How Mobile Private Networks and Internet of Things work

Konference Radiokomunikace

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vodafone
business

Internet of Things
IoT

01

When it comes to IoT, we're established leaders

We provide

162 million IoT connections

in 190 countries

We have

1400 dedicated IoT experts

working around the world

We collaborate to

set industry standards

for IoT innovation

Our awards and recognition

GlobalData.

GlobalData named Vodafone as a leader in the 2023 Global Industrial IoT Services Competitive Landscape Assessment

May 2023

TRANSFORMA INSIGHTS
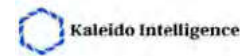
Vodafone named a Leader in the 2023 Transforma Insights Communications Service Provider (CSP) IoT Peer Benchmarking Report 2023

February 2023

Gartner.

Vodafone named a Leader in the 2023 Gartner® Magic Quadrant™ for Managed IoT Connectivity Services, Worldwide

January 2023

Kaleido Intelligence

Vodafone recognised as a leading Champion vendor by Kaleido Intelligence in the Connectivity Vendor Hub: Competitive Analysis & Kaleido Scores H2 2022 report

September 2022

FROST & SULLIVAN

Vodafone has been named by Frost & Sullivan as the recipient of the 2022 Enabling Technology Leadership Award

June 2022

JUNIPER RESEARCH

Vodafone has been ranked as the leading IoT Roaming provider in Juniper Research's Competitor Leaderboard

June 2022

ABIresearch
THE TECH INTELLIGENCE EXPERTS

Vodafone finished third in the ABI Research Telco Sustainability Rankings

April 2022

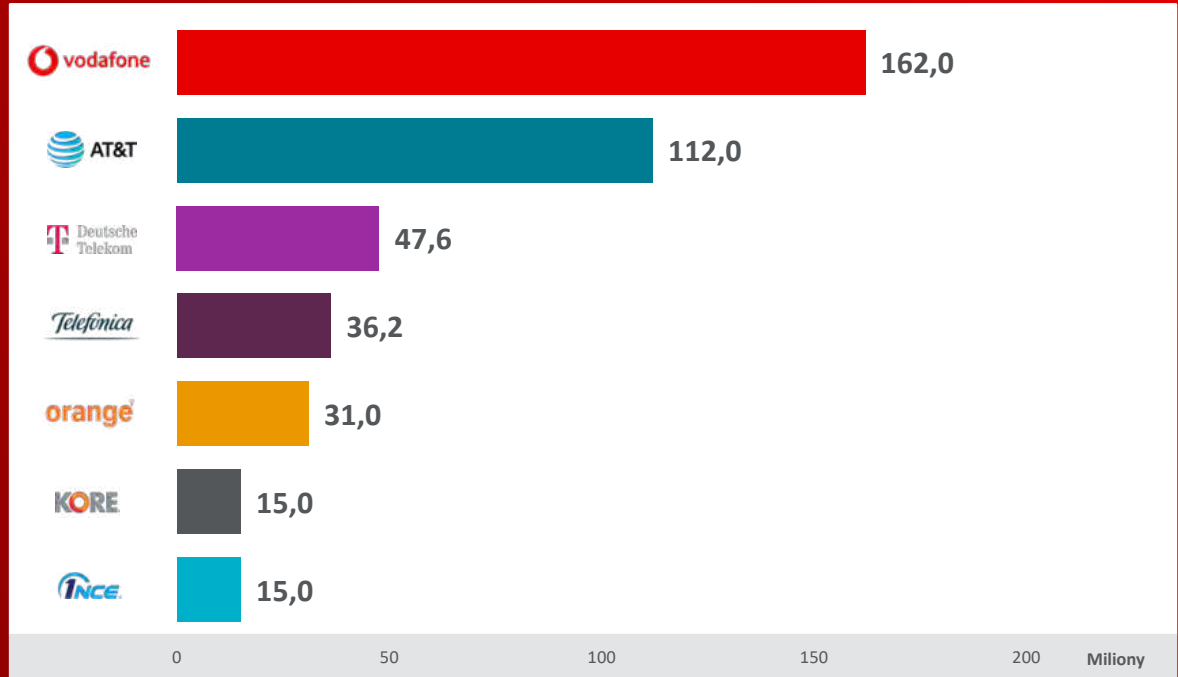
IDC ANALYZE THE FUTURE

Vodafone named a leader in the IDC MarketScape Worldwide Managed IoT Connectivity Services Vendor Assessment

March 2022

Because we're a leading global provider, you can rely on us.

Our scale and heritage in IoT means we can give you a reliable experience like no other. That includes minimal downtime and minimal risk, allowing you to connect your business with confidence.

