Digital transformation of Ports & Terminals

Accelerating industries digitalization to Industry 4.0 with Industrial-Grade Private Wireless Networking

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150 years of successful reinvention

From
mobile phones
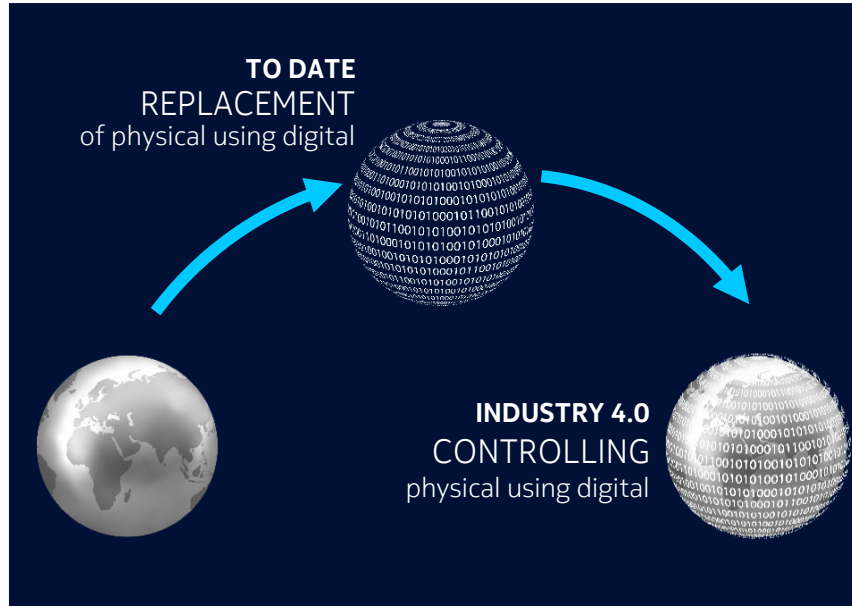
to
telecommunications networking

to
industrial wireless, machine-learning and software

NOKIA

The Path to Industry 4.0

Convergence of Operational Technologies (OT) & Information Communications Technologies (ICT)

TO DATE
REPLACEMENT
of physical using digital

INDUSTRY 4.0
CONTROLLING
physical using digital

OT		ICT
Mission-critical	**Reliability**	Carrier-grade
Specialized	**Technologies**	General-purpose/ standardized
Business process control	**Service(s)**	Media delivery & information services
Slow (decades)	**Rate of tech change**	Rapid (months to years)

Industry 4.0 will drive the convergence of OT and ICT to become 'IOCT'. Industry 4.0 will not replace physical with digital, it will use digital to control physical assets (digital twins).

NOKIA

1st Step of industry 4.0

1st

Step of industry 4.0
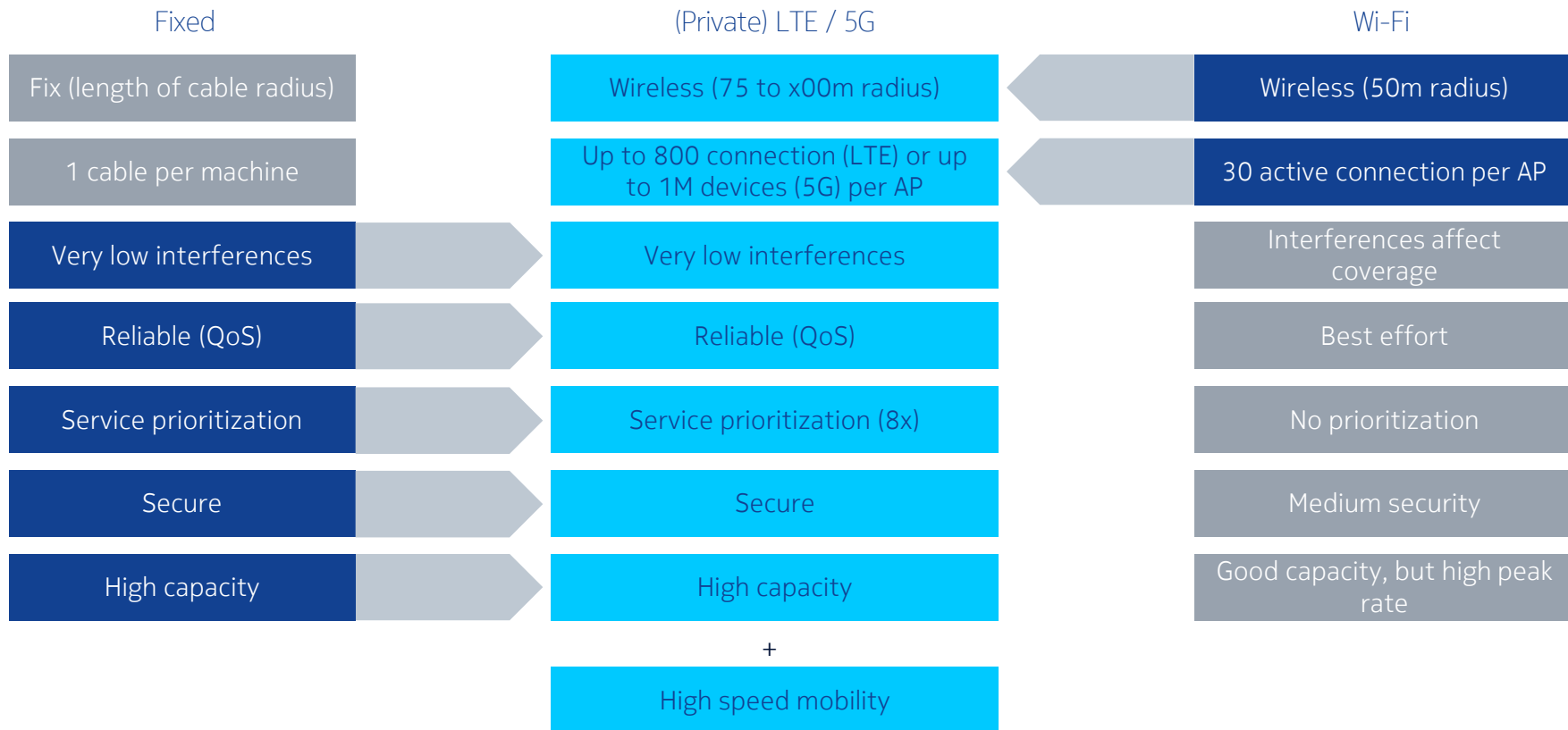Digitalization by connecting
all assets.

