



5G FOR THE NETWORKED SOCIETY

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ERICSSON RESEARCH



RESEARCH AREAS

Radio Access

Wireless Networks

Cloud

Services, Media

Security

Networking

Management

Sustainability

Hardware

Software

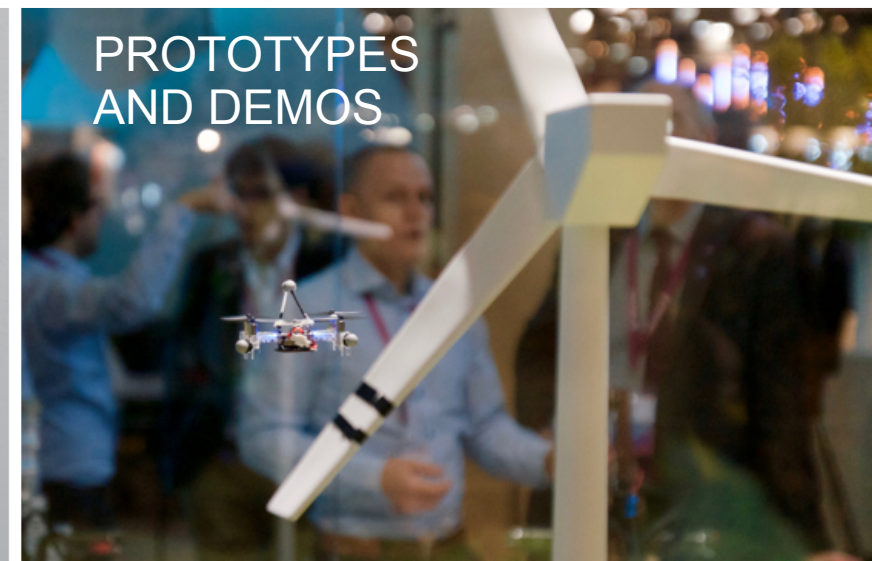
RESEARCH



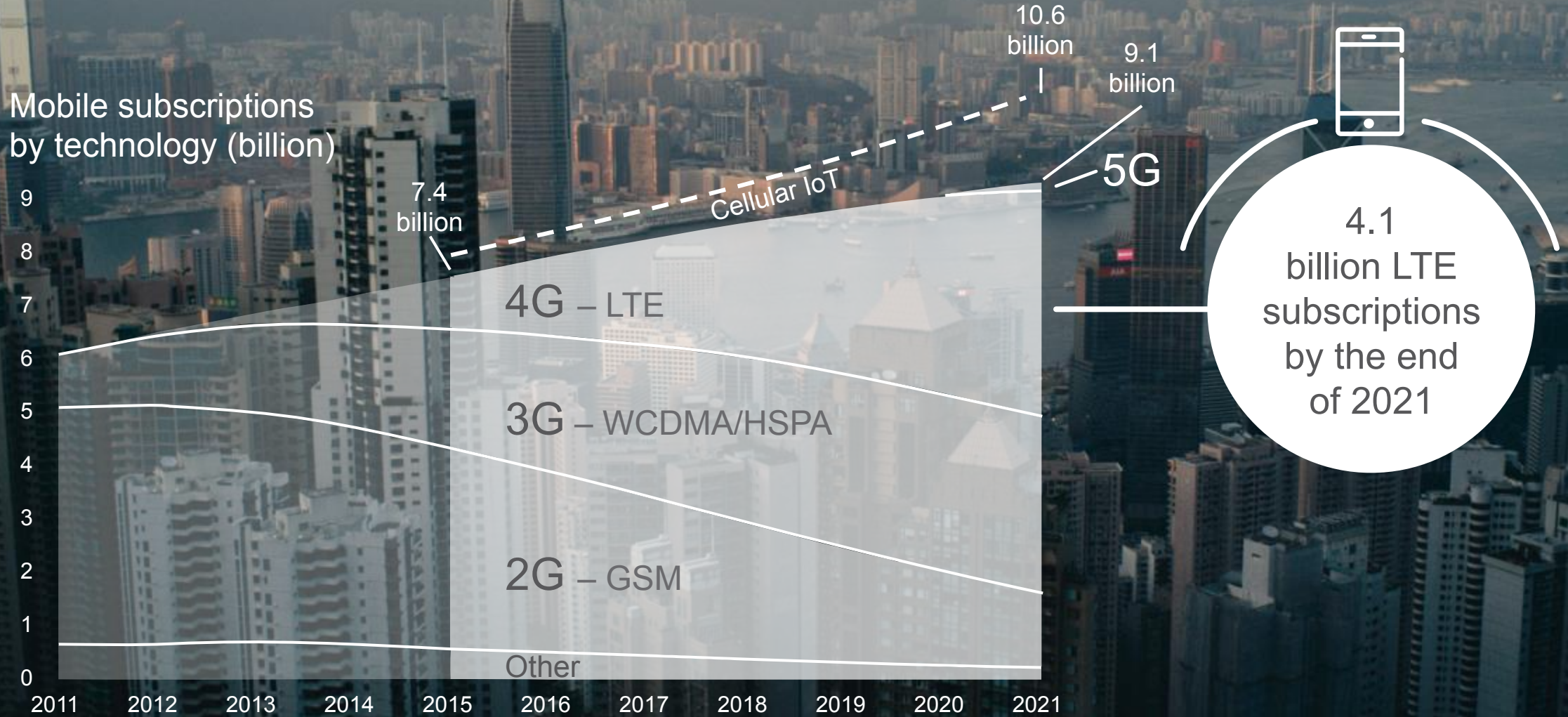