No matter where you are, we can connect you

Hidden Internet of Things

IoT Infrastructure

Connectivity

Gateways

NB-IoT

Middleware

Applications

Perception layer

Connectivity layer

Processing layer

Application layer
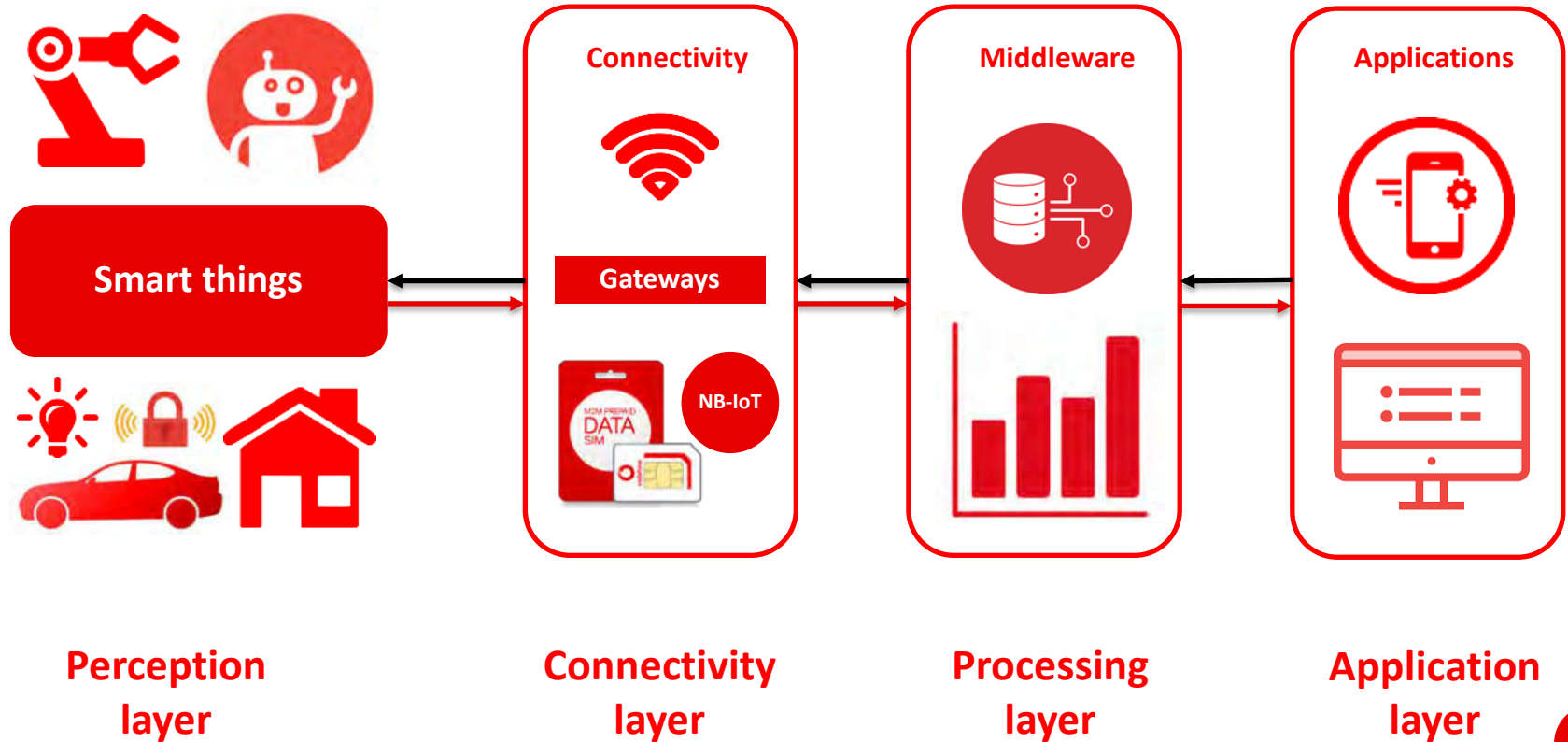
Global Data Service Platfrom
GDSP
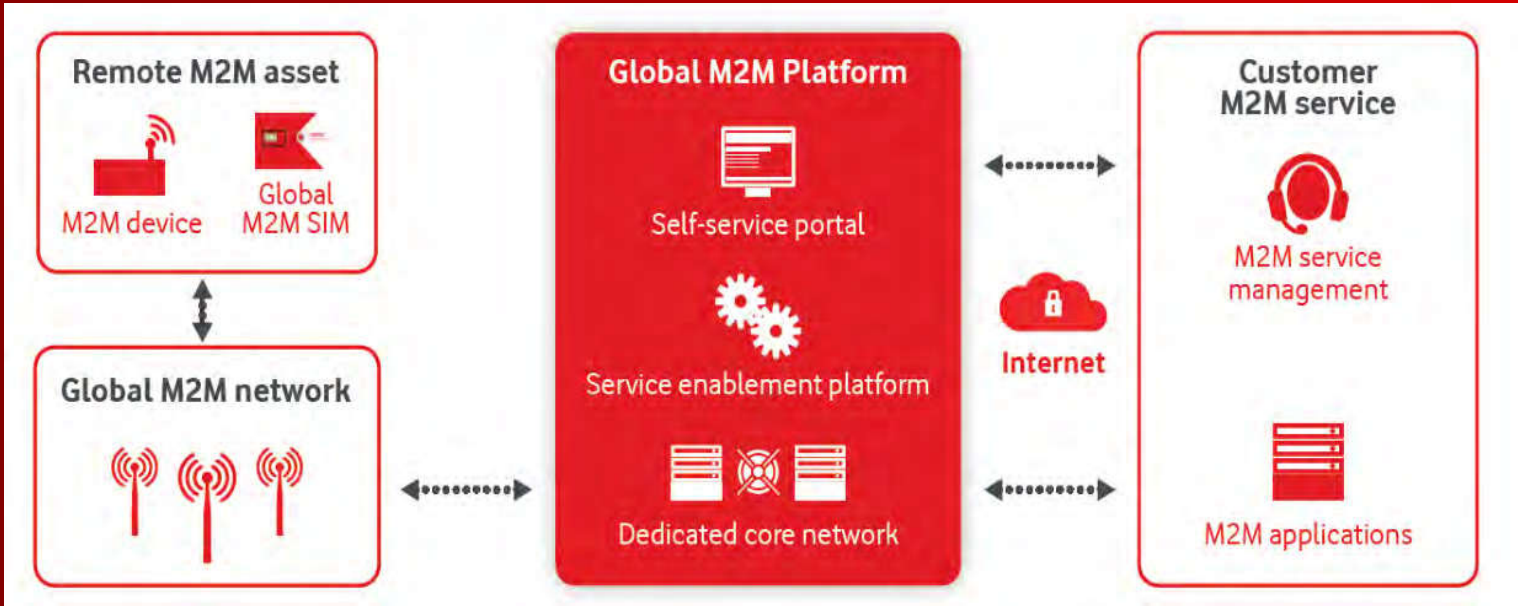
IoT Connectivity