74% of today's data
not yet collected!

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Pervasive, industrial wireless
New operational opportunities with private cellular systems for terminals

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Cellular wireless (LTE / 5G) – Best of Wi-Fi and fixed' DNA

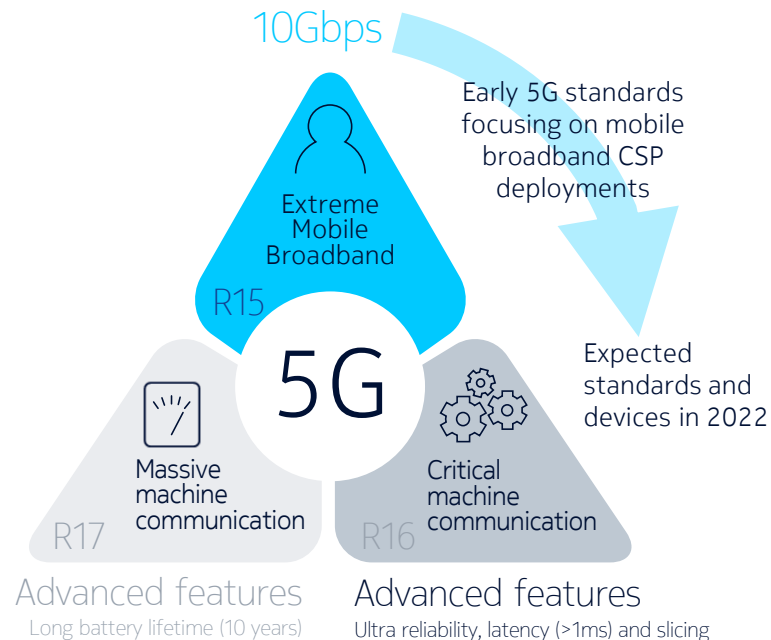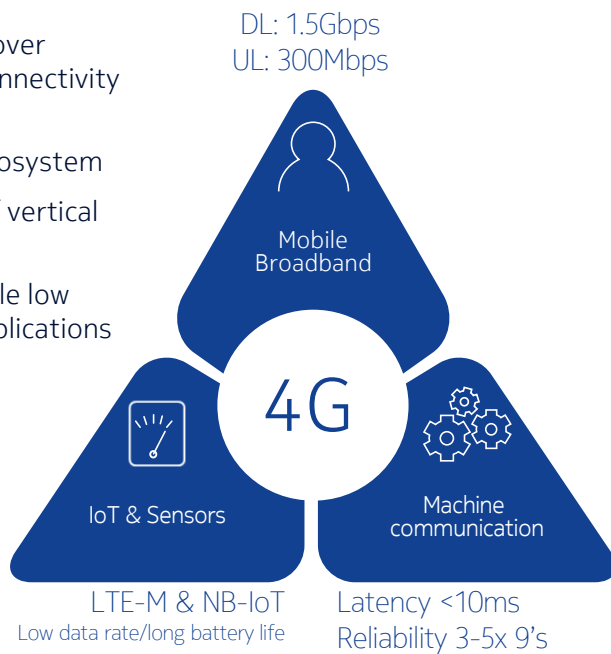| Fixed	(Private) LTE / 5G	Wi-Fi
Fix (length of cable radius)	Wireless (75 to x00m radius)	Wireless (50m radius)
1 cable per machine	Up to 800 connection (LTE) or up to 1M devices (5G) per AP	30 active connection per AP
Very low interferences	Very low interferences	Interferences affect coverage
Reliable (QoS)	Reliable (QoS)	Best effort
Service prioritization	Service prioritization (8x)	No prioritization
Secure	Secure	Medium security
High capacity	High capacity	Good capacity, but high peak rate
	+	
	High speed mobility	