INNOVATION



PROTOTYPES AND DEMOS



SUBSCRIPTION OUTLOOK



2021



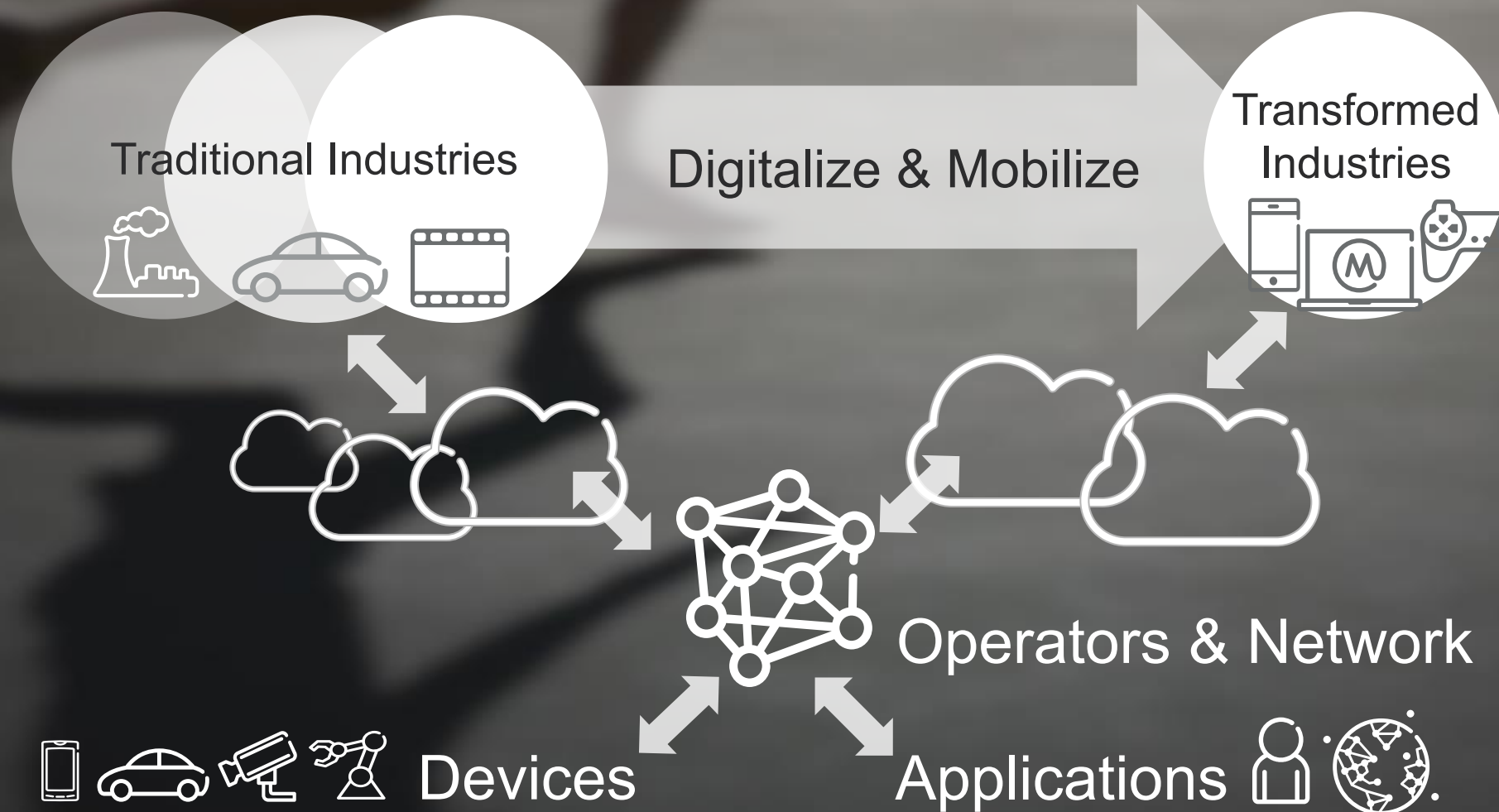
10X data Traffic
90% pop coverage of MBB
75% 4G pop coverage



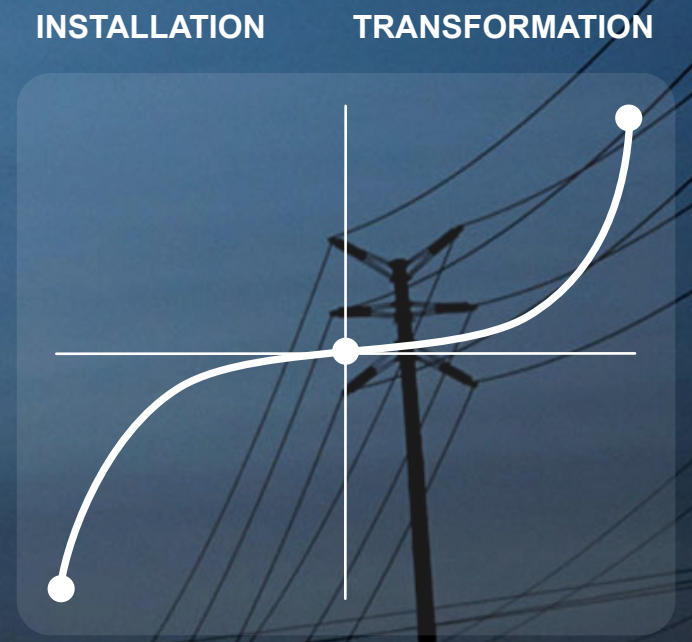
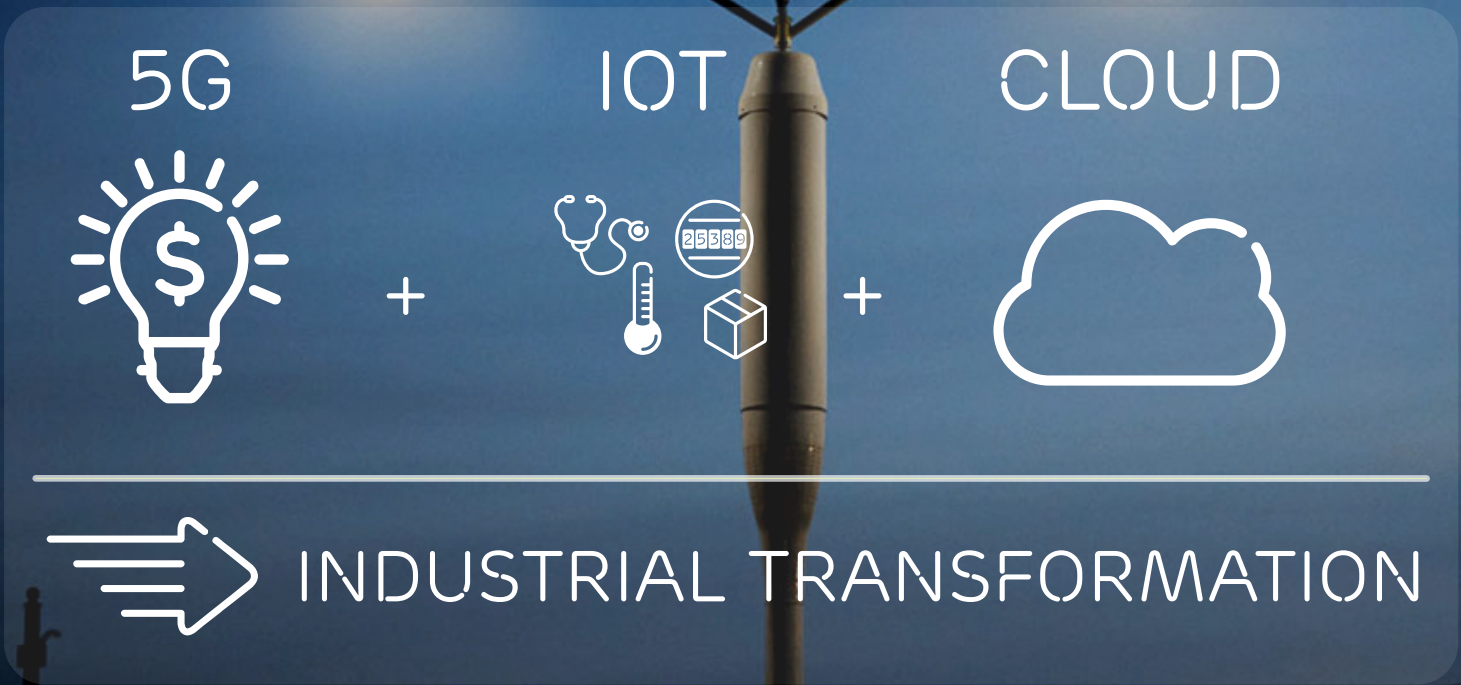
9.1 Billion Mobile Subscriptions
90% Mobile Broadband
150 Million 5G Subscriptions