LPWA

2G (GSM)
in 190 countries

4G (LTE)
in 190 countries

5G
in 190 countries

LTE-M (Cat-M)
in 190 countries

NB-IoT
in 190 countries

LTE CatM (LTE-M) **complementary** technology for NB-IoT

electricity smart meters

water, gas smart meters

	Bandwidth	Coverage	Battery life	Capacity	Peak Throughput	Mobility	Voice
LTE-M	1.4 MHz	160dB (+15dB)	10+ Year	1M+/cell	0.8/1 Mbps (300/375 kbps)	Connected & idle mode mobility	Supported
NB-IoT	200 kHz	164dB (+20dB)	10+ Year	200K/cell	227/250 kbps (21/63 kbps)	Idle mode mobility	Not Supported

— LTE-M

Coverage · Low Latency · Low Power · Mobility · Density · Data rate

— NB-IoT

Coverage · Low Latency · Low Power · Mobility · Density · Data rate
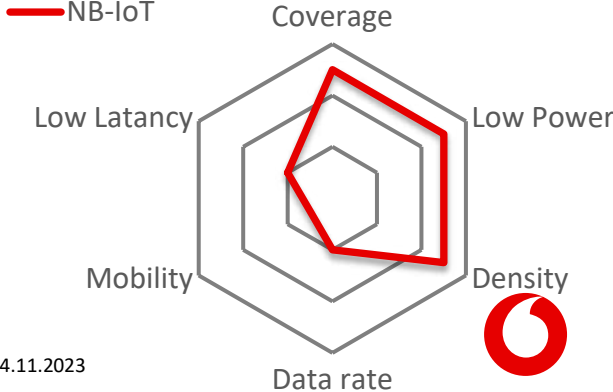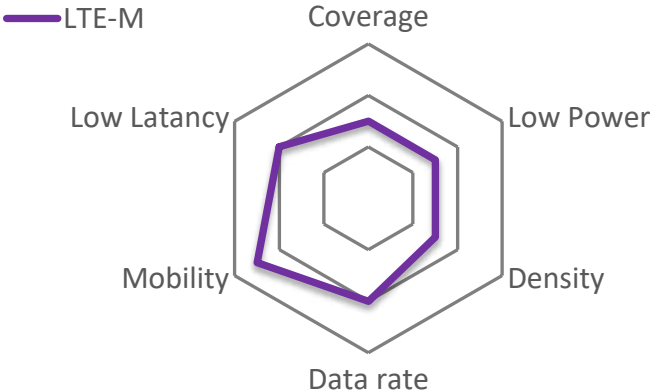
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IoT connectivity now and future

