

5G Connected Cars: Status and Challenges



5G und 6G – Gamechanger für eine vernetzte Mobilität der Zukunft, Ingolstadt

15.09.2022

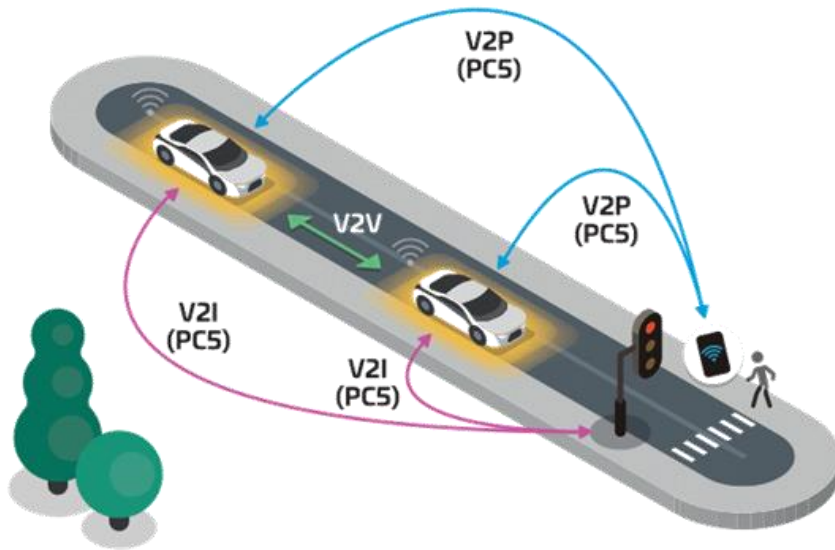
Dr. Uwe Pützschler

Connected cars: Cellular–V2X (C-V2X) -- complementary communication modes

C-V2X Direct Communications

V2V, V2I, and V2P operating independent of cellular network

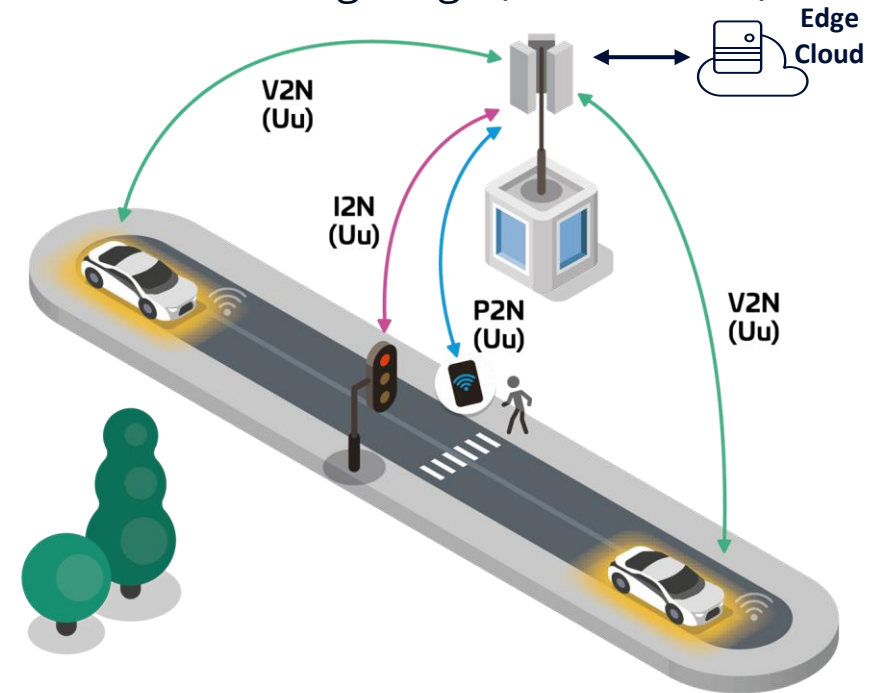
- Short range (<1 kilometer)



C-V2X Mobile Network Communications

V2N/I2N/P2N in licensed spectrum bands designated for mobile network communication

- Long range (>1 kilometer)



Source: Adopted from 5GAA)

Rollout of 5G networks in Europe – Road coverage obligations

Examples



Spectrum Auction
2019:
2GHz & 3,6GHz

2019 Step 1 (12/2022):

- All motorways: 100 Mbit/s, 10 ms
- Main primary roads: 100 Mbit/s, 10 ms
- Primary rail tracks: 100 Mbit/s

Step 2 (12/2024):

- Remaining primary roads: 100 Mbit/s, 10 ms
- Secondary and rural roads: 50 Mbit/s
- All rail tracks: 50 Mbit/s
- Harbors and important inner-country waterways: 50 Mbit/s



Spectrum Tender 2020:
700 MHz

Step 1 (within 4 years):

- 100% of core corridors
- 98% of side corridors

Step 2 (within 6 years):

- 100% of core corridors
- 100% of side corridors

of railway and road corridors sections within the Trans-European Transport Network (TEN-T) in the “Core Network” and “Comprehensive Network” categories.



