

STEW 20161013, LINKÖPING



# TOWARDS THE NETWORKED SOCIETY – A SOFTWARE CHALLENGE



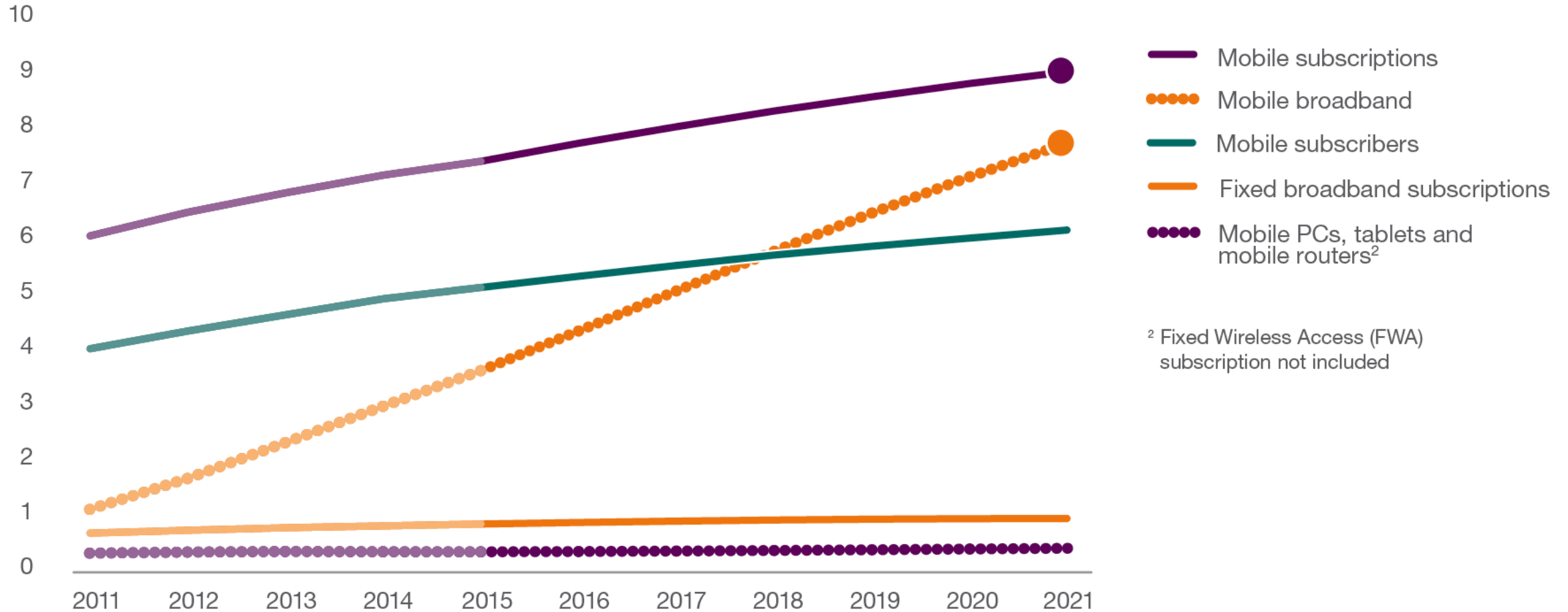
Ulf Wahlberg  
VP Industry and Research Relations

# NUMBER OF SUBSCRIPTIONS

85% OF MOBILE SUBSCRIPTIONS WILL BE FOR MOBILE BROADBAND IN 2021



Subscriptions/lines, subscribers (billion)