	LTE Cat 1	LTE Cat 1bis	LTE Cat 4	LTE Cat NB2 (NB-IoT)	LTE Cat-M1 (eMTC)	RedCap	eRedCap
3GPP release	Rel-8	Rel-13	Rel-8	Rel-14	Rel-13	Rel-17	Rel-18
Bandwidth	Up to 20 MHz	Up to 20 MHz	Up to 20 MHz	180 KHz	1.4 MHz	FR1:20 MHz	FR1: 5-20 MHz[1]
Duplex mode	FD, TDD	FD, TDD	FD, TDD	HD, FDD	FD[2], HD, TDD	FD, HD, TDD	FD, HD, TDD
Download (DL) peak data rate	10 Mbps	10 Mbps	150 Mbps	127 Kbps	300 kbps	FR1: 220 Mbps	10 Mbps
Upload (UL) peak data rate	5 Mbps	5 Mbps	50 Mbps	159 Kbps	375 kbps	FR1: 120 Mbps	10 Mbps
Max Tx/ Rx chain	1T/2R	1T/1R	1T/2R	1T/1R	1T/1R	1T/2R (1T/1R)	1T/1R
Tx power	23 dBm	23 dBm	23 dBm	14/20/23 dBm	20/23 dBm	20/23/26/ 29 dBm	23 dBm
Range (MCL)	144 dB	141 dB	144 dBm	164 dB	156 dB	140 dB	137 dB
Power save	eDRX, PSM	eDRX, PSM	eDRX, PSM	eDRX, PSM	eDRX, PSM	eDRX, MICO	eDRX, MICO
Voice	Supported	Supported	Supported	Supported	Supported	Supported	TBD

Source: Qualcomm

NB-IoT and Cat-M deployment

A globally deployable standard that can exist on today's LTE networks	**NB-IoT will be built on existing mobile network infrastructure**	Natural evolution and extension of LTE, with flexible deployment options	Best LPWA option for: • **Low power** • **Signal propagation** • **Reduced module costs**

NB-IoT deployment options:

"In-band"

180 KHz NB-IoT Carrier

← LTE carrier →

"Guard band"

← LTE carrier →

"Standalone"

← GSM carriers →

or

← LTE carrier →
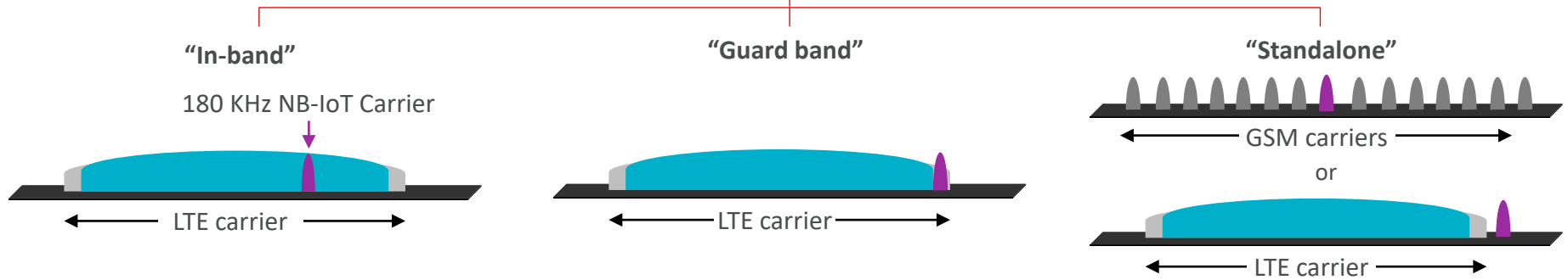
LTE cat-M deployment options:

Cat-M In-band

← LTE carrier 5, 10, 20 MHz →

Cat-M only

← eMTC only cell →

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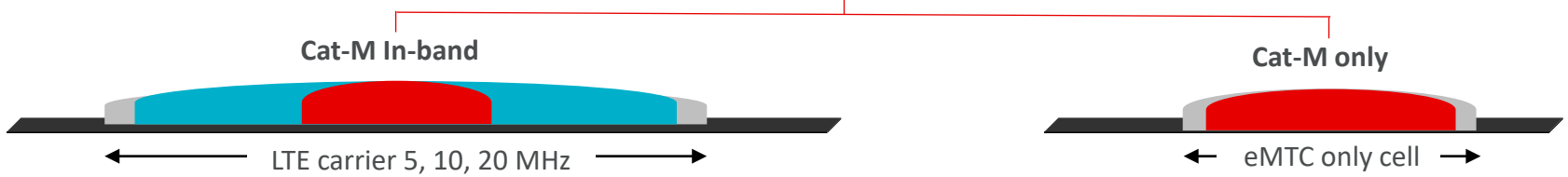
Extensive power management

