ConnRAD – Connectivity and Resilience for Automated Driving

Midterm Presentation
Berlin 6G Conference, 01. – 04.07.2024

ConnRAD
Connectivity & Resilienz für automatisierte
Fahrfunktionen in Deutschland

ConnRAD Use Cases for Automated Driving Functions
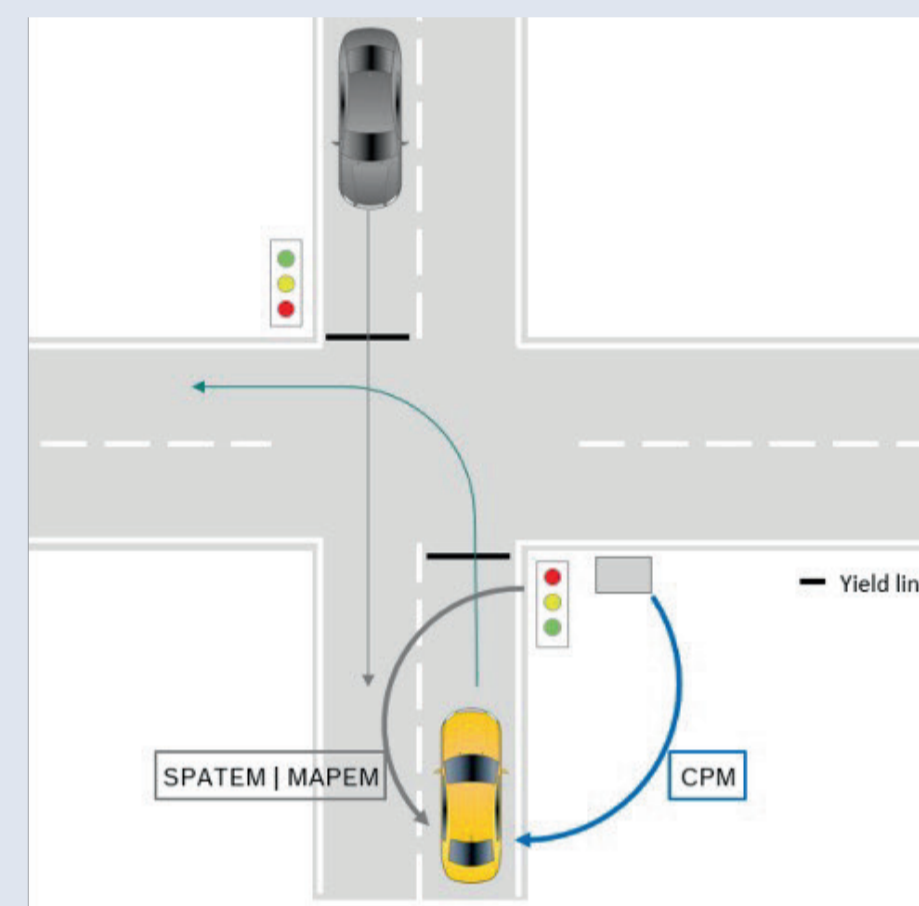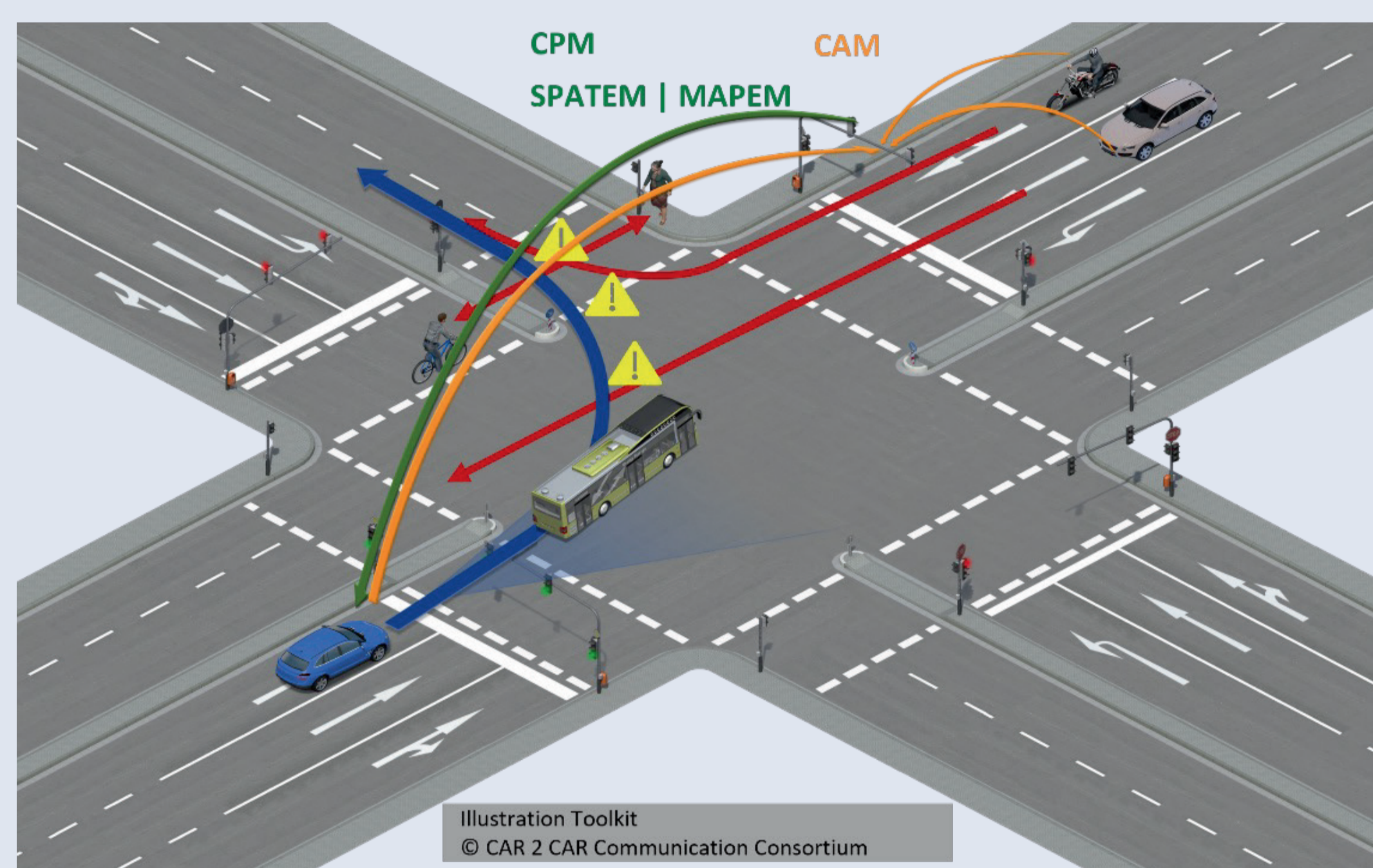
Motivation