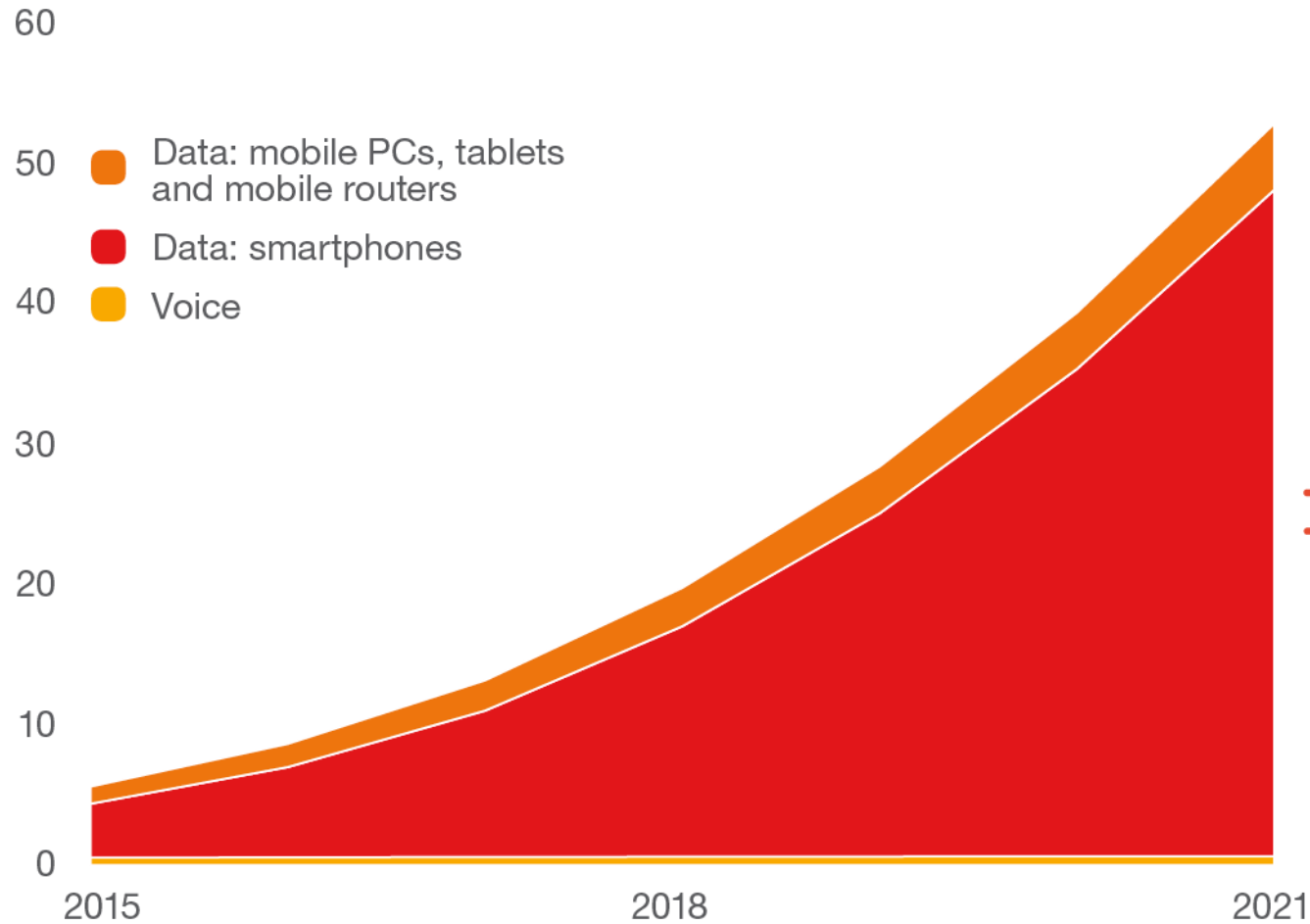


<sup>2</sup> Fixed Wireless Access (FWA) subscription not included

# TRAFFIC OUTLOOK



Global mobile traffic (monthly ExaBytes)



12X

Between 2015 and 2021, there will be a 12X growth in smartphone traffic



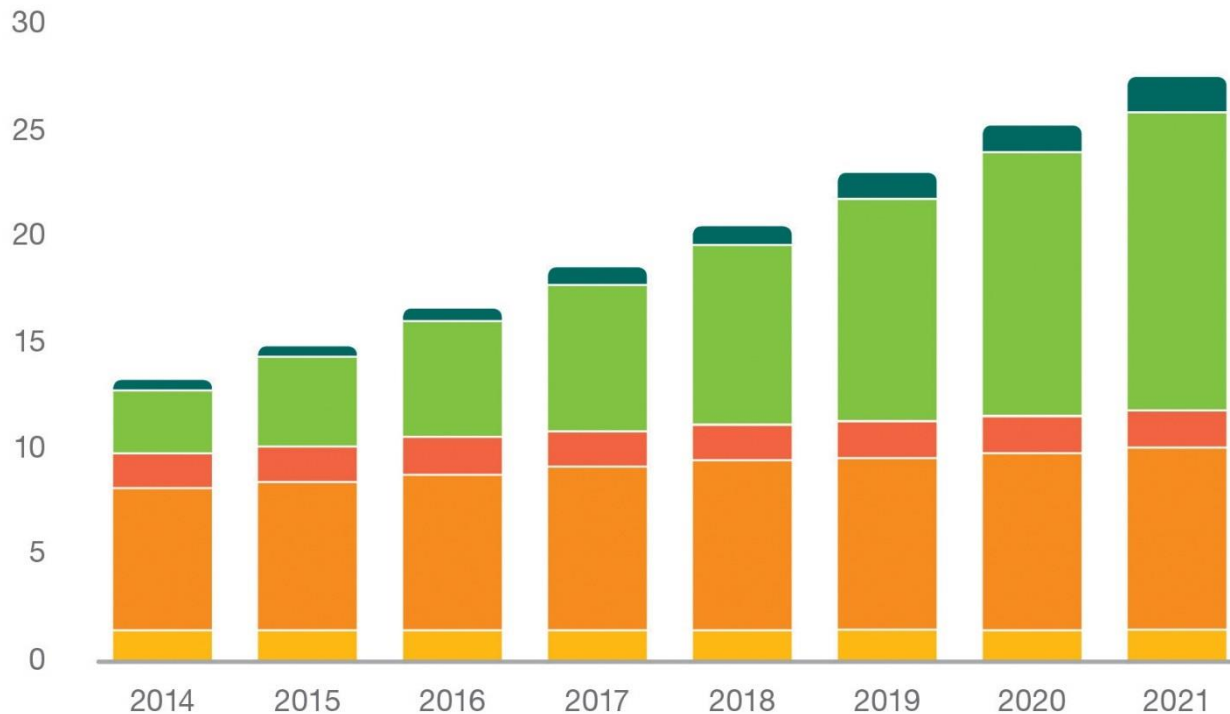
Around 90% of mobile data traffic will be from smartphones by the end of 2021