Combination of Power Saving Mode (PSM) and Extended Sleep Cycle (eDRX)

Extended Sleep Cycle eliminates unnecessary receiver activations

Reachability improved over Power Saving Mode

WITHOUT POWER SAVING MODE OR EXTENDED SLEEP CYCLE

POWER — PAGING OCCASION — DRX — DATA — TIME

PSM

POWER — PAGING OCCASION — DRX — DATA — eDRX — TIME

Trace PSM

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C2 General
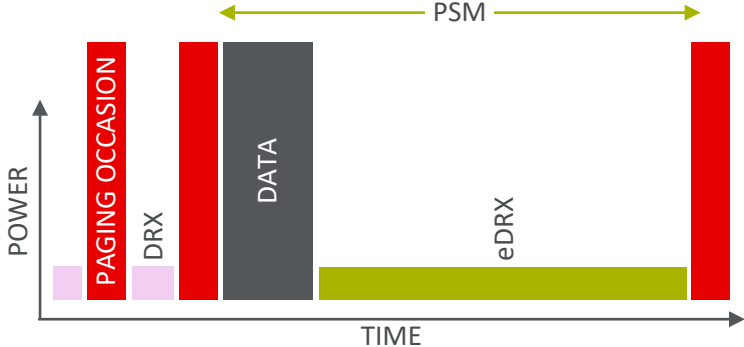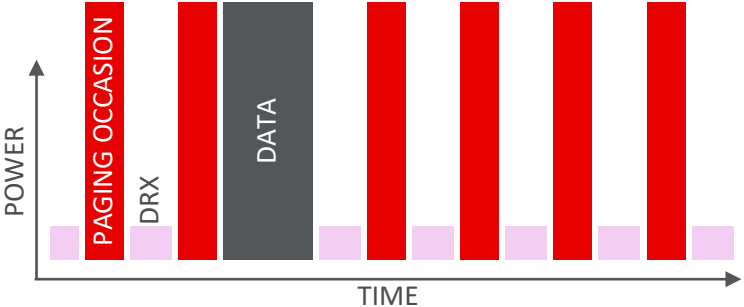
Extended coverage

Extended coverage mode extends coverage by up to +20 dB and is achieved by:

- Repetition of transmissions
- New control channels

Based on our testing, NB-IoT will be able to penetrate two to three double-brick walls, enabling connectivity of objects in underground car parks and basements.

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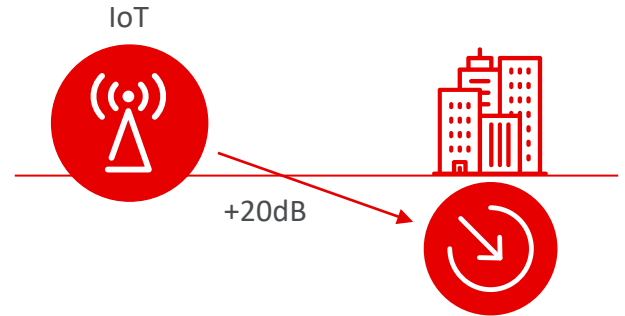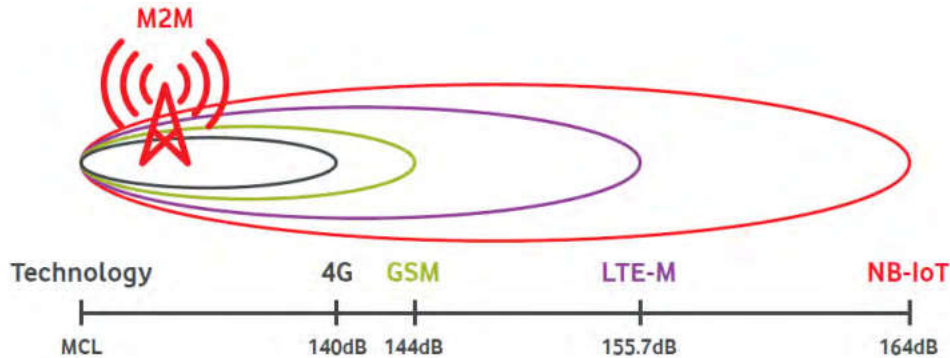
Vodafone is a trusted provider of IoT solutions

IoT sensors

Smart Building

Energy Data Management

Monitoring solutions

IoT for Public (smart waste, smart irrigation)

