5G and Industry 4.0

Ulrich Rehfuess, Head of Spectrum Policy, Nokia
New user demands – with extremely diverse requirements
5G is more than 1 generation ahead of LTE

Design and architecture principles:
flexible | scalable | automated | cloud native
software centric | dynamic network slicing

Devices
1.5 GB/day

Billions of sensors connected

Smart Factories
1 PB/day

Autonomous driving
1ms latency

100 Mbps whenever needed

10,000 x more traffic

<1 ms radio latency

Ultra low cost for massive machine comms.

Ultra reliability < 10^-9 EE outage

Zero mobility interruption

> 10 Gbps peak data rates

1,000,000 devices per km²

10 years on battery

“Unlimited experience”

Connectivity

Capacity

Latency

Reliability

“Instant action”

“For everything”

Critical machine communication

Massive machine communication

Extreme mobile broadband
Example: Enabling distributed cloud and automation
e2e Network Slicing - across radio, transport, core edge and central clouds

Use case-specific slices

- Autonomous driving
- Agriculture
- SmartMeter

Connectivity, performance and security
Industrial network slicing in one RAN, one spectrum
Local slices terminate in private mobile edge cloud, public slice in MNO core

- Customized for the factory needs
- Camera at public site
- Sensor
- AR-enhanced maintenance
- Public MNO slice
- Control room
- Cyber physical system – virtual copy of physical system
- MBB streaming app – video surveillance

Industry premise
Network slicing on industry campuses for verticals
MNO can leverage private enterprise CAPEX for network slices to indoors

MNO network slices on MNO and/or private spectrum
private campus coverage

campus network designed to industry requirements
enterprise data remains local
Network slicing in combination with proposed BNetzA rules for C-Band *)

Local co-operative model between MNO and local enterprise

BNetzA proposal for 3.4-3.8 GHz
- 3.4-3.7 GHz in nation wide „Vergabeverfahren“ 1H19, auction, nationwide
- 3.7-3.8 GHz in local and regional application procedure for local indoor, local outdoor and regional, expected 1H19
- Mutual obligation to allow use of others’ spectrum if unused

Possible spectrum assignment scenario in e.g. an industry campus in 3.4-3.8 GHz ~2019
- 3 nation wide MNO licensees own 100 MHz each (subject to auction outcome)
- Several local and regional license owners of e.g. 40, 10 & 20 MHz

Possibly limited use of lowermost 20 MHz due to CEPT requirements on protection of services below 3400 MHz

Local enterprise could own local indoor and outdoor license F and approach MNO B for joint use of 120/200 MHz bandwidth
Bandwidth would be dynamically shared between public network slices of MNO B and private campus network slices
Local RAN ownership (e.g. small cell in-factory network) could be with local enterprise, their IT provider, or with MNO-B

BNetzA model shall allow for flexibility in roles and business models

*) www.bnetza.de/mobilebroadband
www.bnetza.de/mobilesbreitband
5G-ACIA

5G Alliance for Connected Industries and Automation

5G-ACIA mission
- Bring together OT and ICT industry
- Establish a common language
- Assure requirements of OT are considered in standardization
- Address spectrum needs of OT in 5G
- Provide a suitable evaluation framework

- Founded in 04/2018
- 39 members (09/2018)
  - 16 from operational technology (OT)
  - 15 from ICT academia/others

5G-ACIA Board

Regular Plenary Meetings

- Chairman
- Vice-Chairman

Working Group 1: Use Cases and Requirements
Working Group 2: Spectrum and Operator Models
Working Group 3: Architecture and Technology
Working Group 4: Liaisons and Dissemination
Working Group 5: Validation and Tests

(Annual) General Assembly
Thanks for your attention!

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