Johannes Springer,

Chief Technology Officer,
Connected Cars,

T-Systems/Deutsche Telekom

Commercial Deployments of C-V2X Vehicles

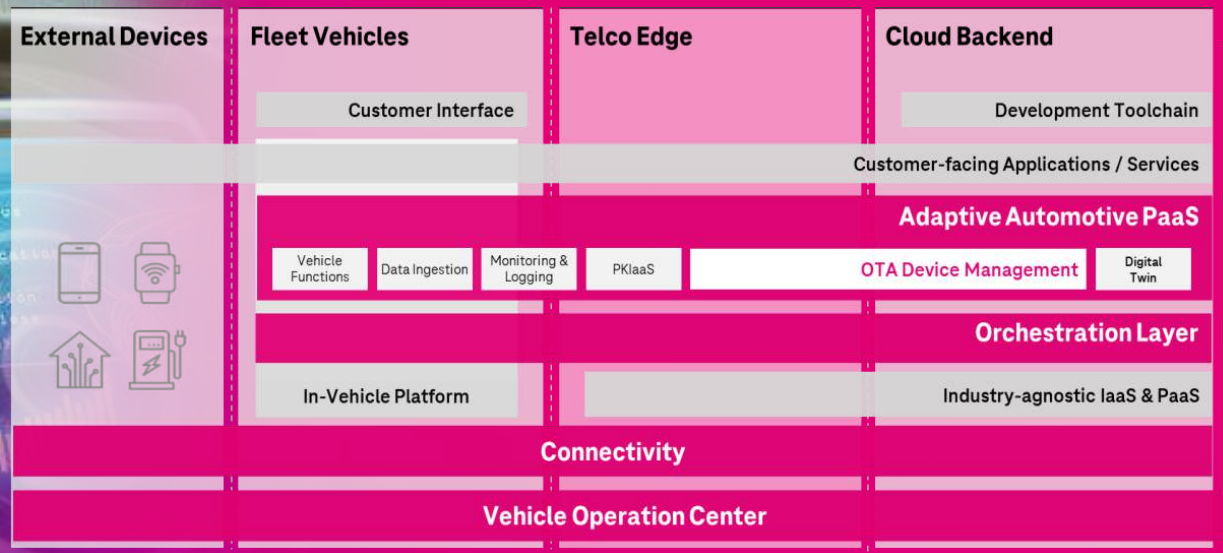
Dr. Johannes Springer | 5G Program @ Automotive
Deutsche Telekom AG | T-Systems International

ETSI/5GAA Plugtests, Klettwitz, March 2022

Road Traffic: Digital environment

Connected Cars

- 100‘s Mio‘s Connected Vehicles worldwide
- Global Connected Car Platform Operations



Connected Car Platform Operations

millions of connected vehicles under global operations since > 10 years

> 25 mio vehicles

under management

worldwide, 24/7

with **> 30** MNOs and content providers.

Expected growth to > 30 mio vehicles

> 10 years

Expertise in Connected Mobility

DevOps & Cloud migration

experience for Connected Backends:

seamless cloud migration

< 5 months

Multi-Cloud provider

Partner of Microsoft Azure and aws

Cloud-agnostic platform

approach based on Building Blocks

200 supported countries worldwide

> 300 Microservices

> 14.000 requests per second

T · · Systems · Let's power higher performance

Spectrum Auctions: → coverage (Example Germany)