Mobilní privátní sítě
MPN

02

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"Network as a service"

5G Antenna

Provide companies' campus with their own 5G network. Sensitive data does not leave the site

Connection to a comprehensive 5G network

If desired, the mobile private network can also be connected to the public network

Management platform

Companies have monitoring and control over their MPN and can add or remove devices as needed

Technical service

Vodafone technicians keep an eye on the mobile private network, keep the technology up to date and proactively fix faults

Data and collaboration

Employees can collaborate with other employees, including scheduling and dispatch as well as augmented reality functions

Connection to the core network

Mobile Private Network core with connection to high speed edge computing (MEC)

Mobile Private Networks
3 possible versions

Dedicated MPN	**Hybrid** MPN	**Segregated** MPN
Physical standalone mobile private network	Physical private network elements deployed in conjunction with the public network	QoS in the Vodafone network with **Network Slicing**
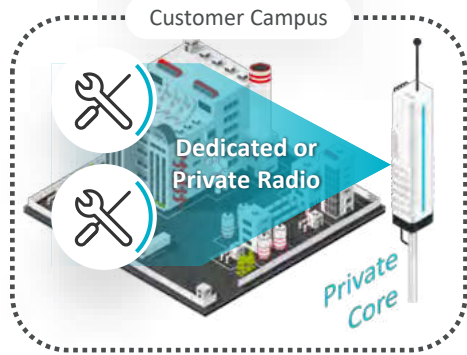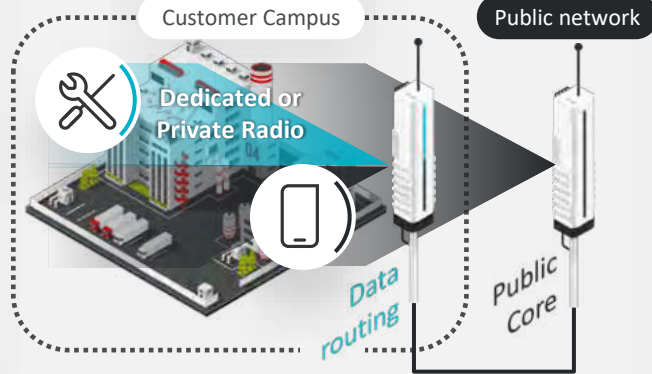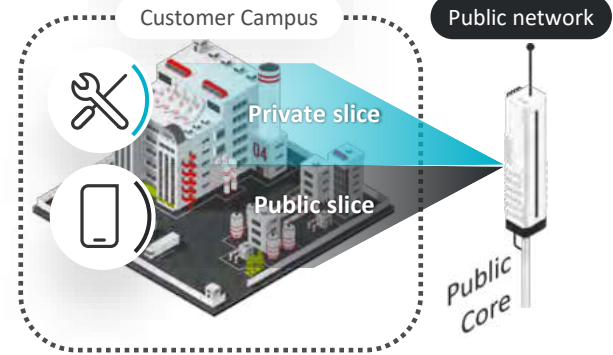
Dedicated MPN	**Hybrid** MPN	**Segregated** MPN
Assured QoS	**Assured QoS**	**Assured QoS**
Keep your data on your campus	Keep your data on your campus	Keep your data on your campus
100% control through customer	100% control through customer	100% control through customer
Interworking with public network	**Interworking with public network**	**Interworking with public network**

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Case study
Ford

Ford is interested in the connectivity of the welding processes used in the manufacturing of electric vehicles.

Vast amounts of data are generated within each factory process:

- Up to 30 data points per mm
- ~ 600 data points per seam weld (>7k pieces of data per vehicle)
- ~ 860 mS weld time

This data needs processing fast, requiring a high-performance, low-latency network.

THE CHALLENGE

- Chris White, 5GEM project lead at Ford:
- "Connecting today's shop floor requires significant time and investment. The technology used is inflexible and bespoke. It can often be viewed as the limiting factor in reconfiguring and deploying reliable manufacturing systems."

