Delivering 5G QUALITY OF SERVICE for Connected and Automated Driving

Tuesday, 3 November 2020 | 09:00 EST | 14:00 GMT | 15:00 CET
Speakers

JOHANNES SPRINGER
Program Lead 5G Automotive Program, Deutsche Telekom / T-Systems

JOACHIM KLINK
Head of Autonomous Driving and Integrated Mobility, Deutsche Telekom / T-Systems

AMIT ROSENZWEIG
CEO & Founder, Ottopia

PANEL MODERATOR
Dr Shane Rooney, Executive Director, IoT Networks, GSMA
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min</td>
<td><strong>Keynote: Introduction to 5G Quality of Service</strong></td>
<td>Johannes Springer, Program Lead 5G Automotive Program, <strong>Deutsche Telekom / T-Systems International</strong></td>
</tr>
</tbody>
</table>
| 15 min | **Joint Keynote and Demonstration: Teleoperations** | Joachim Klink, Head of Autonomous Driving and Integrated Mobility, **Deutsche Telekom / T-Systems International**  
                                        | Amit Rosenzweig, CEO & Founder, **Ottopia**                       |
| 30 min | **Interactive Panel Discussion and Live Audience Q&A** | Moderator: Dr Shane Rooney, Executive Director, IoT Networks, **GSMA**  
                                        | Johannes Springer, **Deutsche Telekom / T-Systems International**  
                                        | Joachim Klink, **Deutsche Telekom / T-Systems International**  
                                        | Amit Rosenzweig, **Ottopia**                     |
# The Socio-Economic Benefits of Connected Vehicles

## Road Traffic Accidents

- In the top 10 causes of death globally across all age groups
- 1.35 million lives lost every year
- Over 90% of vehicle collisions caused by human error

## Over 500 Million Connected Cars on the Road by 2025

## Yearly Benefits of Connected Cars by 2025

- 11,000 lives saved
- 260,000 fewer accidents
- 400,000 tones of CO$_2$ emissions avoided
- 280 million hours of driving saved

Sources: Bosch, 2017 | Ericsson, 2019 | U.S. DOT, 2016 | WHO, 2018
Why C-V2X?

- **Commercially available** globally, leveraging the secure and established 4G LTE network infrastructure

- Seamless and sustainable evolution from **4G to 5G** while upholding **backwards compatibility**

- Superior levels of **security, range, latency and reliability** that vastly exceed the capabilities of alternative solution DSRC/802.11p
Why C-V2X?

• Backed by a **global ecosystem** of 130+ leading mobile operators, vendors, automotive manufacturers, suppliers and companies from the wider industry

• C-V2X **security** is based on internationally recognised interoperable standards leveraging the security services provided by mobile networks, including eSIM

• **Mobile operators** are the experienced, trusted and licensed providers of an already established network infrastructure and are best placed to provide and manage connected vehicle solutions with the necessary scale, coverage, reliability and end-to-end security
What is the GSMA doing?

• The GSMA is working with mobile operators, automotive OEMs and suppliers, industry associations and regulatory bodies to accelerate the growth of the connected vehicle market by agreeing a common approach to security, regulatory and infrastructure solutions.

• To find out more, visit www.gsma.com/automotive
5G – Quality of Service (QoS) for Connected and Automated Driving

Dr. Johannes Springer | 5G Program @ Automotive
Deutsche Telekom AG / T-Systems International
GSMA WebTalk, November, 2020
AUTOMOTIVE CELLULAR CONNECTIVITY / TOPICS

OEM and 3rd party - Backend(s)
(variety of services, e.g. fleet mgmt.,
remote services, maps/location services, etc.)