- In the ConnRAD-Project, possibilities for resilient V2X communication are investigated with respect to three different use cases
- The use cases differ in
  - the communication technology used (ETSI ITS G5, C-V2X, cellular),
  - the messages used (CAMs, DENMs, CPMs, SPATEM/MAPEM, proprietary)
  - and the environment/ODD (urban, rural, highway; different velocities, different road users, …)
- Subsets of the use cases are planned to be realized in simulations, real world tests and demonstrators
- The use cases allow, besides security considerations, to investigate safety-relevant aspects of V2X communication

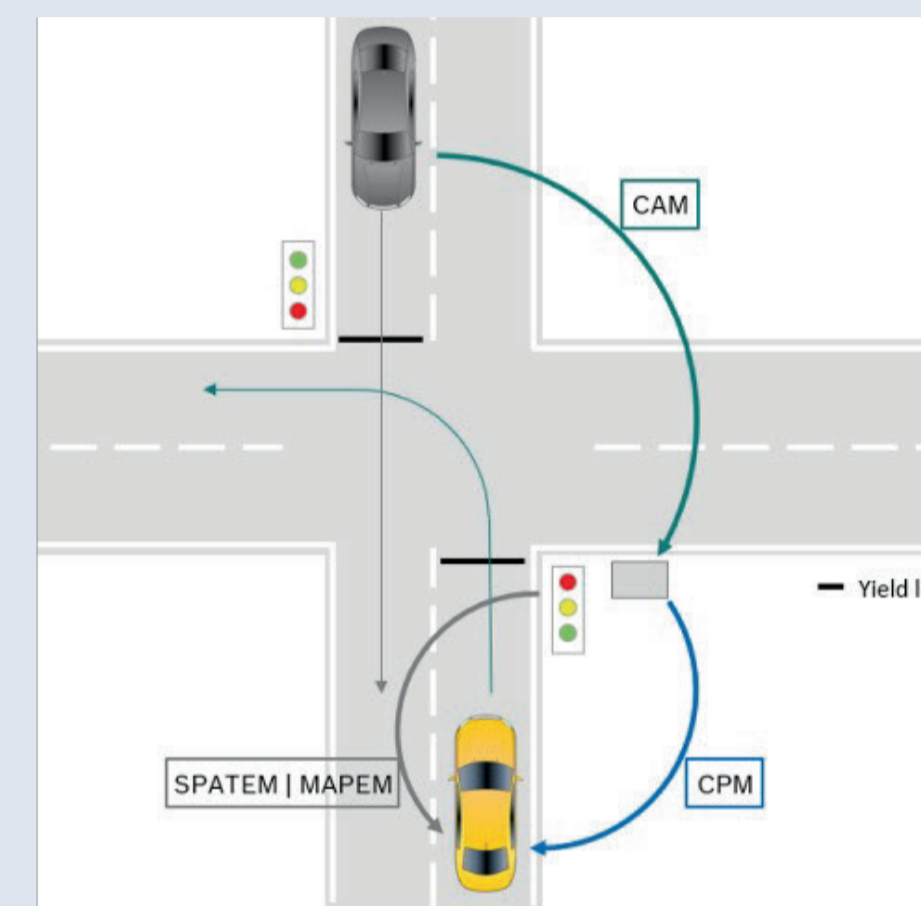## Use Case 1: V2X communication for cooperative, urban AD-functions

Communication: ETSI ITS-G5, C-V2X; Messages used: CPM, SPATEM & MAPEM, CAM
ODD: urban intersection with traffic lights; velocities up to 50 kph; other road users: cars, busses, trucks, motorbikes, pedestrians, animals, w/ or w/o V2X
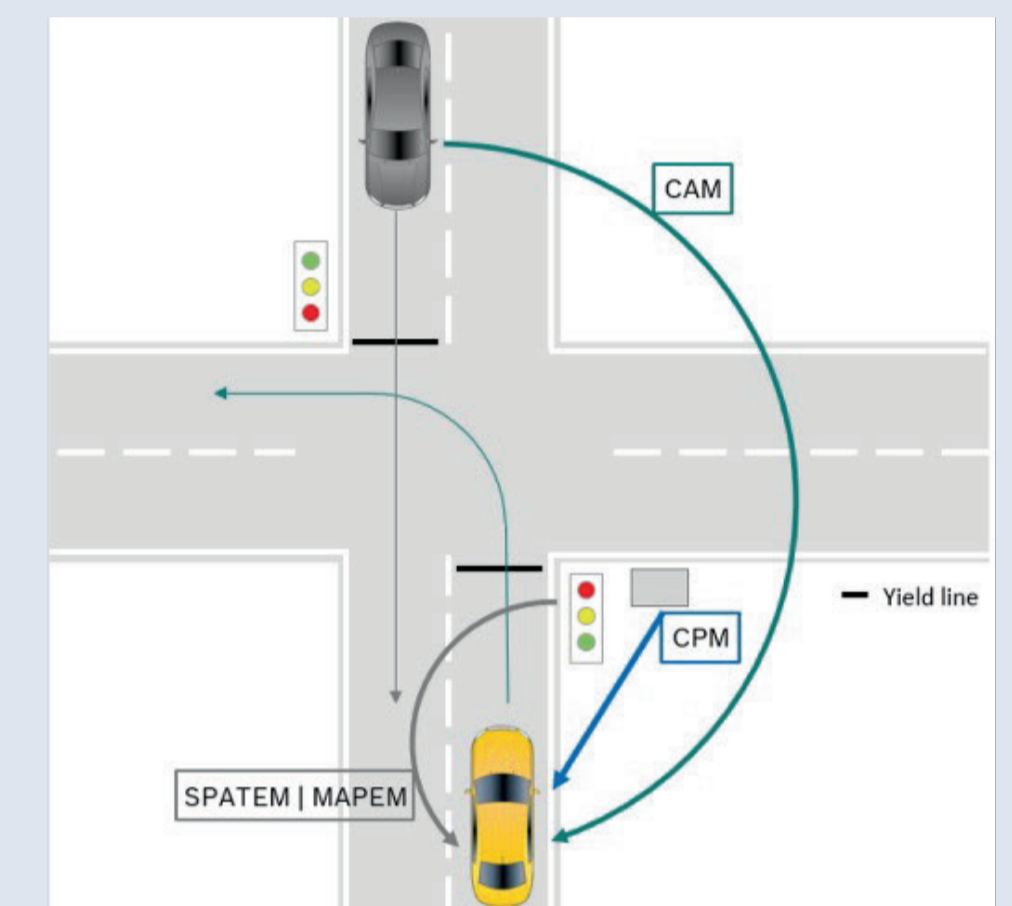