THE SOLUTION

- A 5G Mobile Private Network supporting a welding testbed
- Shared by Ford's welding and factory technology partners
- Enables designs ready for shop floor

Watch the video

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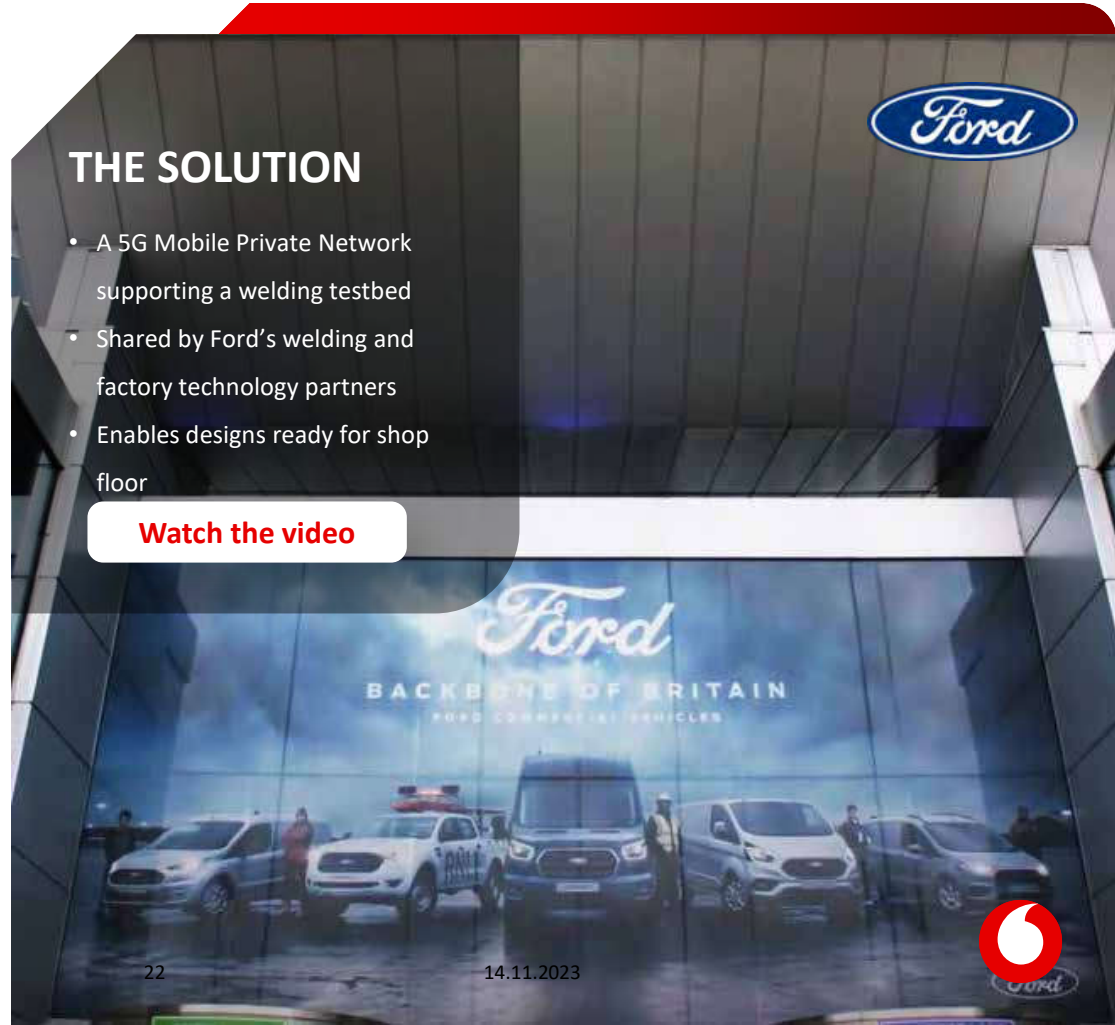
Case study
Lufthansa

DESCRIPTION:

- Virtual and Augmented reality to visualize the 3D design of the cabin equipment
- Accurate position checking by technicians of all planned components
- Using collaborative video between technicians and component developers

CUSTOMER BENEFIT:

- Time saving: Real-time video collaboration between technicians working on the aircraft fuselage and component developers in the factories

THE CHALLENGE:

High bandwidths required for transfer of extensive CAD data

- High capacity required to work on multiple aircrafts simultaneously
- High end security required for keeping the data on Lufthansa base