28 Billion
Connected Devices

INDUSTRY TRANSFORMATION



STATE OF TECHNOLOGY





BROADBAND AND MEDIA
EVERYWHERE



SENSORS
EVERYWHERE



SMART VEHICLES,
TRANSPORT



INFRASTRUCTURE, MONITOR
AND CONTROL



CRITICAL CONTROL
OF REMOTE DEVICES



INTERACTION
HUMAN-IOT

5G

USE CASES

WHAT IS 5G – WHAT WILL IT BRING

A Network for the Networked Society



5G – KEY TECHNOLOGY FEATURES



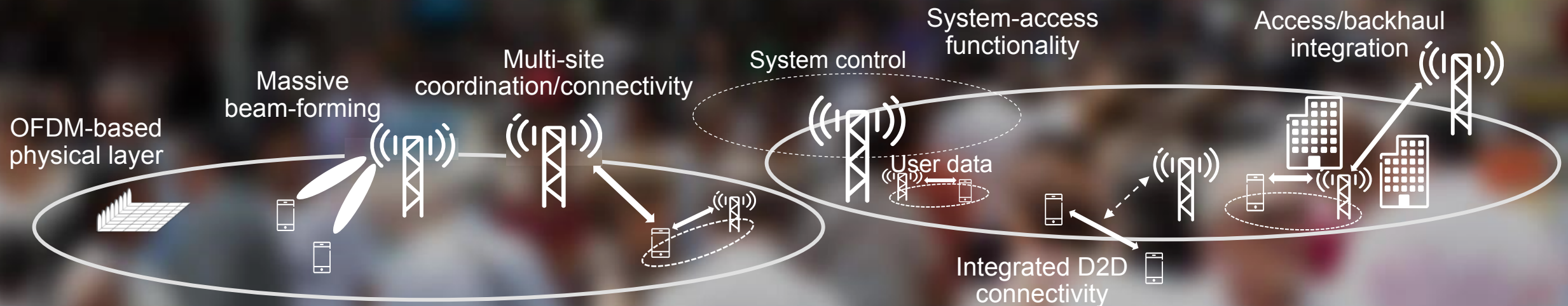
Flexible, scalable and future-proof design