~90% 5G population coverage

2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033

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

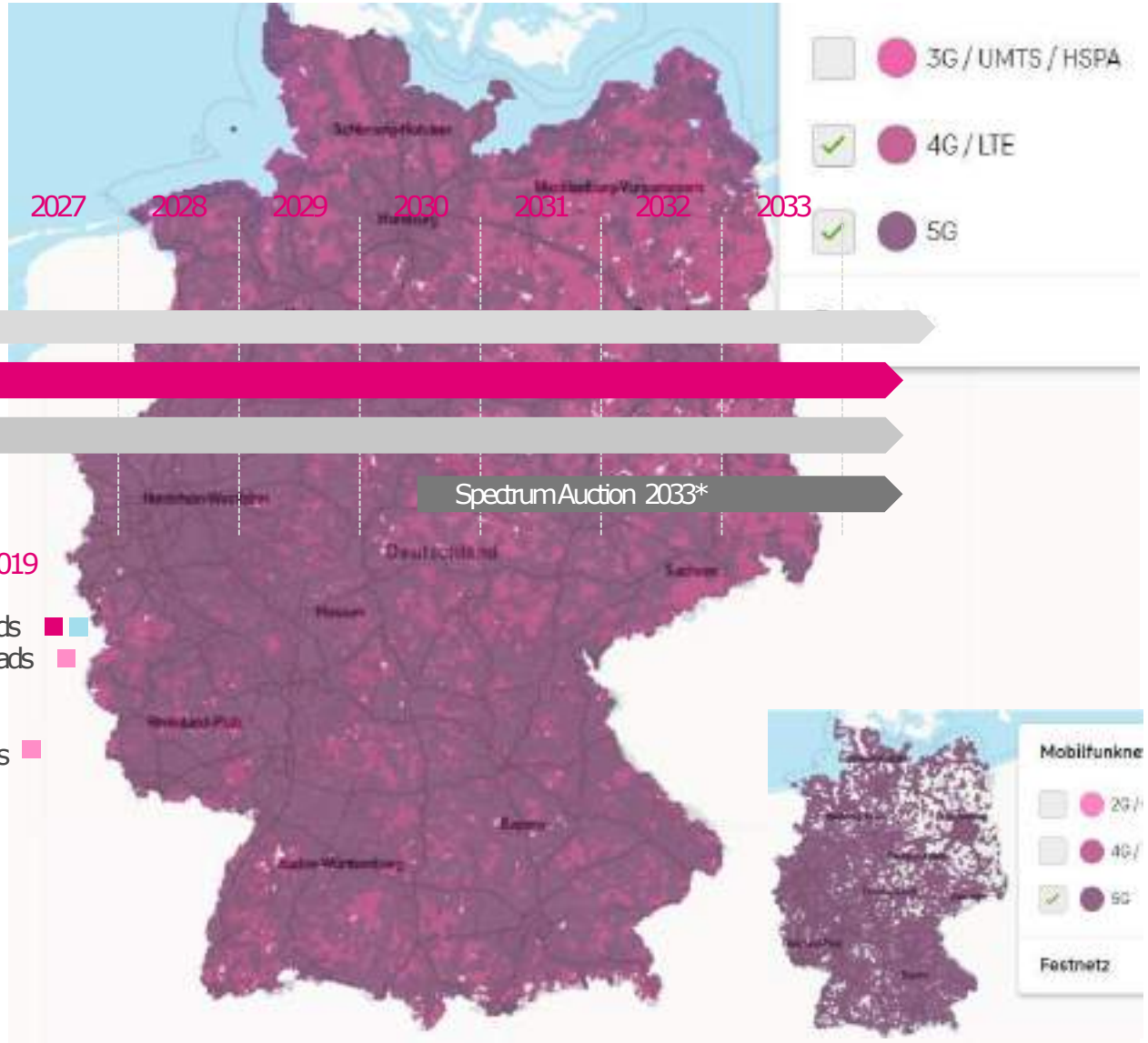
Auction
2 GHz und 3,6 GHz

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 1.000
- Base Stations white spots 500