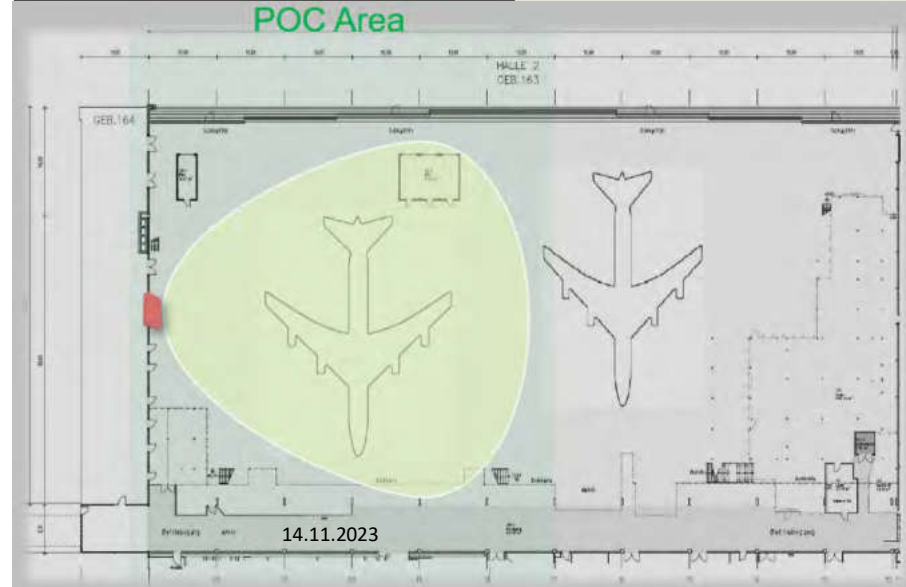## THE SOLUTION

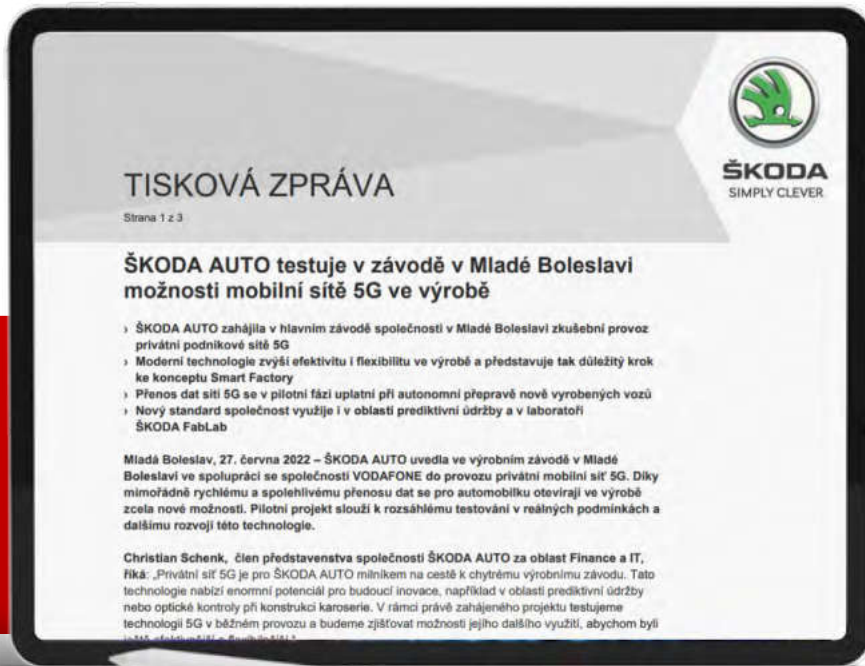- Standalone private 5G campus network at the 8,500 square meters Lufthansa base at Hamburg Airport

POC Area

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Case study
Škoda

Podcast: SIMPLY
CLEVER PODCAST 2.0:
ŠKODA and Vodafone
Partner Up

TISKOVÁ ZPRÁVA

Strana 1 z 3

ŠKODA AUTO testuje v závodě v Mladé Boleslavi možnosti mobilní sítě 5G ve výrobě

› ŠKODA AUTO zahájila v hlavním závodě společnosti v Mladé Boleslavi zkušební provoz privátní podnikové sítě 5G
› Moderní technologie zvýší efektivitu i flexibilitu ve výrobě a představuje tak důležitý krok ke konceptu Smart Factory
› Přenos dat sítí 5G se v pilotní fázi uplatní při autonomní přepravě nově vyrobených vozů
› Nový standard společnost využije i v oblasti prediktivní údržby a v laboratoři ŠKODA FabLab

Mladá Boleslav, 27. června 2022 – ŠKODA AUTO uvedla ve výrobním závodě v Mladé Boleslavi ve spolupráci se společností VODAFONE do provozu privátní mobilní síť 5G. Díky mimořádně rychlému a spolehlivému přenosu dat se pro automobilku otevírají ve výrobě zcela nové možnosti. Pilotní projekt slouží k rozsáhlému testování v reálných podmínkách a dalšímu rozvoji této technologie.

Christian Schenk, člen představenstva společnosti ŠKODA AUTO za oblast Finance a IT, říká: „Privátní síť 5G je pro ŠKODA AUTO milníkem na cestě k chytrému výrobnímu závodu. Tato technologie nabízí enormní potenciál pro budoucí inovace, například v oblasti prediktivní údržby nebo optické kontroly při konstrukci karoserie. V rámci právě zahájeného projektu testujeme technologii 5G v běžném provozu a budeme zjišťovat možnosti jejího dalšího využití, abychom byli

Thank you

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Together we can