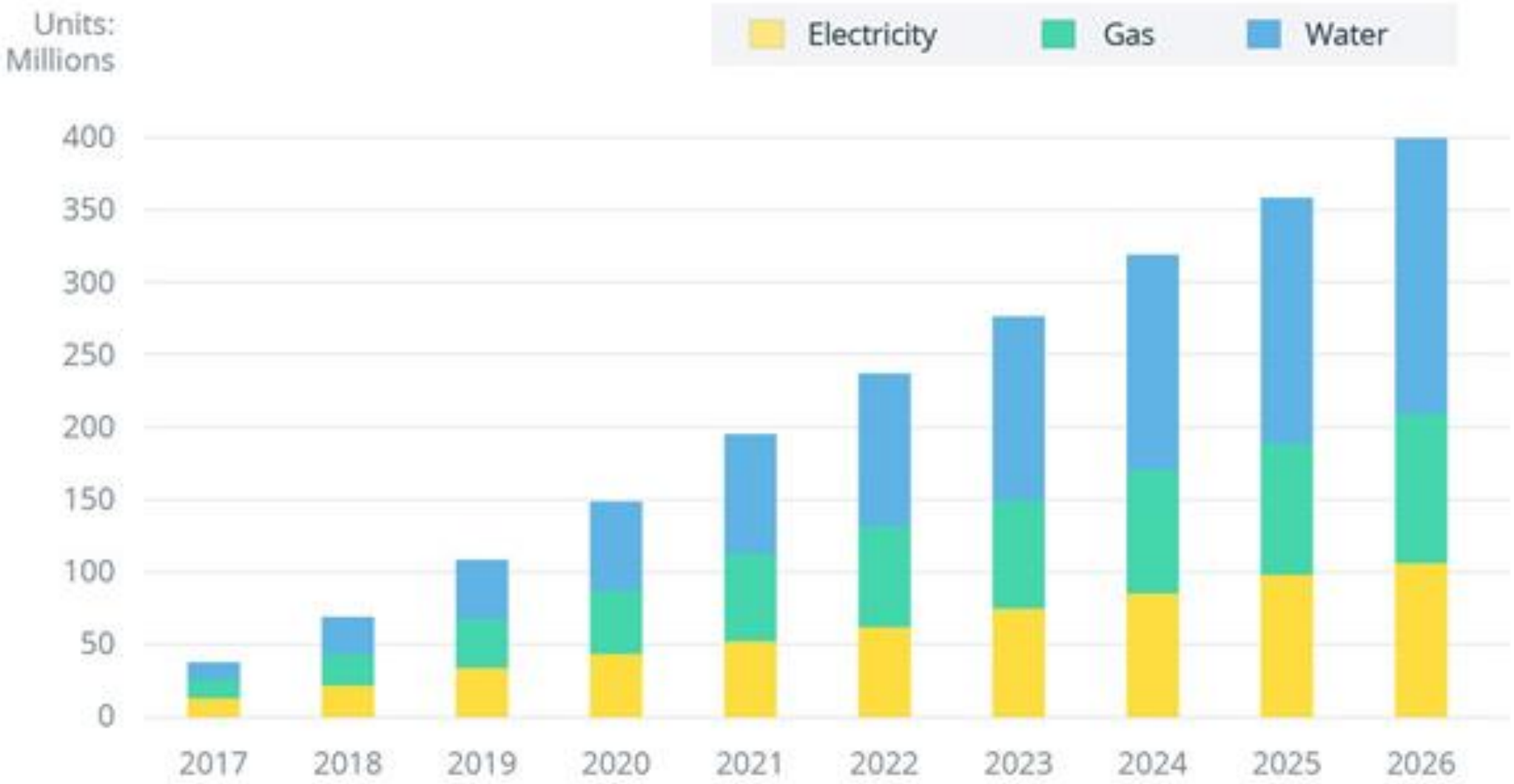
LoRaWAN will temporarily replace 5G networks for IoT