Illustration Toolkit
© CAR 2 CAR Communication Consortium

Option #1

Analyze trust: The receiver (EGO* vehicle) evaluates the trust in messages from the sender (infrastructure).

Option #2

Analyze trust chain: The receiving EGO vehicle evaluates the trust in infrastructure's messages already containing trust into the messages from the other vehicles.
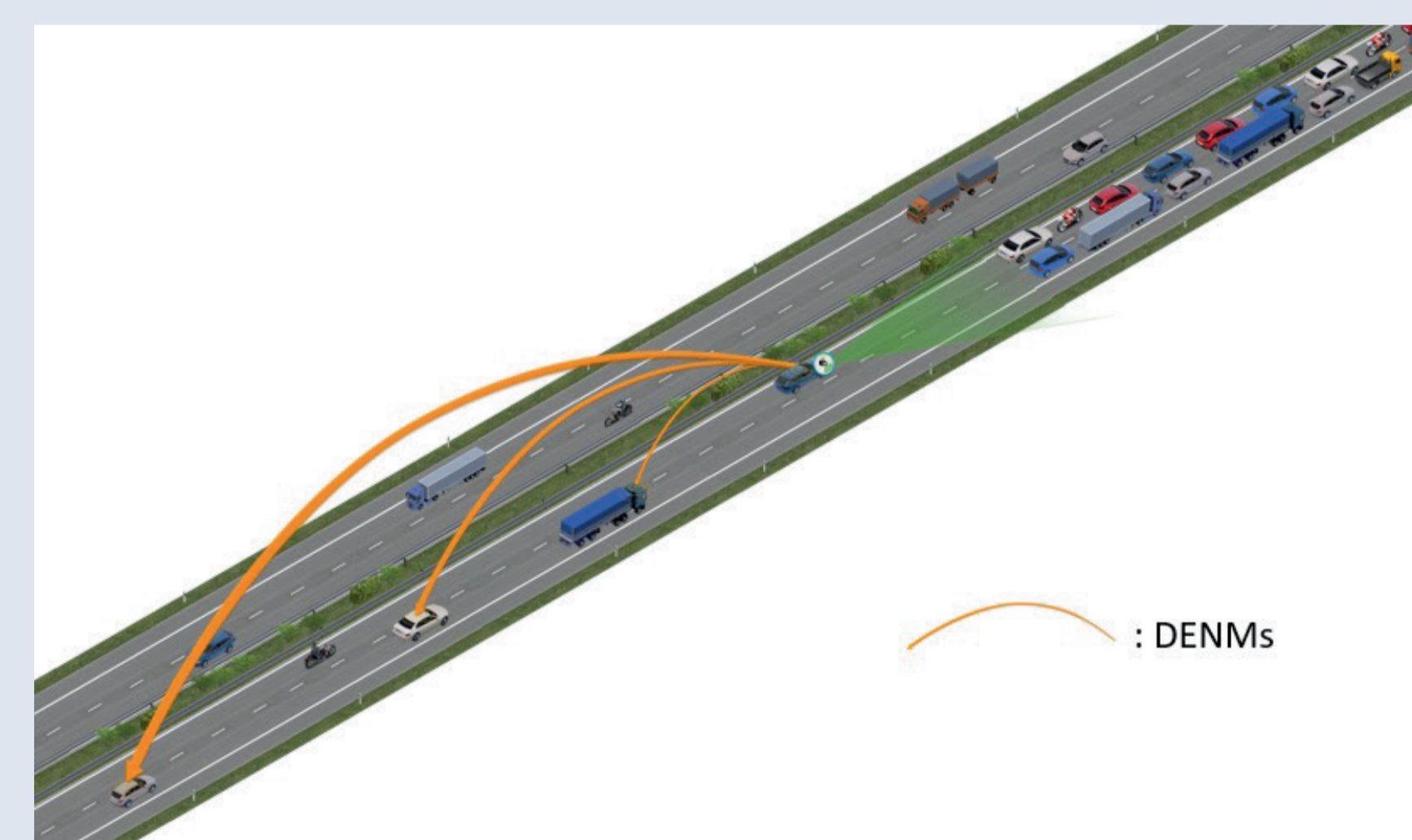
Option #3

Analyze trust from multiple sources: The receiving EGO vehicle evaluates the trust in messages from the senders (other vehicles and infrastructure).