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

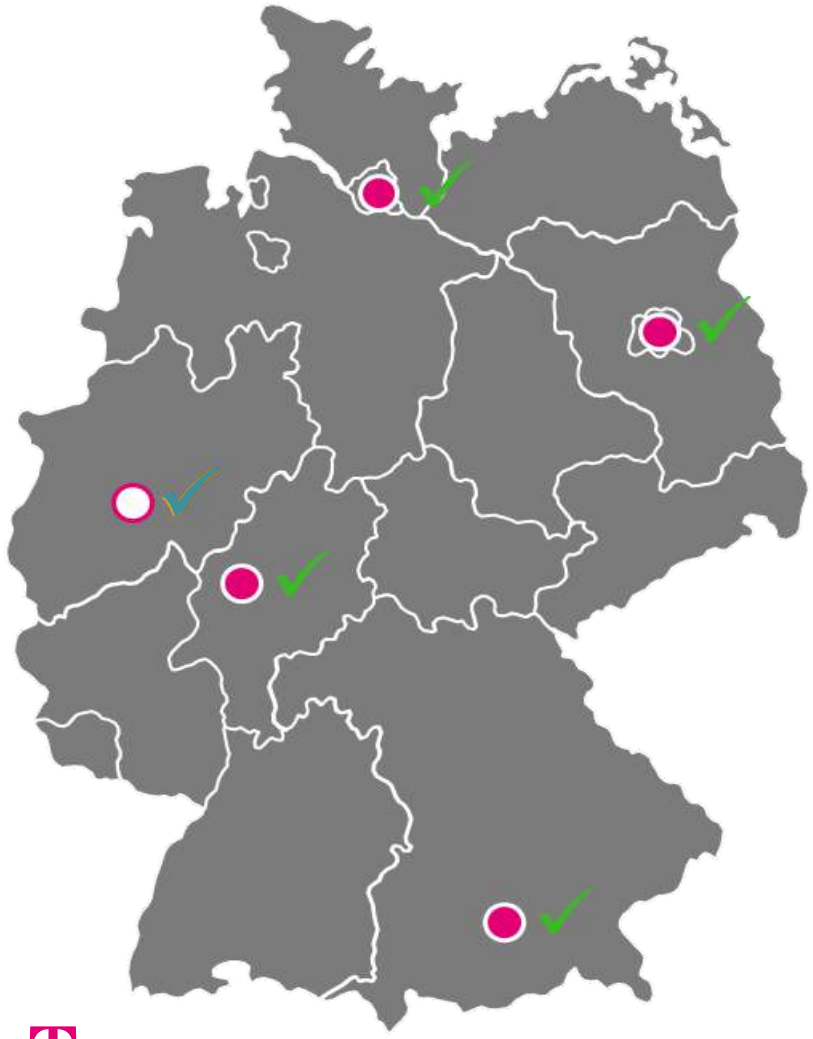
100 Mbit/s 50 Mbit/s 10 ms

*incl. 2 years preparation time



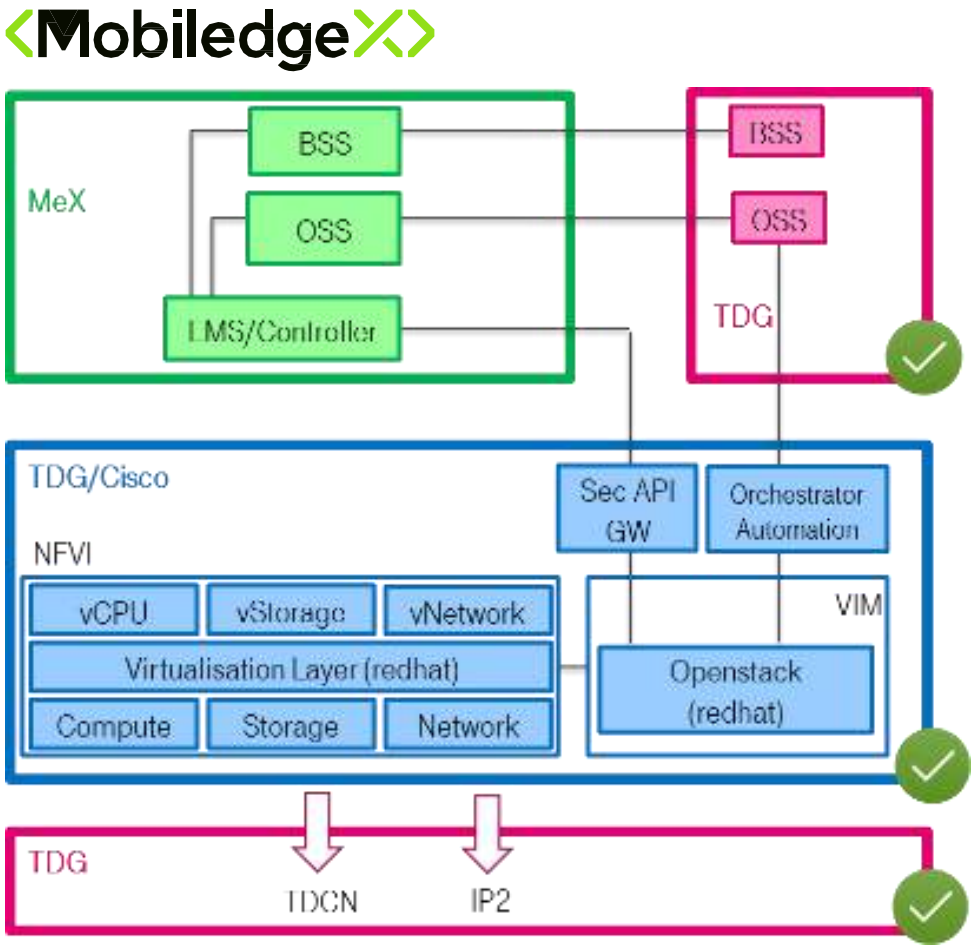
Source: Bundesnetzagentur