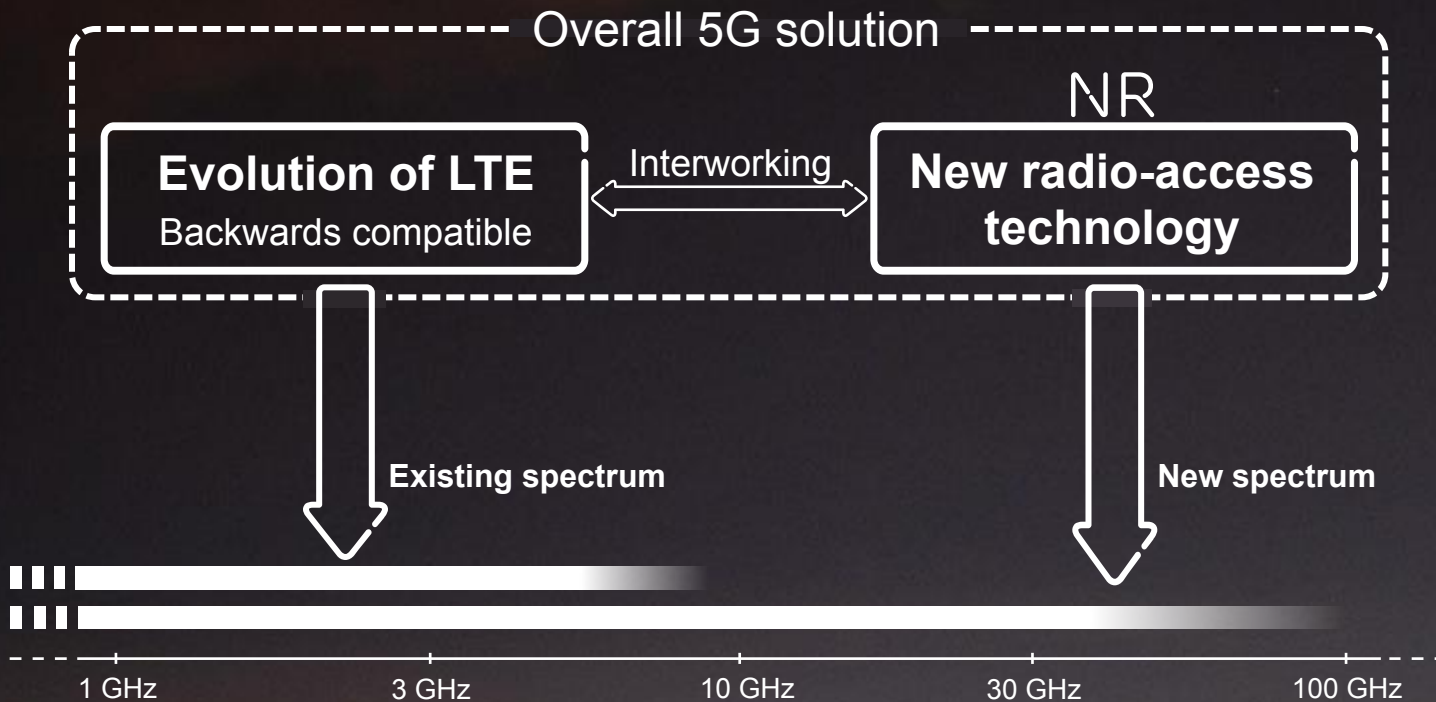
Ultra-lean design



Minimize network transmissions not directly related to user data delivery



5G RADIO ACCESS & SPECTRUM



Spectrum flexibility

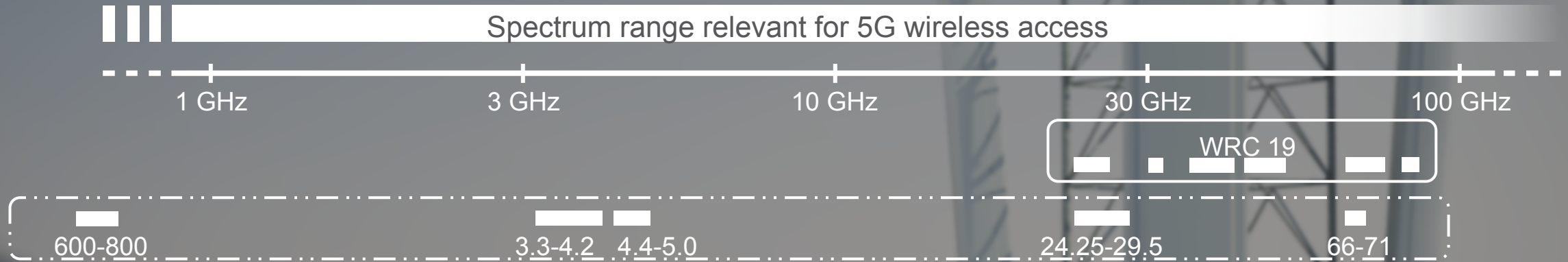
Flexible duplex

FDD and TDD
Dynamic TDD
Full Duplex

Spectrum sharing

Unlicensed
Shared licensed
Complementing dedicated
licensed spectrum

5G SPECTRUM



ITU-R studies towards WRC-19

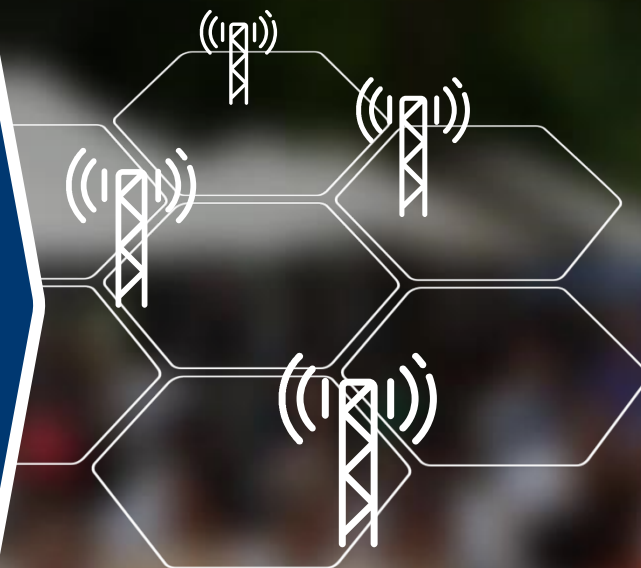
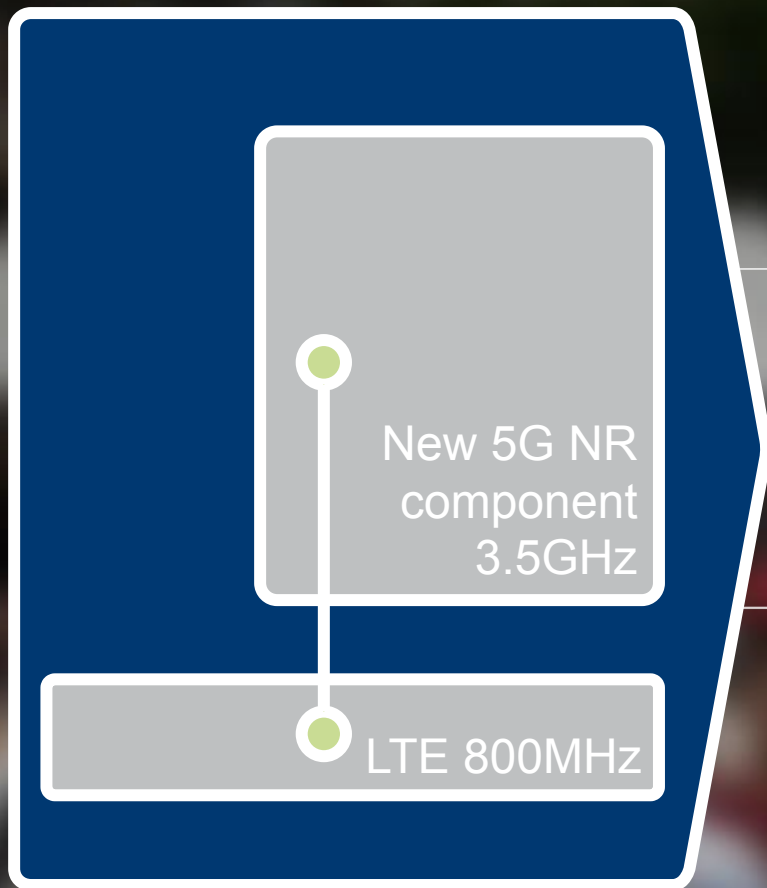
- › Frequency bands between 24.25 and 86 GHz

Additional bands for initial deployment

- › The “28” GHz band
- › The “3.5” GHz band
- › 600-800 MHz “UHF” band as available
- › Frequency range in 4.5 GHz band (Japan/China)