# INTERNET OF THINGS TO SURPASS MOBILE PHONES IN 2018



- expected to be largest category of connected devices

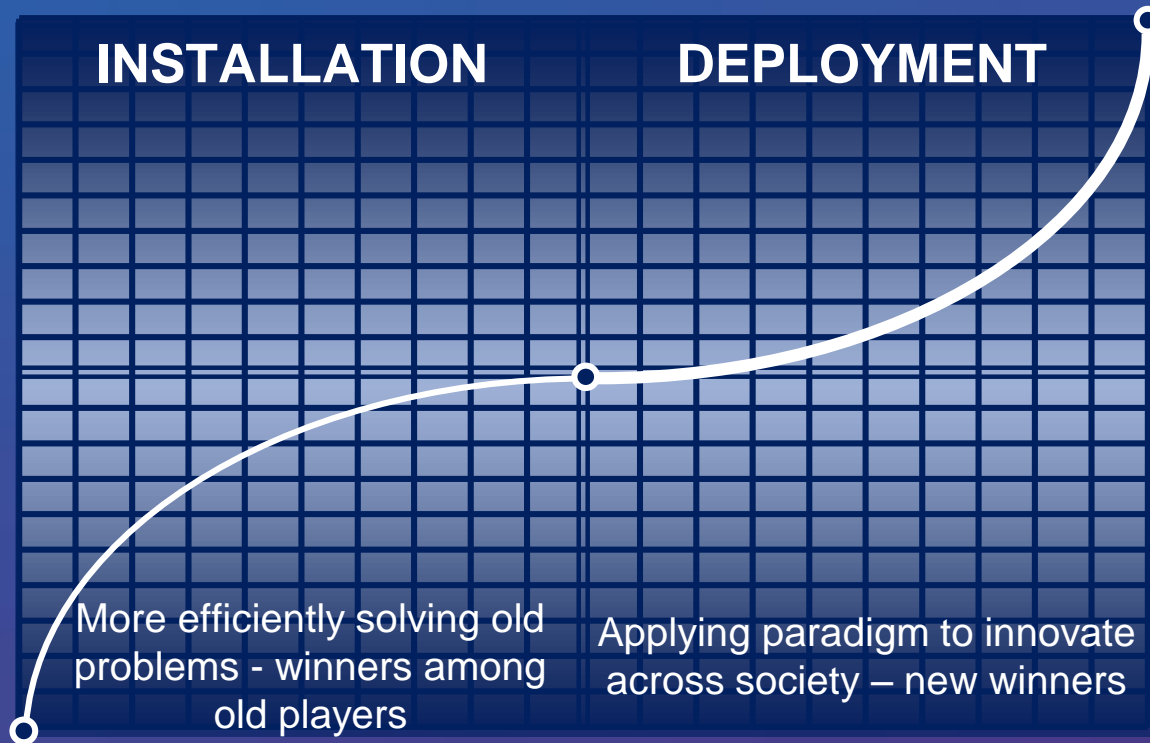
Connected devices (billions)



	15 billion	28 billion	CAGR 2015–2021
Cellular IoT	0.4	1.5	27%
Non-cellular IoT	4.2	14.2	22%
PC/laptop/tablet	1.7	1.8	1%
Mobile phones	7.1	8.6	3%
Fixed phones	1.3	1.4	0%