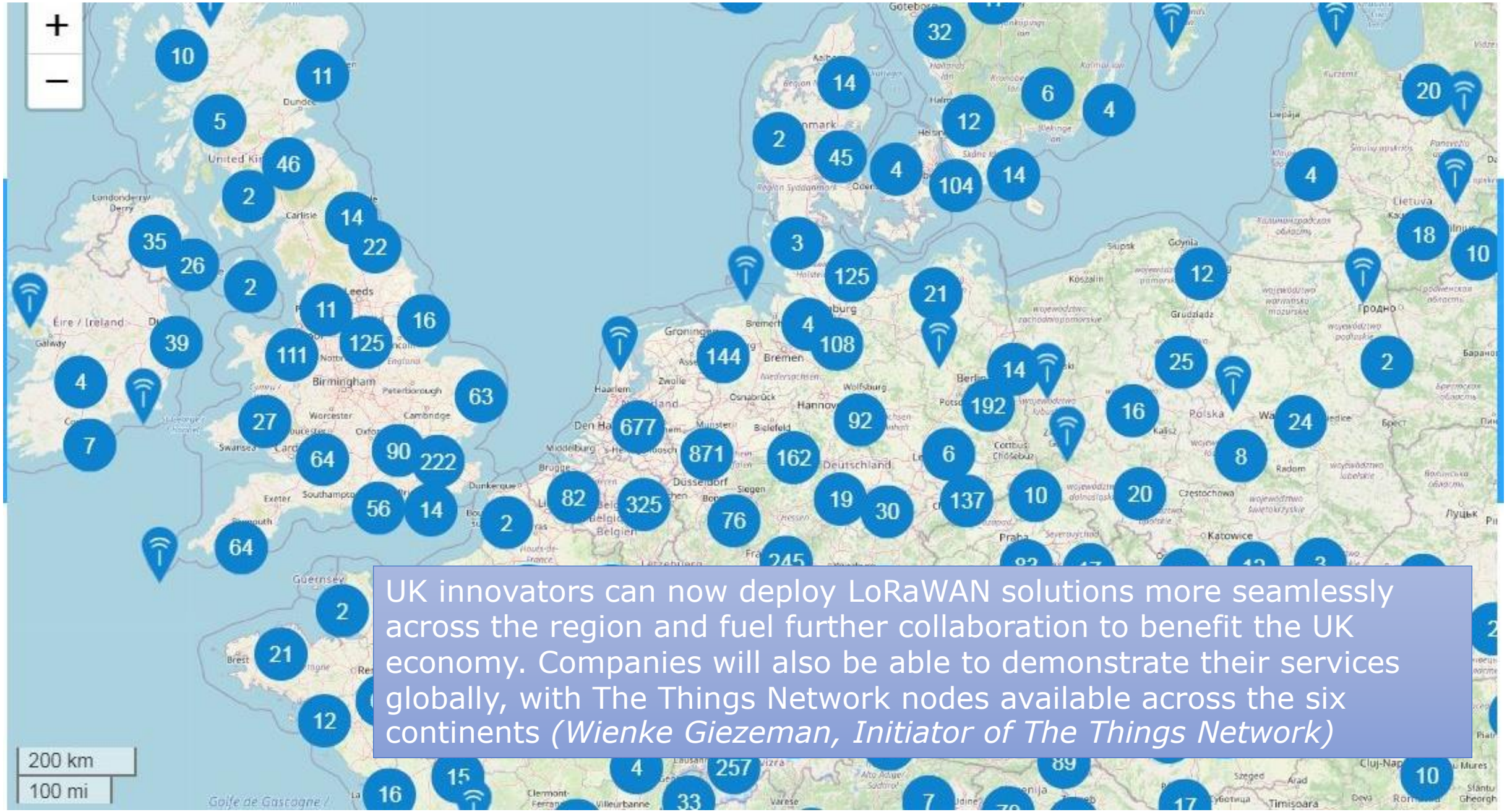
- LoRaWAN can replace 5G, at least until 5G becomes available worldwide.
- *But it will take several years for the technology to cover most of the planet. Thanks to LoRaWAN, you don't need to wait.*
- LoRa/LoRaWAN can do most of the same tasks that 5G can do — just more slowly and cheaply
- A LoRa-based device can work for up to ten years with one battery, whereas a 5G device will only last several hours.

- *5G networks will revolutionize the Internet of Things (IoT)*
- To build a 5G network in an area, you need to build specific infrastructure from scratch.

LPWAN connectivity will be the driving force behind the uptake of IoT, bringing new companies and services to market. This partnership enables us to expand and accelerate UK innovation *(Peter Karney, Head of Product Innovation, Digital Catapult)*

Non-cellular LPWAN connections by smart meter type




UK innovators can now deploy LoRaWAN solutions more seamlessly across the region and fuel further collaboration to benefit the UK economy. Companies will also be able to demonstrate their services globally, with The Things Network nodes available across the six continents *(Wienke Giezeman, Initiator of The Things Network)*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O'zbekiston
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中国
Indonesia
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connexin

COVID-19 For Business For Home Media Centre About Us Contact

LoRaWAN Technology

Worldwide IoT protocol offering an efficient, flexible and economical solution to real-world problems

LoRa™

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We design, b
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Learn Mor

Connexin partners with Yorkshire Water to provide a carrier-grade network for IoT pilot

BEN POCOCK ON APRIL 29, 2020

Apex Technical Solutions LLC.