Multi-Access Edge (MEC) Data Centers in Germany



5 Edge data centers (cloudlets) deployed at coresites:

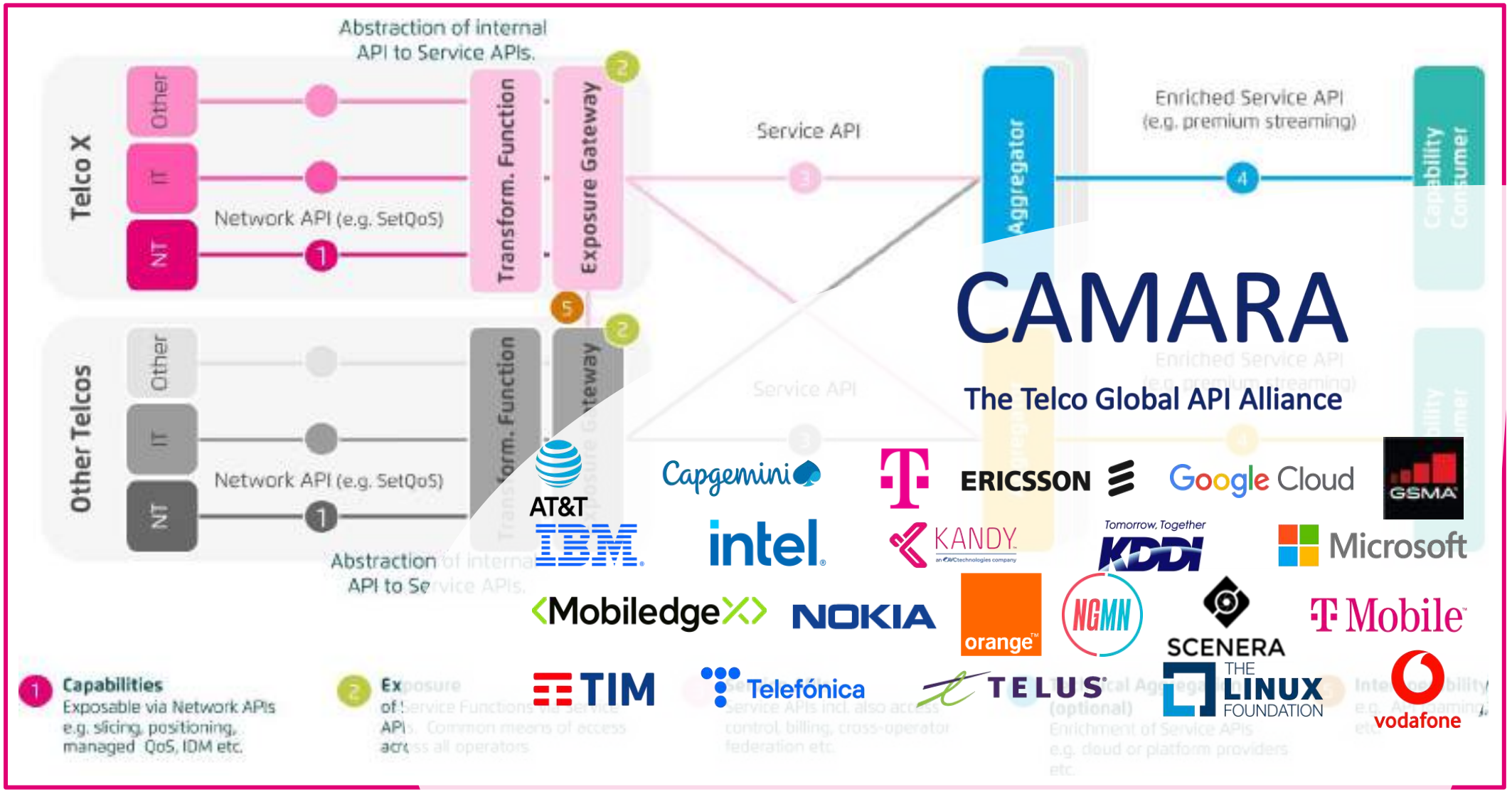
- Berlin
- Frankfurt
- Hamburg
- Munich
- Düsseldorf