# THE NETWORKED SOCIETY

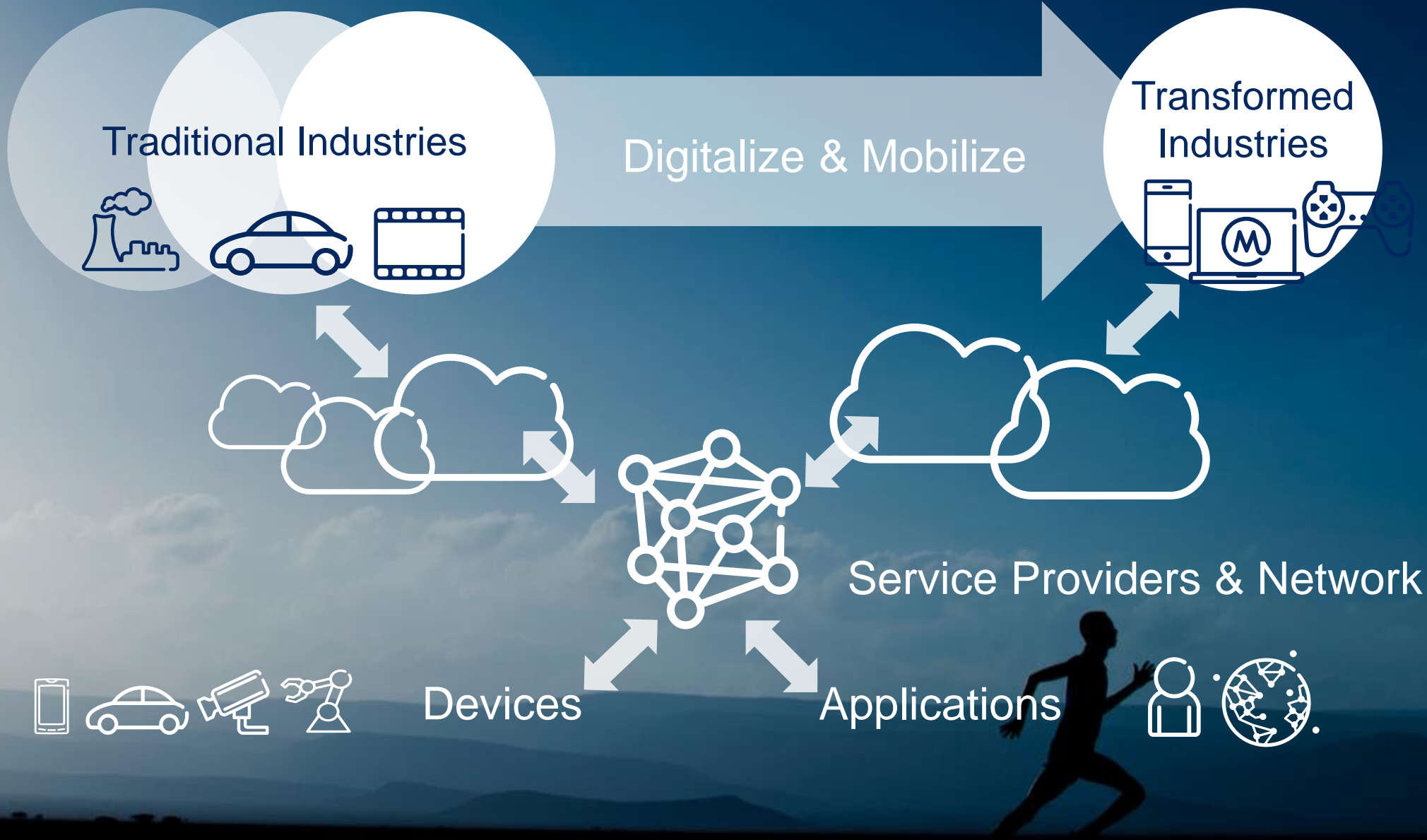
WE ARE AT THE ICT INFLECTION POINT



- › Foundation for innovation
- › Broad application
- › Transforming society



MOBILITY - BROADBAND - CLOUD



Traditional Industries

Digitalize & Mobilize

Transformed Industries

Service Providers & Network

Devices

Applications

# ERICSSON'S TRANSFORMATION



Business mix 1999 – 2014



# INNOVATION FROM HW TO SW



Innovation in  
HW



Innovation in HW  
and SW



Innovation in  
SW

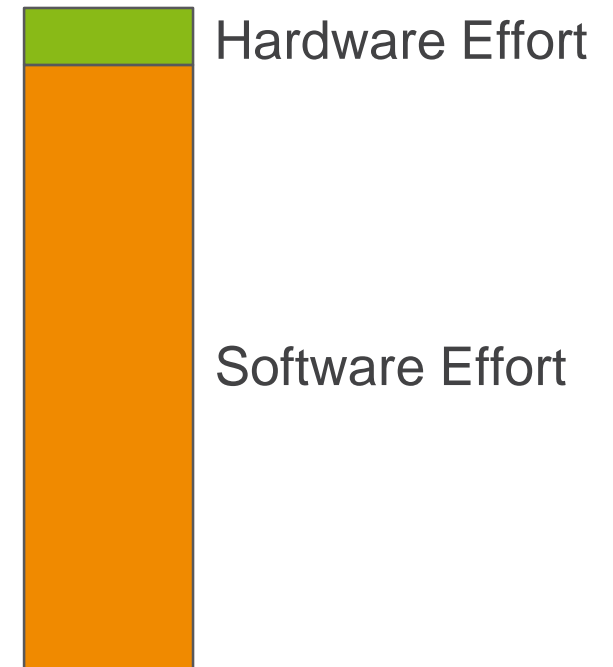


# THE IMPORTANCE OF SW



Software is, to a very large extent, the means to create the functionality we sell