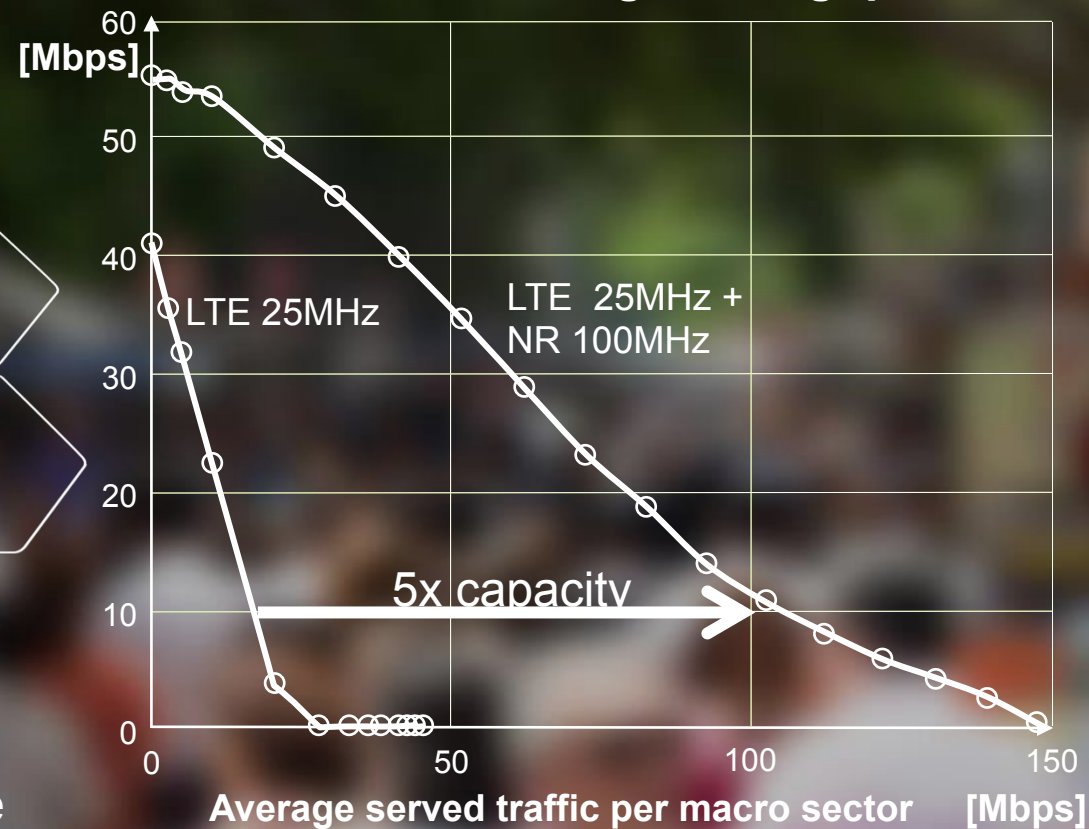
ONE NETWORK

Combining high and low frequencies



Large European city,
500m inter-site distance

Downlink cell edge throughput



MACHINE TYPE COMMUNICATION

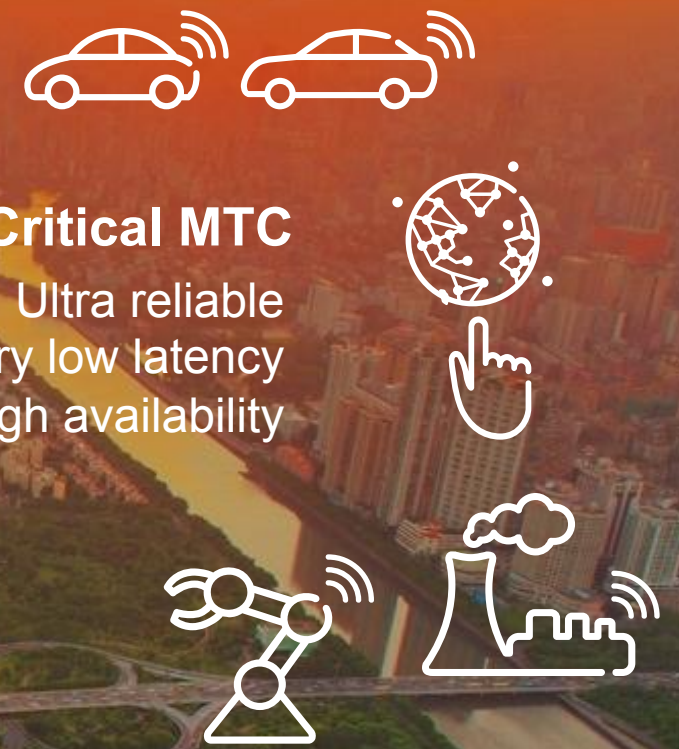
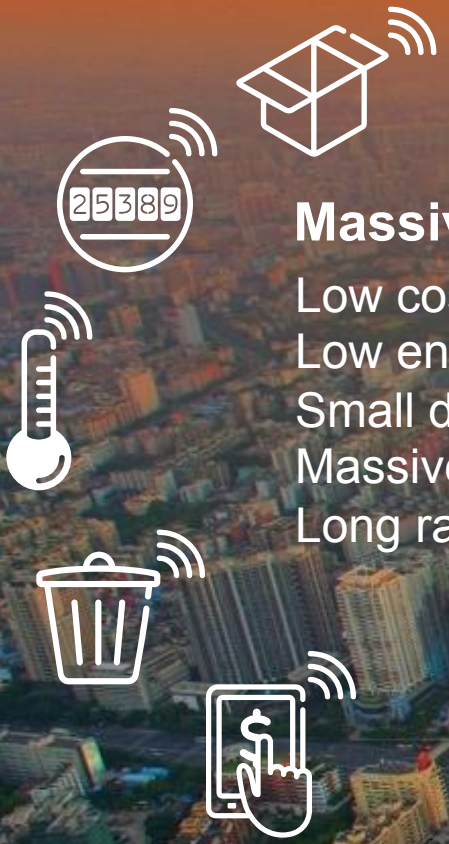