Customer Connectivity /
Dual eSIM
Contract Links/Meshs

5G New Radio

LTE-A (5G)

Road side
infrastructure
(e.g. traffic lights,
digital street signs)

LTE-V2V (5G)

Customer Connectivity / LTE-V2X / C-V2X (incl. 5G NR)

Mobile Edge Computing / Broadcast

Quality of Service (QoS)/
Network Slicing & predicted QoS

OEM-Backend
(virtual vehicle)

Precise Positioning
Positioning Integrity

Base Stations as GNSS-
Reference Station

Direct Communication /
LTE-V2X / C-V2X (incl. 5G NR)

Precise Positioning
Integrity

LOCAL SENSOR COVERAGE

CUSTOMER to Infotainment
Communications

Access to Traffic
Infrastructure Information (e.g. via
NB-IoT / LTE-M)
UBIQUITOUS AVAILABILITY: ONE STRATEGY, 4 ACTION CLUSTERS

1. Continuous Network Expansion

2. Network Slicing delivering dedicated SLA’s

3. Prediction of SLA loss: → Predictive QoS

4. Global Coverage through Global Partnerships
SPECTRUM AUCTIONS: → COVERAGE (EXAMPLE GERMANY)

Coverage Obligations 2019
Step 1 (12/2022):
▪ 98% of households in every federal state
▪ All motorways
▪ Main primary roads
▪ Primary rail tracks
▪ 5G base stations
▪ Base Stations white spots

Coverage Obligations 2019
Step 2 (12/2024):
▪ Remaining primary roads
▪ Secondary and rural roads
▪ All rail tracks
▪ Harbors and important inner-country waterways

Spectrum Auction 2010
Spectrum Auction 2015
Spectrum Auction 2019
Spectrum Auction 2025*
Spectrum Auction 2033*

2 GHz und 3,6 GHz

* incl. 2 years preparation time
ARCHITECTURE OF A 5G CAMPUS NETWORK

PUBLIC NETWORK

CUSTOMER DATA CENTER (OPTIONAL)

PUBLIC TRAFFIC

LOCAL PRIVATE TRAFFIC

DEDICATED CORE NETWORK AND EDGE CLOUD (CAMPUS-L)

LOCAL PATH

5G CAMPUS NETWORK (CAMPUS-L)

PUBLIC CORE (CAMPUS-M)

PUBLIC CLOUD

PUBLIC NETWORK

LOCAL TRAFFIC

PUBLIC TRAFFIC

DT FREQUENCIES

ENHANCED ON-SITE PUBLIC NETWORK
EXAMPLE FOR NETWORK SLICING:
TELE-OPERATIONS AS PART OF AUTONOMOUS DRIVING

5G managed low latency and high bandwidth are key capabilities

Human driver at vehicle control center takes over in case of accident, technical problems, identification or decision issues
PREDICTIVE QUALITY OF SERVICE HELPS TO ANTICIPATE NETWORK COVERAGE

What KPIs along route A and B?
KPI prediction for route A and B

AI powered Network Forecast Service

Internal and external static and dynamic data
5G CAPABILITIES NEED TO BE PROVIDED GLOBALLY

- High quality global access portfolio
- Connectivity services via own infrastructure or tier one partners:
  - Deutsche Telekom own network
  - GMA + GMA Bridge Alliance
  - Roaming Partners
GLOBAL AVAILABILITY AND SMART ROUTING

- Smart routing for latency critical use cases (e.g. remote control)
- Legal constraints, e.g. South Korea, Brazil, Turkey
- Centralization / decentralization of management features (e.g. SOTA / FOTA / MapUpdate)
THANK YOU!
IoT WebTalk: Delivering 5G Quality of Service (QoS) for Connected and Automated Driving

Joachim Klink, T-Systems International
Amit Rosenzweig, Ottopia
The difference between today’s connected car portfolios and CASE...

Bandwidth [Mbit/s]

Latency [s]

Vehicle stats
Telemetry data
Remote lock/unlock
Remote climate
EV charging status
Road condition/traffic warning
Weather News
E-/b-call
Theft alert
LBS
IP radio
SD-/HD-Video
Internet
Offboard navigation

Connected Car Platform
... are “just” 20+ times more challenging requirements.
And QoS is THE key differentiator to literally save lives.
Example for ultra-reliable, high bandwidth and low latency requirements: Teleoperation – Why is it a challenge?

Your perception is limited...

- 4 HD Video Streams
- 50 times less than one human eye
- 50% of a single radio cell

Your control command comes (too) late

- Here is where the car is
- Here is where the wheel starts to turn
- Here is what you see

Obstacle
Imagine…

Bad signal

Permanently changing conditions

Many consumers
Safe teleoperation to enable automated/autonomous driving

Amit Rosenzweig, CEO and Founder, Ottopia
Panel Discussion and Audience Q&A