There are about 10-15 software designers per hardware designer in Ericsson today



# WIRELESS ACCESS GENERATIONS



The foundation of mobile telephony

Mobile telephony for everyone

The foundation of mobile broadband

The evolution of mobile broadband

Non-limiting access; anywhere, anytime, anyone, anything

**1G**

AMPS TACS  
NMT

~1980

**2G**

GSM D-AMPS  
PDC IS-95

~1990

**3G**

WCDMA/HSPA  
CDMA2000

~2000

**4G**

LTE

~2010

**5G**

~2020



SENSORS  
EVERYWHERE



BROADBAND AND MEDIA  
EVERYWHERE



SMART VEHICLES,  
TRANSPORT



INFRASTRUCTURE, MONITOR  
AND CONTROL



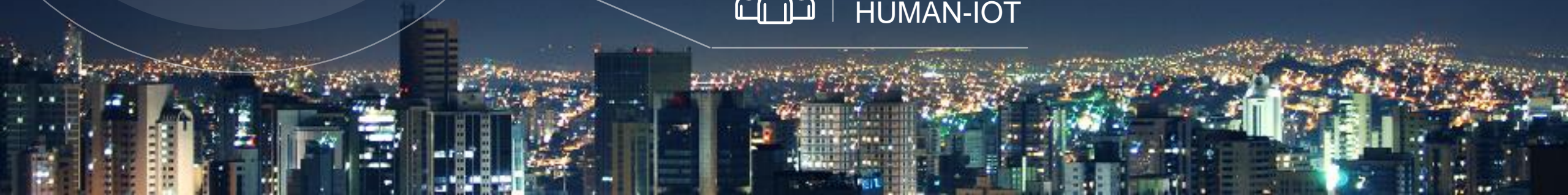
CRITICAL CONTROL  
OF REMOTE DEVICES



INTERACTION  
HUMAN-IOT

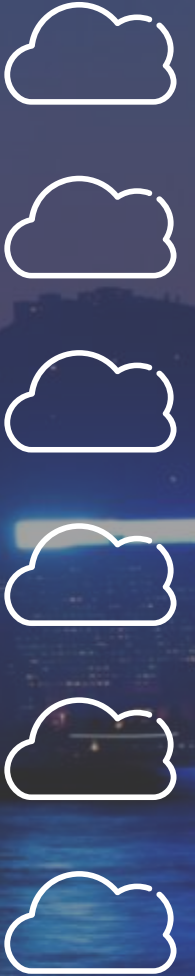
# 5G

## USE CASES



# ONE ARCHITECTURE—MULTIPLE INDUSTRIES

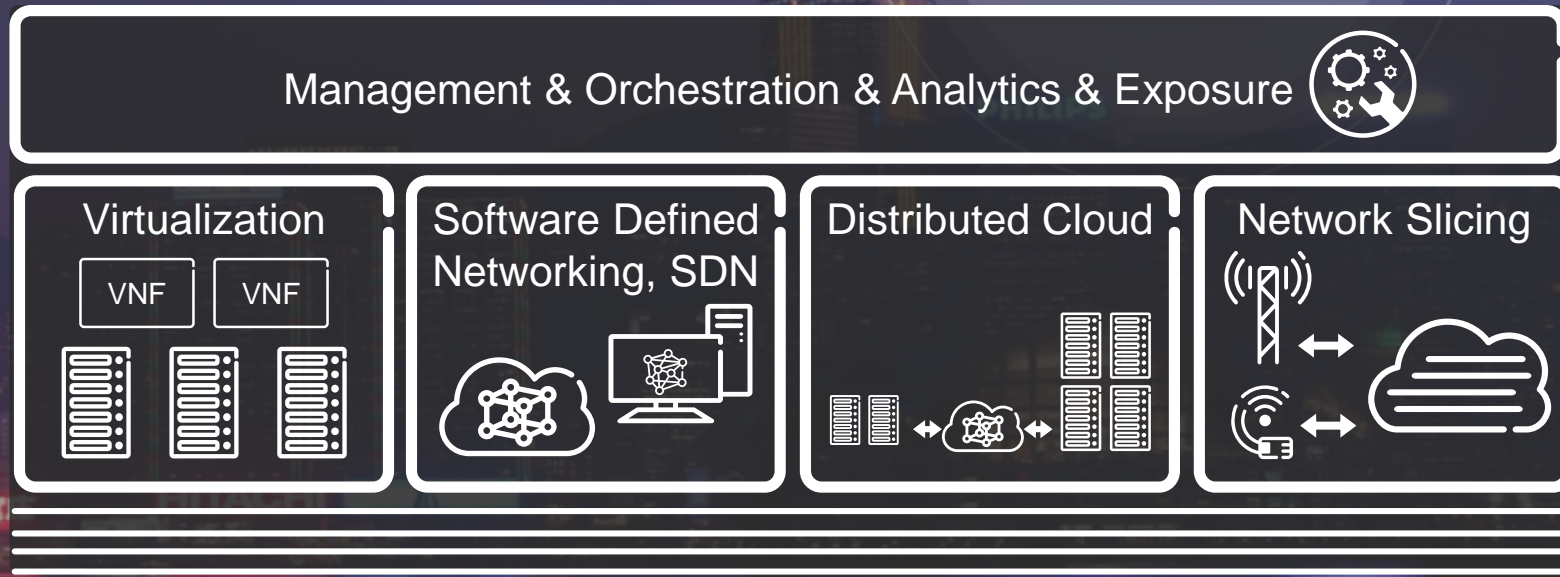
5G



A common network platform  
enabling ICT transformation

# ONE ARCHITECTURE—MULTIPLE INDUSTRIES

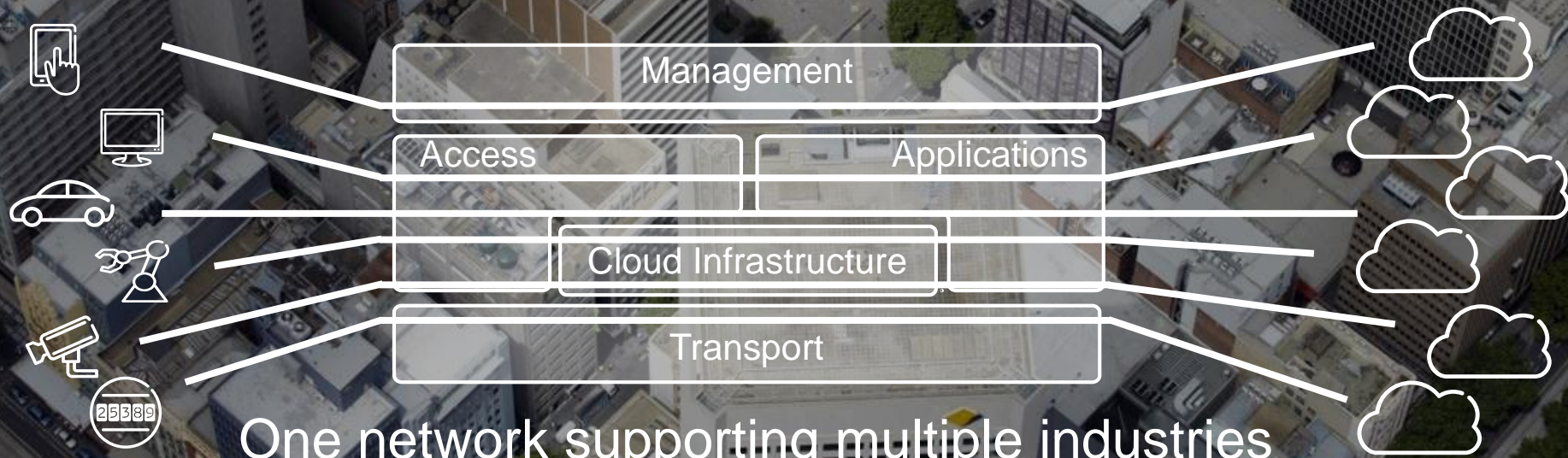
# 5G



A common network platform  
enabling ICT transformation

# WHAT IS 5G – WHAT WILL IT BRING

## A Network for the Networked Society



# 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



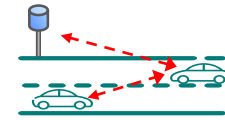