Massive MTC

- Low cost
- Low energy
- Small data volumes
- Massive numbers
- Long ranges

Critical MTC

- Ultra reliable
- Very low latency
- Very high availability



FULL RANGE OF SOLUTIONS

Addressing diversity of use cases

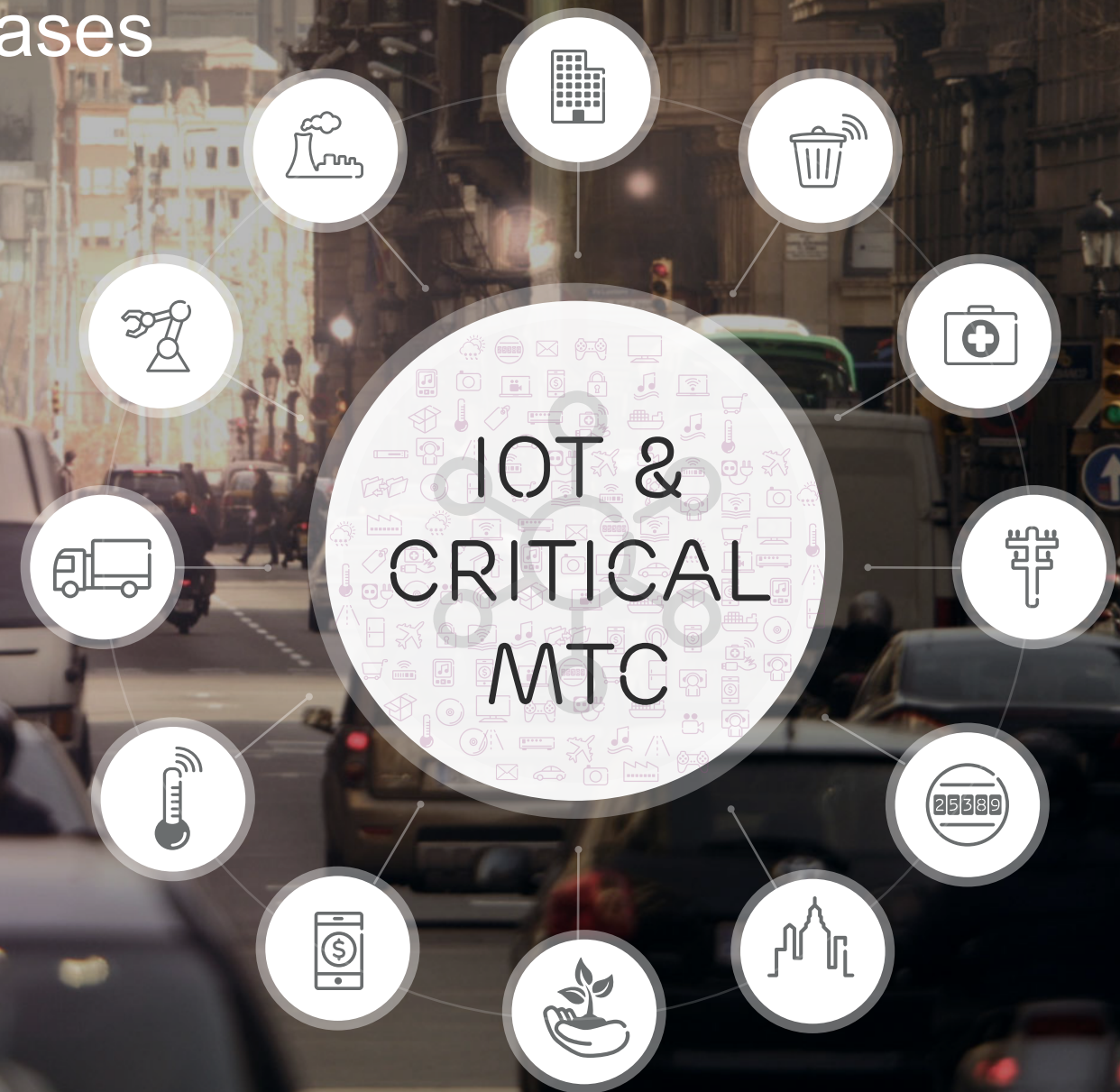


EC-GSM | Global cellular IoT for all GSM markets

LTE-M | Wide range of Massive IoT applications

NB-IoT | Low-bitrate Massive IoT applications

5G NX | Critical Machine-Type Communication



LTE MODULE COST EVOLUTION



Widely deployed
LTE will serve
Massive IoT



Significantly reduced
device complexity,
functionality and
capability, thus cost

CAT-4

100%
3GPP Rel.8

CAT-1

-25%
3GPP Rel.8

CAT-0

-60%
3GPP Rel.12

CAT-M

-80%
3GPP Rel.13

NB
IOT

-90%
3GPP Rel.13

LTE-M & NB-IOT



	Cat-M	NB-IoT
SW upgrade on LTE installed base		
UE Complexity	LOW	ULTRA LOW
Bandwidth Operation	1.4 MHz	200 kHz
10+ Year Battery Lifetime		

	Cat-M	NB-IoT
Extended Coverage	+15 dB	+20 dB
Deployment	Fully Multiplexed on LTE Carrier	FLEXIBLE
Throughput (DL/UL)	1/1 Mbps	128/64 kbps
Extreme capacity for applications	1M+ per cell	200k per cell

CELLULAR SOLUTIONS FOR MASSIVE IOT

TIMELINE

Accelerated 3GPP work



2015 | 2016 | 2017 | 2018 | 2019 | 2020

ITU

WRC 15

IMT-2020 requirements

IMT-2020 proposals

WRC 19

IMT-2020 spec

3GPP

SI: CM > 6 GHz
SI: 5G req.



SI: NR

SI: NR enh.

SI: self-evaluation

SI – Study Item
WI – Work Item
NSA – Non-Stand-Alone
SA – Stand-Alone

NR Phase 1 (NSA)



(SA)

WI: NR Phase 2

WI: NR evo

Accelerated timing

VzW

Olympics

Olympics

BUILDING THE 5G ECOSYSTEM



TRUSTED PARTNER



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SIGNED 5G OPERATOR AGREEMENTS

LEADING DIGITALIZATION



 AUTOMOTIVE AND TRANSPORT

 MANUFACTURING

 PROCESS INDUSTRY

 SAFETY/SECURITY

 AGRICULTURE

 ENERGY AND UTILITIES

5G FOR INDUSTRIES

Some examples



ARA AUTONOMOUS RESEARCH ARENA PRE-STUDY

AUTONOMA SYSTEM

- Safety and Security focus
- Heterogeneous system organizing systems
- Handling of the information data analytics, visualization
- Cloud solutions to master complexity, safety, security

5GEM 5G-ENABLED WORLD CLASS MANUFACTURING

- Evaluate 5G technology in manufacturing industry
 - Wireless factory communication
 - Industrial Internet of Things (IIoT)
 - Mission critical clouds (MCC)
 - Data analytics
- Improved productivity
- Increased flexibility
- Excellent traceability

PIMM PILOT FOR INDUSTRIAL MOBILE COMMUNICATION IN MINING

- Evaluate mobile communication infrastructure in an industrial context
- Consider strict requirements on safety and robustness in underground mining
- Improved Safety
- Increased productivity
- Industrial 5G requirements
- Understanding new eco system, business models, etc.