NOKIA

Start digitalizing, automating your operations with LTE
Paving the way for 5G terminal operations use cases

- 85% of industrial applications supported on LTE
- Significant benefits over existing industrial connectivity solutions
- Existing industrial ecosystem
- Supports majority of vertical use cases
- Edge cloud for reliable low latency industrial applications

DL: 1.5Gbps
UL: 300Mbps

Mobile Broadband

4G

IoT & Sensors

Machine communication

LTE-M & NB-IoT
Low data rate/long battery life

Latency <10ms
Reliability 3-5x 9's

10Gbps

Early 5G standards focusing on mobile broadband CSP deployments

Extreme Mobile Broadband

R15

5G

Massive machine communication

Critical machine communication

R17

R16

Expected standards and devices in 2022

Advanced features
Long battery lifetime (10 years)

Advanced features
Ultra reliability, latency (>1ms) and slicing

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A world's first – 5G test bed in the Port of Hamburg, Germany

"The test bed has given us a glimpse of the huge potential that 5G and, in particular, network slicing will offer. I believe the new standard […] is the last push we need to make a breakthrough in term of digitization."

Jens Meier, CEO of the **Hamburg Port Authority**

Enterprises across the globe have already begun deploying Industrial Wireless networks
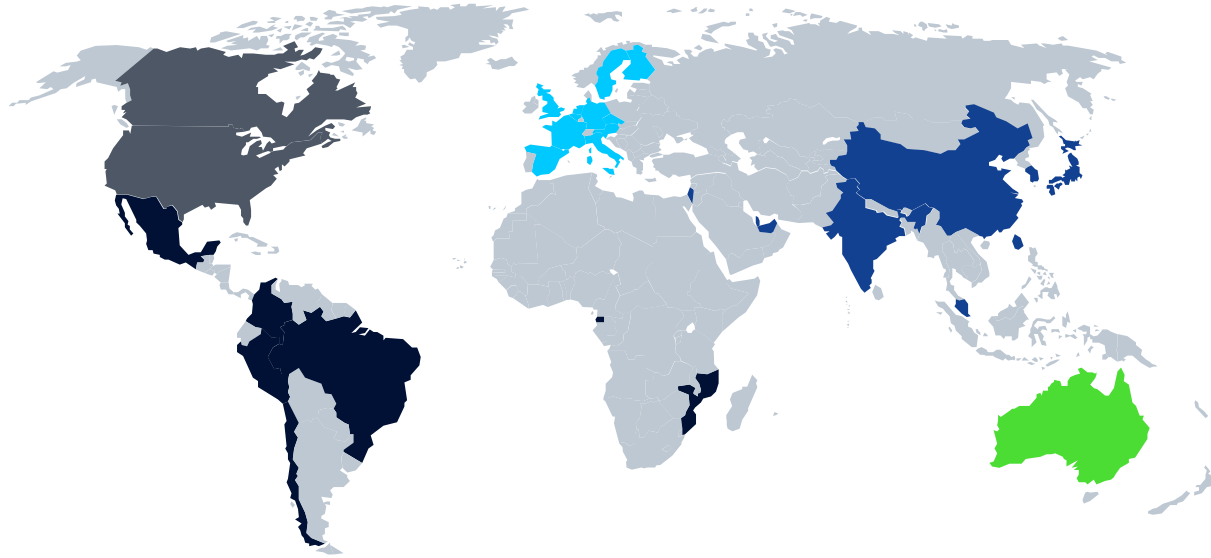
0120+
And counting

120+ enterprises deploying Nokia private wireless in their premises

+ 22 GSM-R networks, poised for private LTE/FRMCS upgrade

Public wins

ALTAN REDES

Etteplan

CITY OF TAMPERE

Ameren

华晨宝马

KOKKOLAN SATAMA

beach

东方明珠

LUT University

FINAVIA

CARGOTEC

N+

VIE Vienna International Airport

PORT OULU

KONECRANES Lifting Businesses

ELEKTRO

RioTinto

conectar4GRO

SANDVIK

KR network

STEVECO

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Go Allwhere.

Networking solutions for the new age of industry.

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