Sensors, actuators



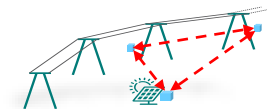
Smart buildings



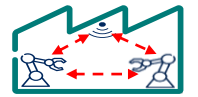
Capillary networks



Traffic safety & control



Smart grid



Industrial applications

# 5G RADIO ACCESS TECHNOLOGIES



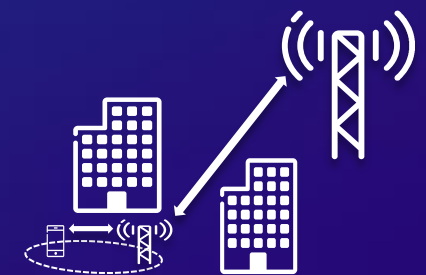
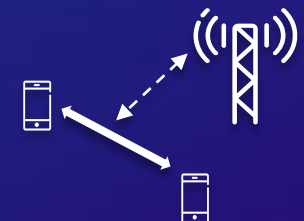
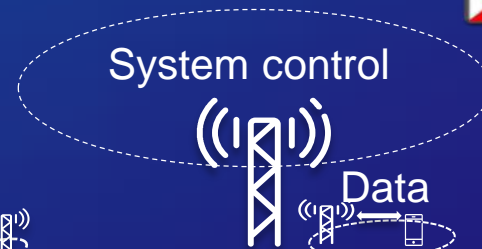
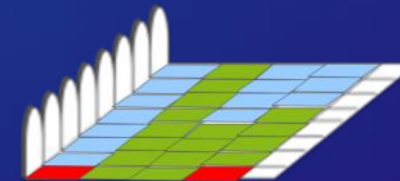
Beamforming antennas  
Multi-antenna/Site connectivity  
including Distributed MIMO

Separation of data  
and control plane

New connectivity layers  
Wireless backhaul, D2D, ...

Ultra-Lean Design  
User throughput and  
Energy Efficiency

Flexible and scalable L1 design  
Flexible OFDM, dynamic TDD, ...



Integrated D2D



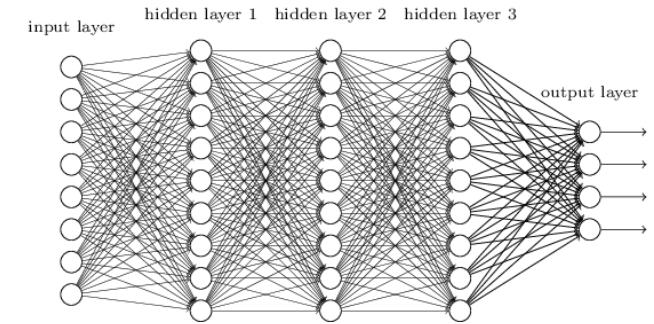
# IMPORTANT SOFTWARE TECHNOLOGY AREAS



Automatic Fault Diagnosis and Treatment



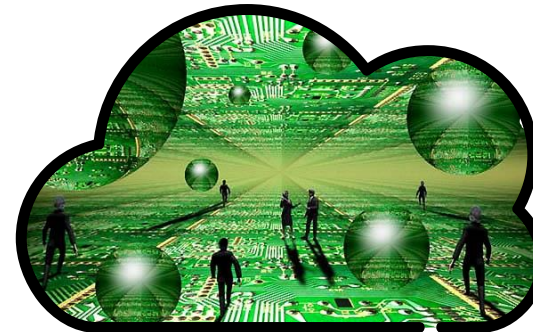
Data Driven Approach and Machine Learning



Future Programming Technology



Vulnerability Containment for Secure and Safe Software



Cloud Optimized Virtual Network Functions

# ERICSSON TEST-BED SHOWN AT MWC 2016



5G  
RADIO  
TESTBED

ERICSSON

25.2 GBIT/S

DOWNLINK THROUGHPUT

A graphic panel with a black background and white text. It features the Ericsson logo in the top right corner. The text '5G RADIO TESTBED' is centered at the top. Below it, '25.2 GBIT/S' is displayed in a large font, followed by 'DOWNLINK THROUGHPUT' in a smaller font.



# 5G FOR INDUSTRIES



AUTOMOTIVE AND TRANSPORT

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MANUFACTURING

---



PROCESS INDUSTRY

---



SAFETY/SECURITY

---



AGRICULTURE

---



ENERGY AND UTILITIES

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# ABB

## REMOTE OPERATION OF ROBOTS

- Evaluate potential of mobile communication for industrial use
- Consider requirements from mission critical operation



- Industrial 5G requirements
- Transformation benefits
  - Central utilization of expertise
  - Minimize personnel in hazardous environments
  - Increased productivity



Photo: ABB

# 5G FOR INDUSTRY



# 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.



Photo: Boliden

# 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 production efficiency
- Increased flexibility
- Excellent traceability