Spectrum Auction
2022:
3,4 GHz MHz

No specific road coverage obligations

Growing momentum: Connectivity to support safety related use cases #1

1. 5G/C-V2X enabled vehicles



"First 5G enabled car on the road",
25.12.2020

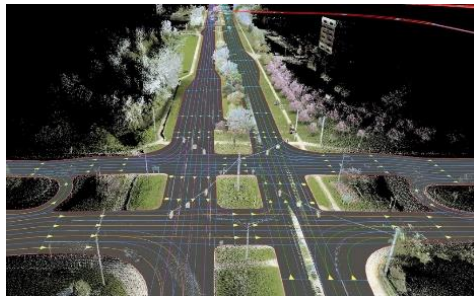


"BMW iX with 5G connectivity via two network operators",
02.09.2021



"GM to produce 5G-connected cars in 2023 with AT&T", 19.08.2021

2. New safety oriented use cases



"Precise data for greater safety: Audi warns its drivers about slippery roads",
08.03.2021



"Mercedes-Benz further expands Car-to-X communication; pothole detection",
12.08.2021

Growing momentum: Connectivity to support safety related use cases #2

3. Data for road safety initiative in the EU

Objective:

Create an SRTI Ecosystem to share safety critical data between OEMs, service providers and public authorities ...", [Source](#)



8 SRTI Use cases:

1. Temporary slippery road
2. Unprotected accident area
3. Short term road works
4. ...

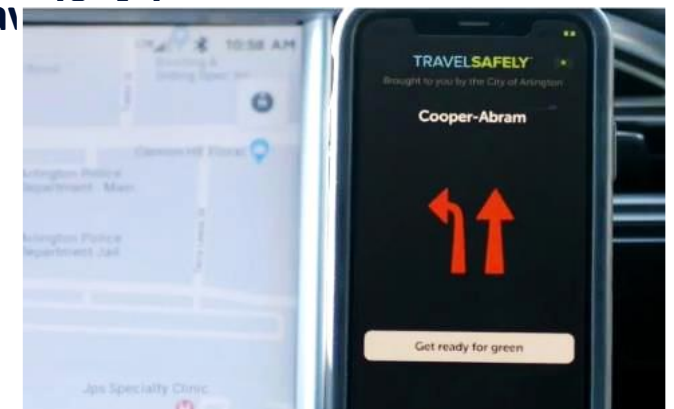
4. Intelligent traffic with smartphone apps

The Netherlands – Talking Traffic:

- Approx. 2 million users
 - 850 Intelligent traffic light in operation
 - Real-time status of bridges and locks
- [Source](#)

US: Georgia, Texas, .. Trav

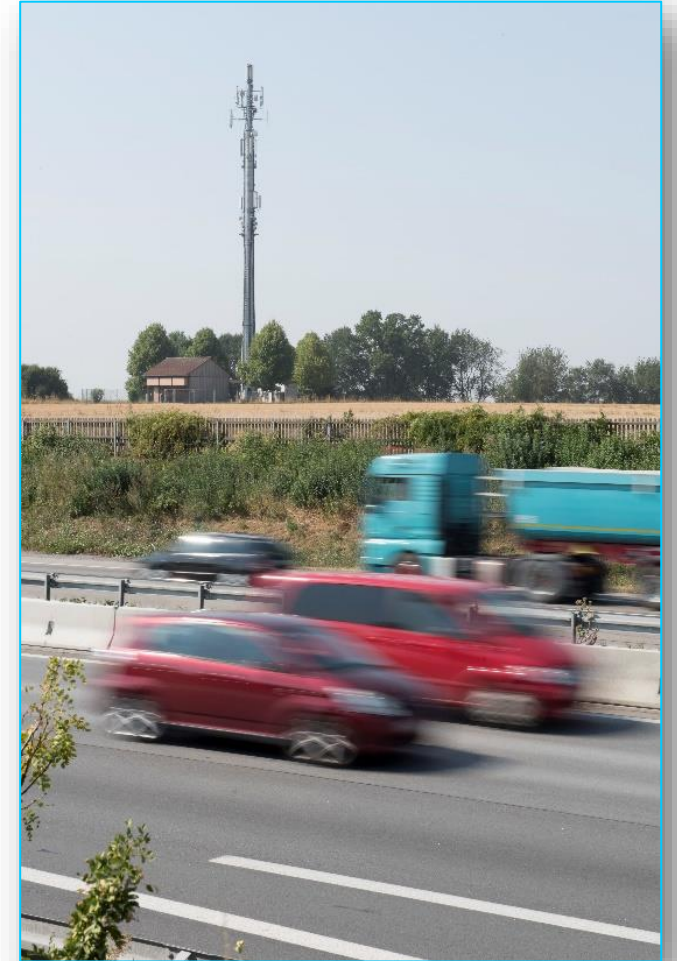
- 1000+ intersections
 - Emergency vehicles
 - School zone warning
 - Rail crossing warning
- ... , [Source](#)



Challenges of the ecosystem related to communications

OEMs: most of new vehicles are connected via mobile networks

1. OEMs have different views on direct communications
2. Road operators have different deployment strategies for use of network based and direct communications
3. Road operators are aligned on need for digitalisation of road infrastructure, but high costs to digitalise “older” road infrastructure
4. Business and cooperation models for traffic safety and automated driving related applications



NOKIA