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- +968-95674155
- majid.ibrahim@apexoman.net

CHALLENGES

- BARRIERS TO GROWTH
- ISOLATED DATA SILOS
- LACK OF INFRASTRUCTURE SUPPORTING DATA DRIVEN INNOVATION
- GAPS IN SKILLS & COMPETENCES
- LEVERAGING BUSINESS & CITIZEN

Universities

International partners

MK Innovation Network

Industry

Citizens

KEY OUTPUTS

- SAFEGUARDING GROWTH IN 14,500 JOBS BY 2026
- SUPPORTED GROWTH OF SMEs
- CITIZEN INNOVATION
- SMART CITY CPD
- SMART CITIES INSTITUTE
- INTEGRATED OPEN DATA ECOSYSTEM
- SMART

StarShip’s Autonomous Robot (video)

الهيئة العراقية لخبراء التكنولوجيا

Iraq Technologists Board

www.IraqTech.org

فرق العمل


الشركات الصغيرة والمتوسطة
SMEs
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entrepreneurship and Innovation
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التعليم الإلكتروني
e-Learning
الحكومة الإلكترونية
e-Government
البنية التحتية
infrastructures
البحث والتطوير
Research and Development
التدريب والتأهيل
training and development
التشريعات والقوانين
regulation and legislation
الشركات الكبيرة
large Enterprise
المواهب والمهارات الرقمية
Digital Skills and Talents
تأسيس نظام عمل مبني على الشراكة
Public-Private Partnership
الاقتصاد الرقمي والمعرفي
Digital Economy
Knowledge Economy
الخصوصية وأمن المعلومات
Cybersecurity

خطوة نحو الاقتصاد الرقمي

يعنى الاقتصاد الرقمي بالاستخدام الواسع النطاق لتكنولوجيا المعلومات والاتصالات في الجهود الاجتماعية والاقتصادية، ويسهم في توسيع الفرص وزيادة النمو الاقتصادي وتحسين جميع الخدمات العامة المقدمة.

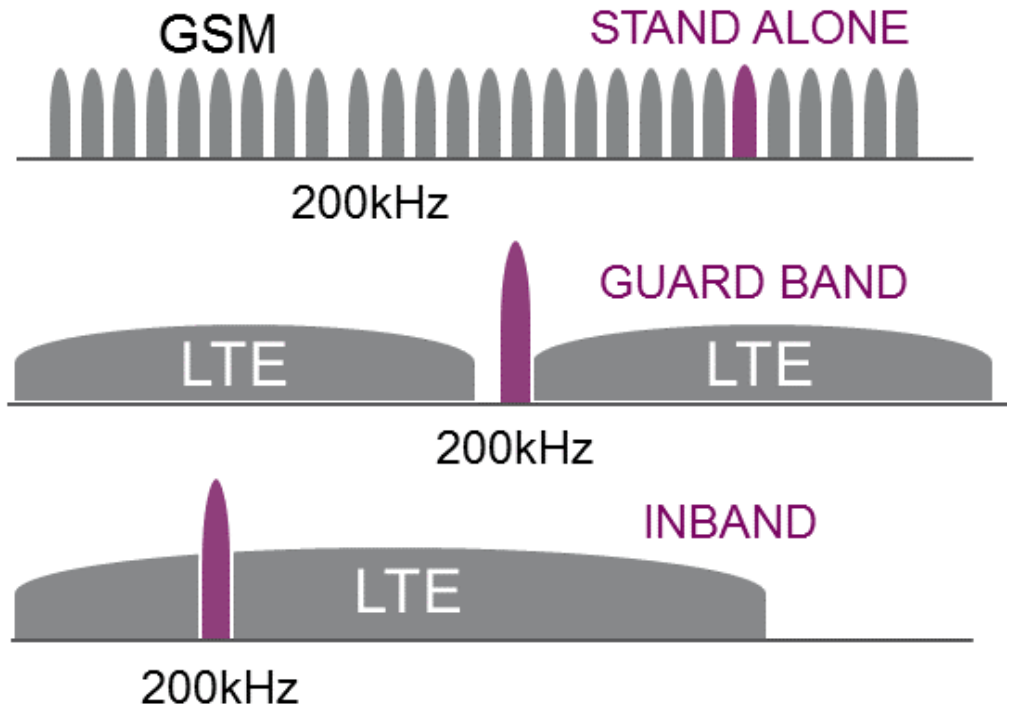
والاقتصاد الرقمي ضروري لخلق "مجتمعات ذكية" تمكن الجهات، من سلطات عامة وحكومات وشركات وأفراد و لاسيما الشباب، من اتخاذ أفضل القرارات على أساس معلومات وافية والحد من أوجه عدم المساواة. وللثورة الرقمية أثر بعيد المدى كما كان للثورة الصناعية في القرن التاسع عشر.