Use Case 2: Reliable and trustworthy event-notification via V2X direct communication on highways
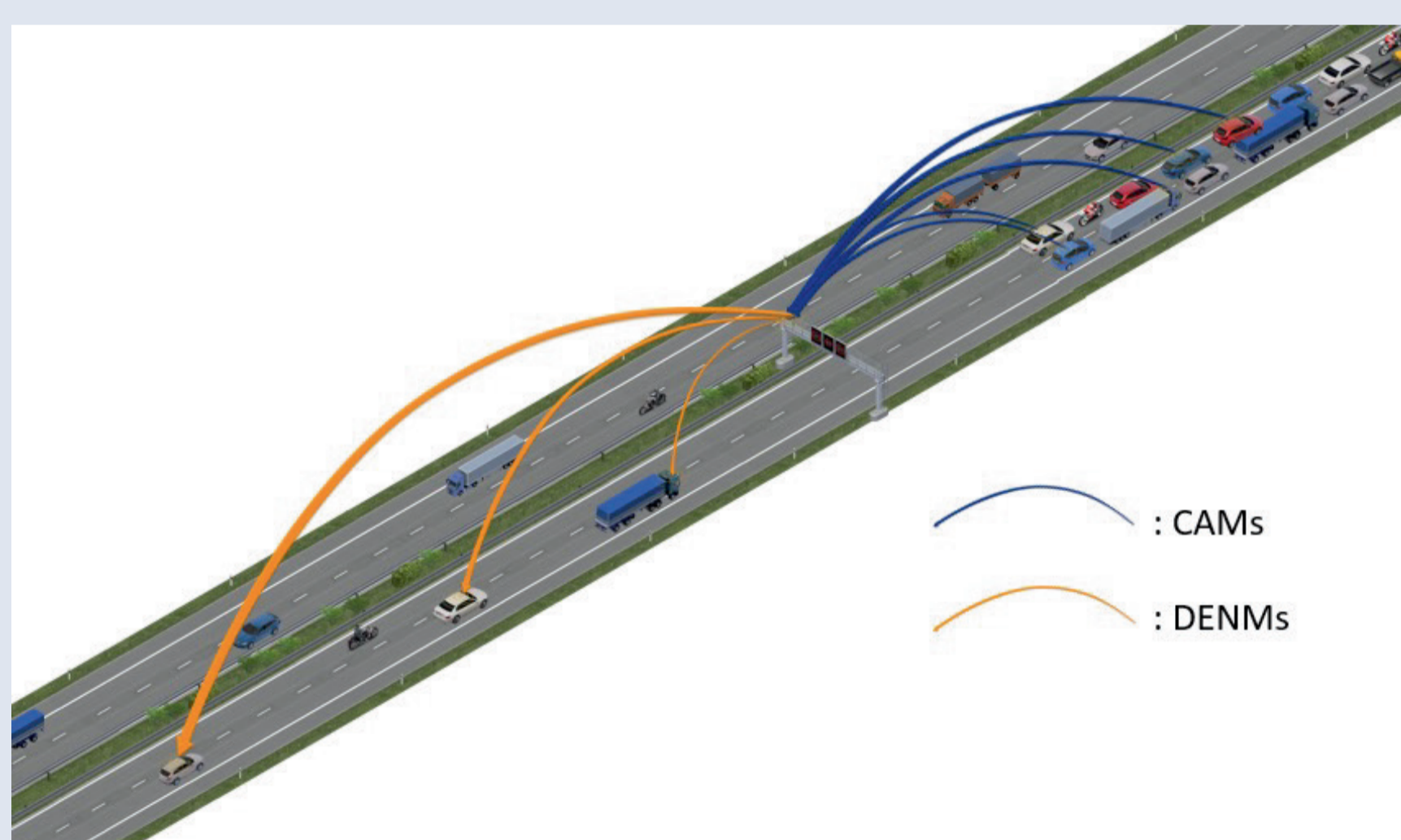
Communication: ETSI-ITS-G5, C-V2X; Messages used: CAM, DENM