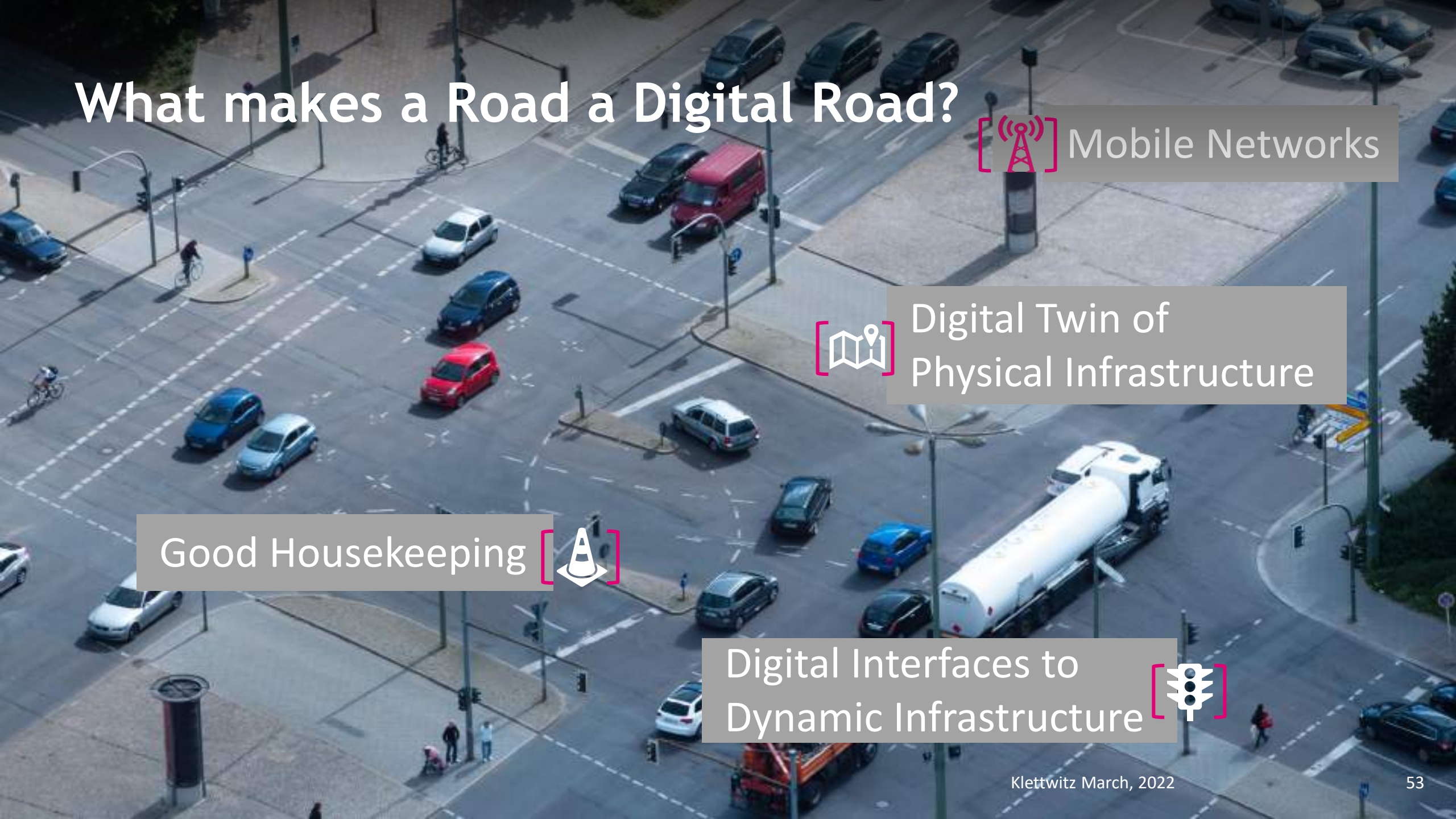
Quality on Demand


BMW
Valeo

Network API's: exposure in a global world



What makes a Road a Digital Road?