# 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 (system configuration, road authority, etc.)



- Emergency vehicle prioritization
- Remote-controlling of platoons
- Automatic service orchestration
- ...and more



Photo: Scania



# ARA

## AUTONOMOUS RESEARCH ARENA PRE-STUDY

- Safety and Security focus



- Heterogeneous systems integration – self organizing systems
- Handling of the information explosion, big data analytics, visualization and interaction
- Cloud solutions to master growing complexity, safety, security, reliability



Part of Wallenberg Autonomous Bus Systems Program – WASP



# OPERATOR PARTNERS ALL CONTINENTS



>25

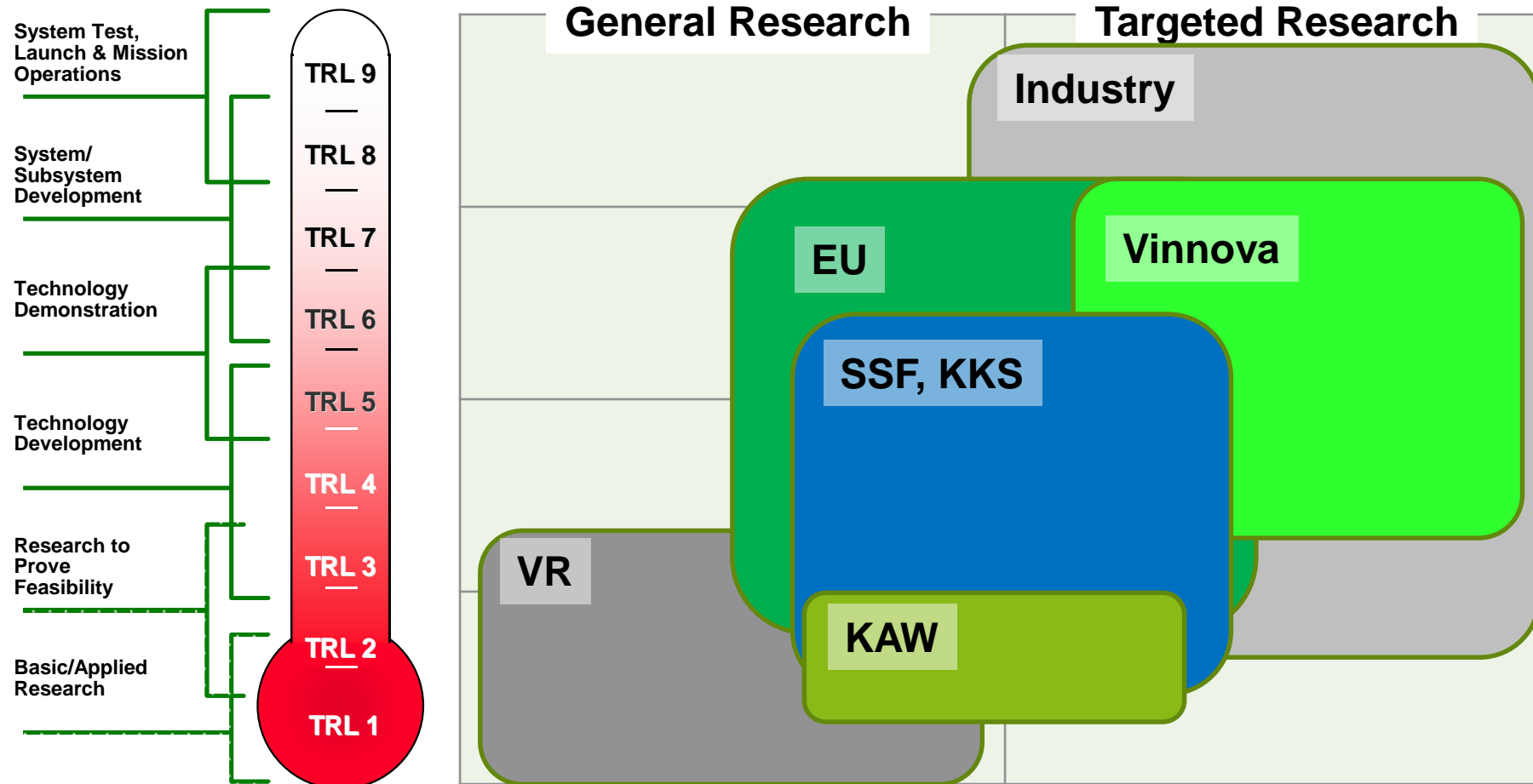
OPERATORS 5G  
MOU/TRIALS

>30

PROOF OF CONCEPT WITH INDUSTRIES

\*As of March 2016

# WE NEED TO ACT FOR AN INCREASE OF RESEARCH AND EDUCATION IN SOFTWARE INTENSE SYSTEMS





**ERICSSON**