CMA CONNECTED MOBILITY ARENA STOCKHOLM

- Create Europe's leading test site for connected mobility
 - Open innovation platform
 - Open cellular radio connectivity
 - Management and control platform
 - Efficient management of test activities

ABB REMOTE OPERATION OF ROBOTS

15 GHZ RADIO TESTBED

› Spectrum

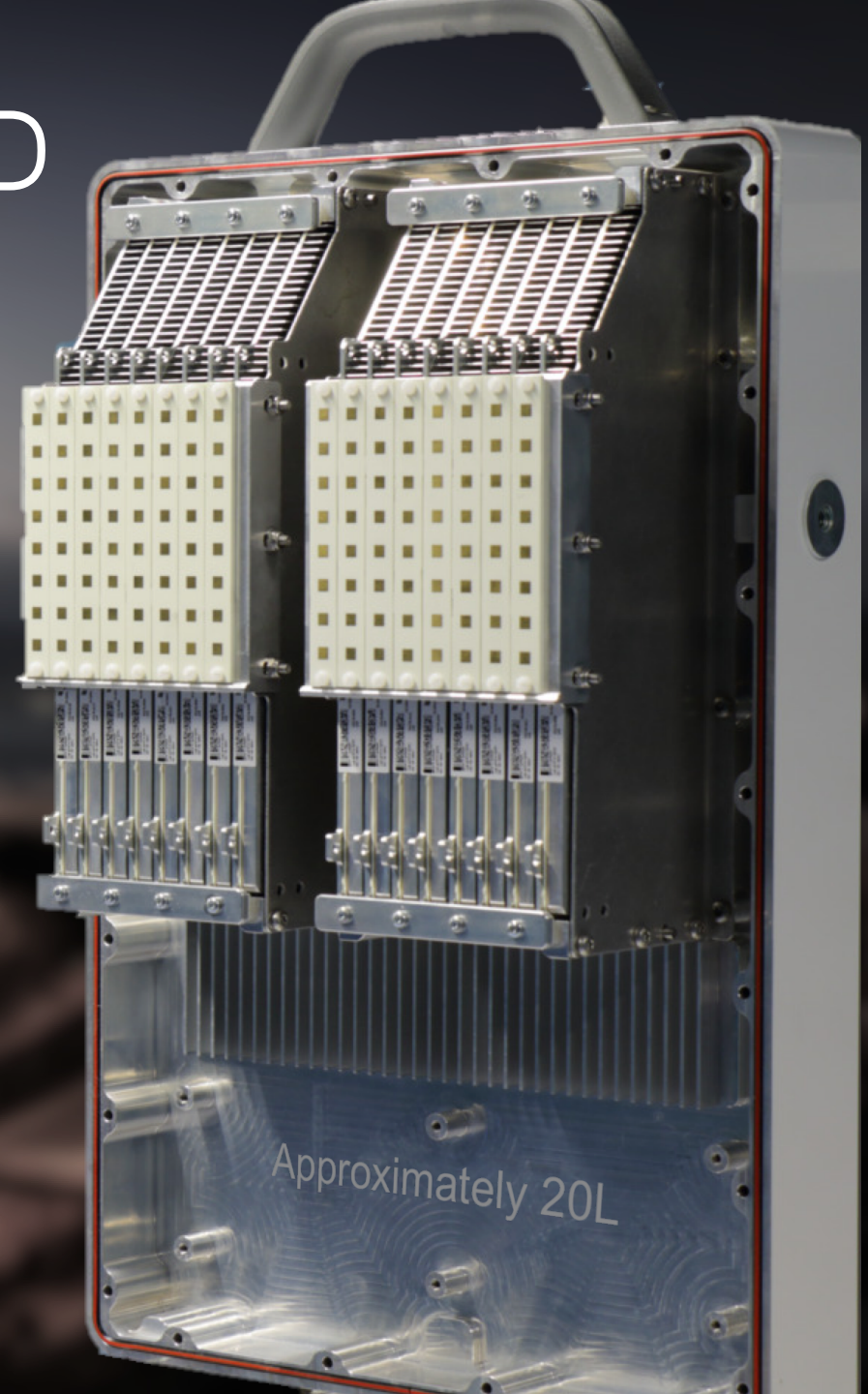
- 14.5 – 15.35 GHz
- 800 MHz

› Array antenna

- 128 antenna elements
- $\pm 60^\circ$ horizontal steering
- $\pm 15^\circ$ vertical steering

› Features

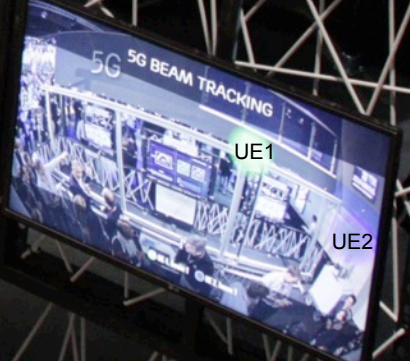
- Dynamic TDD
- Indoor and outdoor – fully weatherproof