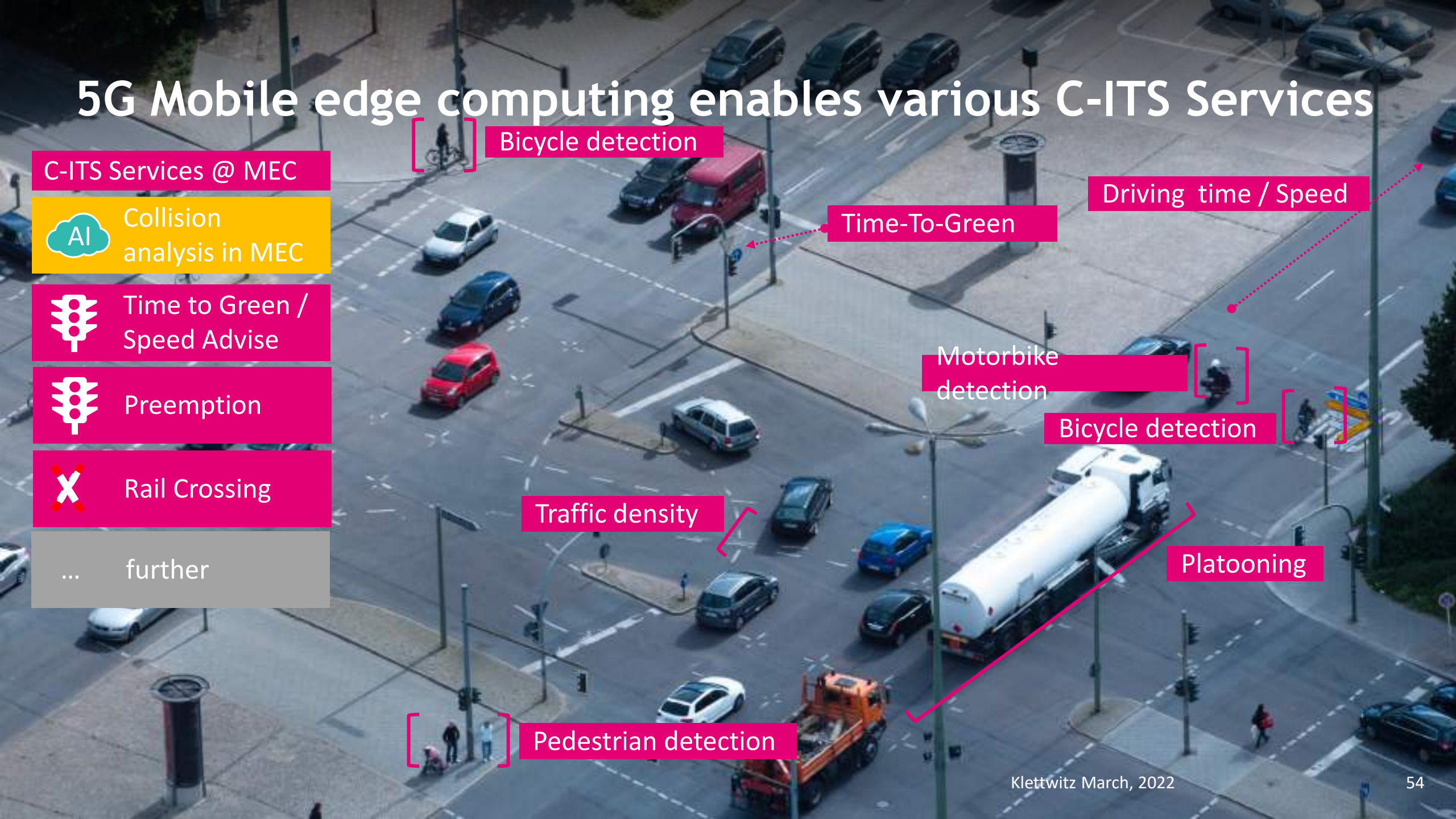
Mobile Networks

Digital Twin of
Physical Infrastructure

Good Housekeeping

Digital Interfaces to
Dynamic Infrastructure

5G Mobile edge computing enables various C-ITS Services



Example: Digital Guardian Angel for Cyclists

Collaborative traffic services solution

ITS Services

TTG (Time to Green), incl Prioritization

a Informational service = user has to react, reaction time 500 ms

b Automated driving = latency critical

c Prioritization of bicycles and scooters

d Prioritization of trucks and platoons

Collision Warning

User has to react, reaction time = latency critical

This project is funded by the Federal Ministry of Transport and Digital Infrastructure

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Collaborative traffic services solution

How does it work?