ولايمكن أن يبقى العراق بعيدا عن هذا التوجه بل لابد من أن يستفيد من المزايا التي يقدمها ويتصدى للمخاطر المرتبطة به. ويمكن للعراق ، بما يتمتع به من طاقات بشرية كبيرة وشباب مثقّفين وموارد مالية وموقع جغرافي مركزي، أن يستخدم الاصول التي يتيحها الاقتصاد الرقمي لتحويل اقتصاداته

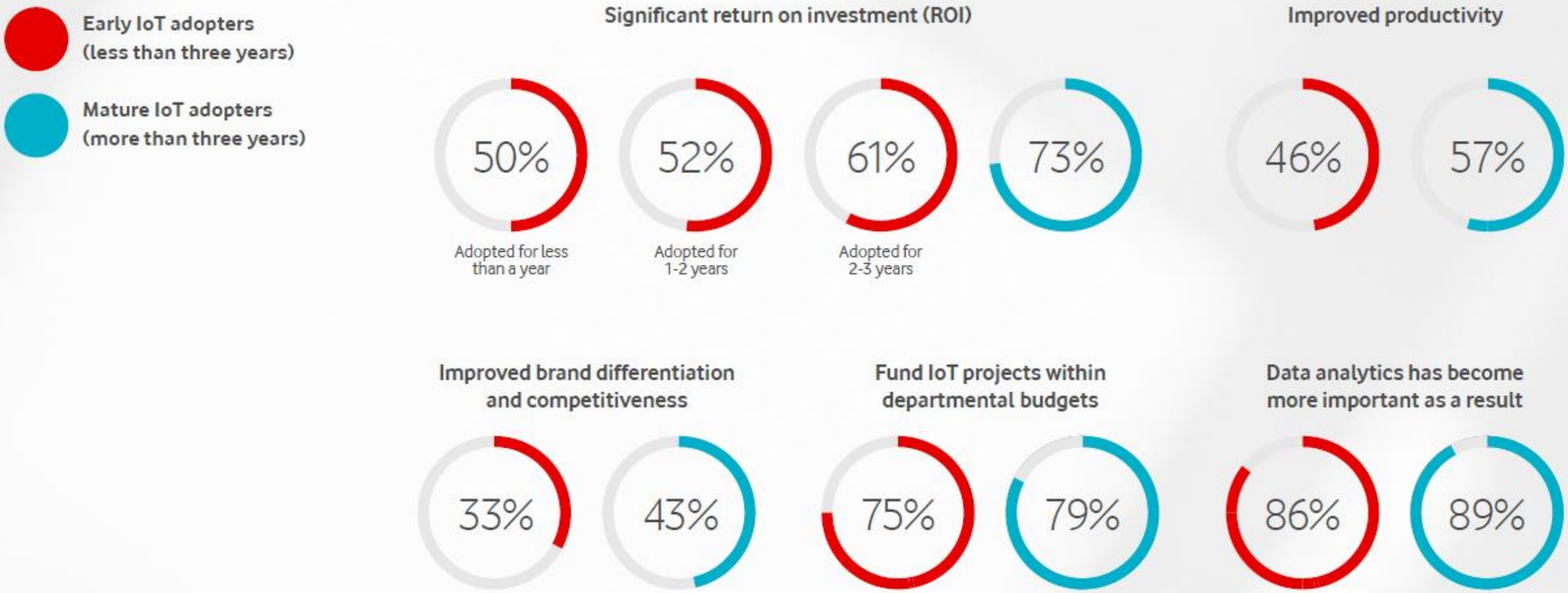

AL KINDI
Society of Engineers
جمعية الكندي للمهندسين
bcs
The Chartered Institute for IT
UON
University of Northampton
OPEN DAY
2018
Thanks for your attention
Waterside Campus 2018
University of Northampton
#STUDYABROADWITHESCC
TRANSFORMING LIVES .... INSPIRING CHANGE

What is NB-IOT?

- From an end-user perspective, NB-IOT based systems are designed to make IOT deployments possible in situations **where it is impractical or impossible to deploy a dedicated unlicensed network**.



How are attitudes towards IoT changing as the benefits of adoption become more apparent:



Speed	1Mbit/s+	~100kbit/s	<10kbit/s
Example technology	4G	2G, LTE-M	LoRa, SIGFOX, NB-IoT
Spectrum	Licenced	Licenced	Licenced or unlicenced
Example use cases	 Smart phone  Connected car  CCTV	 Smart grid  Smart watch  High value object tracking	 Low value object tracking  Smart meter  Smart parking  Smart street lights