5G RADIO TEST BED MWC 2016



UE1



MU-MIMO OUTDOOR together with NTT DOCOMO



BS Antenna
Unit & UE #1

UE #2, location A

100m

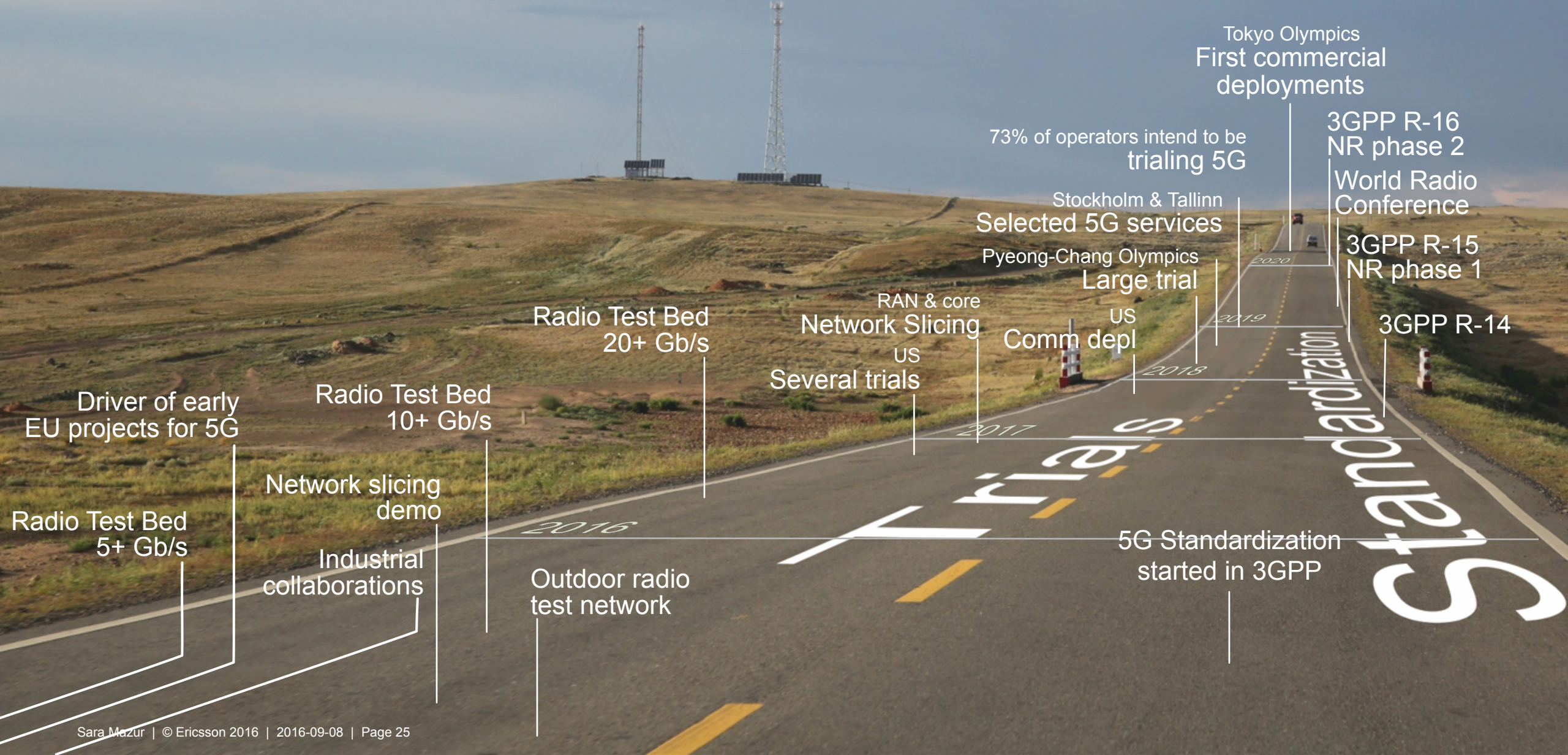
120m

15GHz
800MHz



UE #2, location B

THE ROAD TO 5G

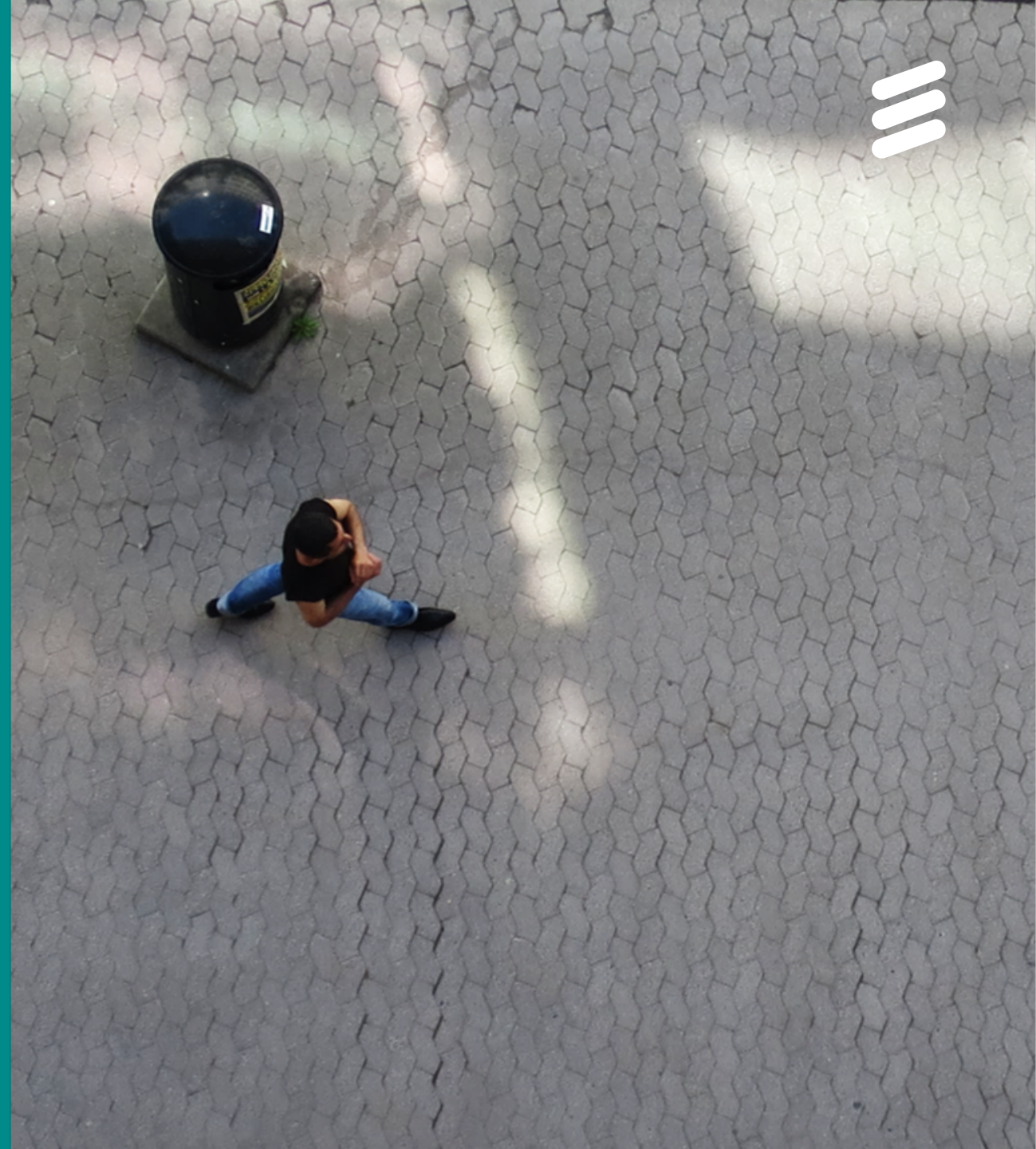


SUMMARY

Standardization activities and trials for 5G are at full speed

Internet of Things is becoming increasingly important

Ericsson is a key contributor in the research community, standardization and in the transformation of industries and societies





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