I2N (Uu)

SPAT / MAP (uplink only)

I2N

Telefonica Mobile network

ITS Server
Mobile Edge Infrastructure of Deutsche Telekom)

MECs: Hamburg

CAM
Position
Heading
Speed

DEMN

SPAT
MAP

ITS Services:

TTG
(Time to Green)

a) Informational service = user has to react, reaction time 500 m

b) Automated driving = latency critical

c) Priotization of bicycles/scooters

d) Priotization of trucks/platoons

Collision Warning
user has to react, reaction time = latency critical

- (e-)Bikes, Scooters
- Motorbikes
- Pedestrians
- Trucks
- Cars

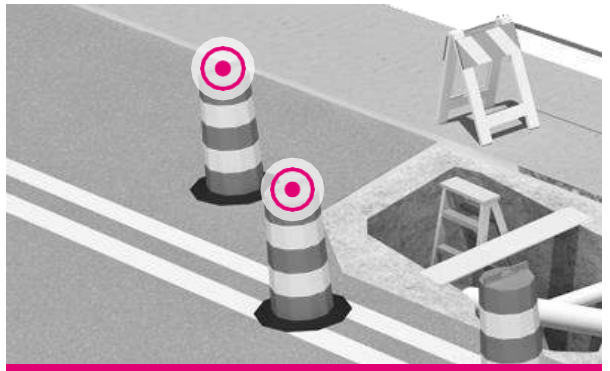
RSU: Roadside Unit
I2N: Infrastructure to Network
CAM: Cooperative Awareness Message
DEMN: Decentralized Environmental Notification
SPAT: Signal Phase and Time
MAP: Topology Information of the intersection (ISO TS 19091 / SAE J2735)

This project is funded by the Federal Ministry of Transport and Digital Infrastructure

5G technology is an important driver of future mobility and supports the “C-A-S-E” vehicle

Precise Positioning

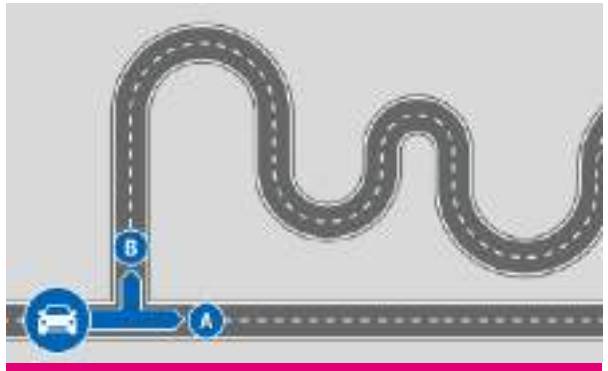
Mobile Edge Computing



V2X / AD Infrastructure

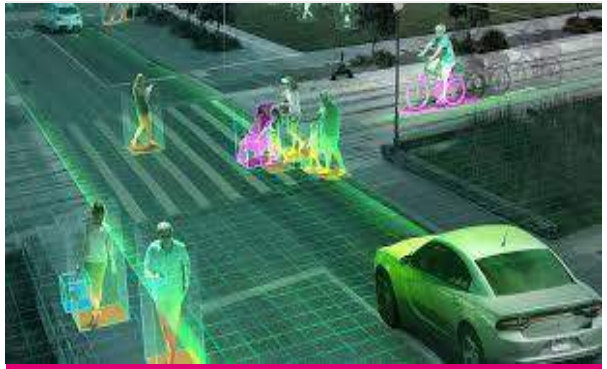
Tele-Operation

OTA Distribution



(Predictive) QoS

In-Car Broadband



Virtual/Digital TestDrives

Thank you!