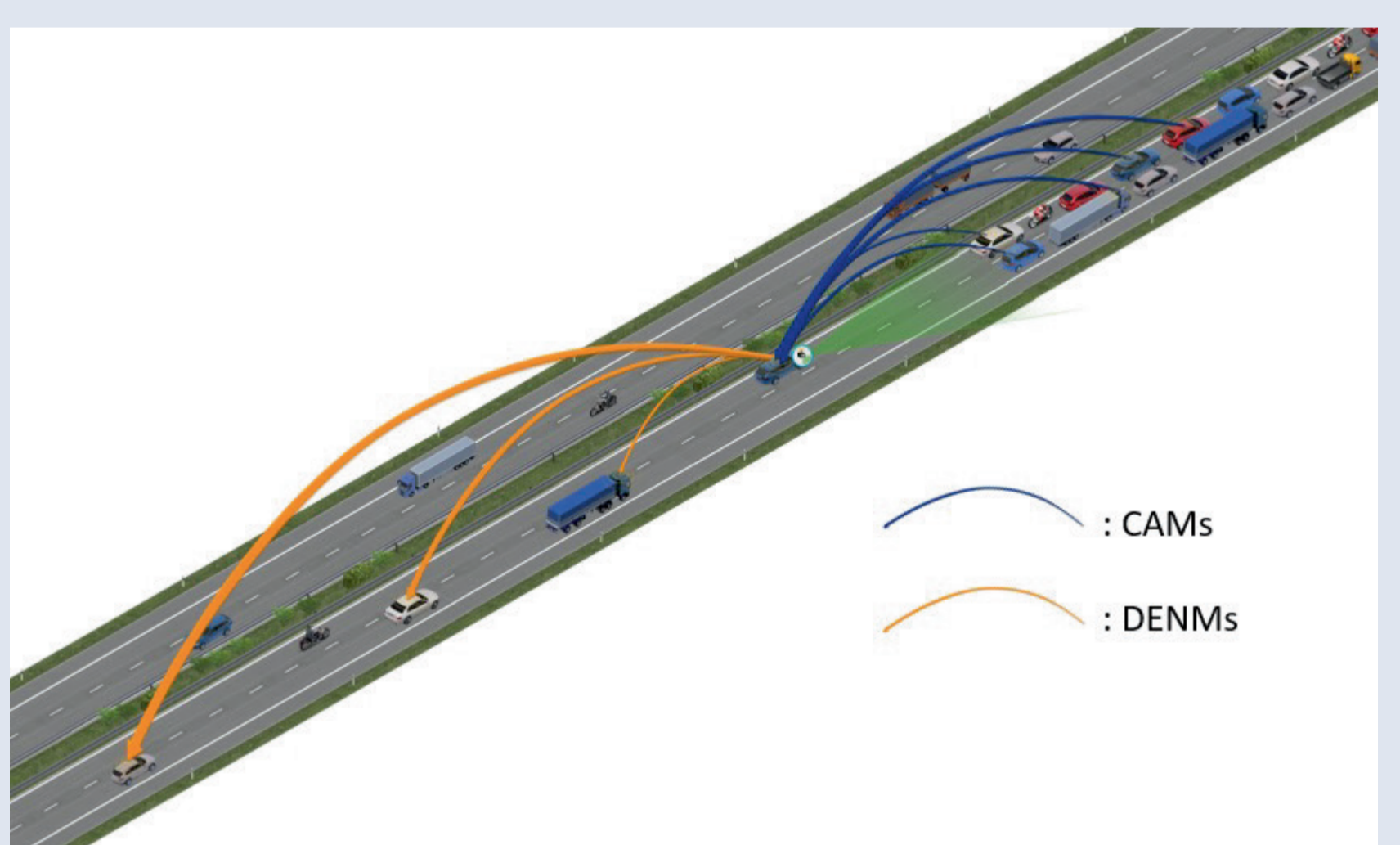ODD: Highway; velocities up to 130 kph; other road users: cars, trucks, motorbikes, busses

Scenario 1: Traffic jam detection by internal sensors (Radar, LiDAR, Camera)

: DENMs

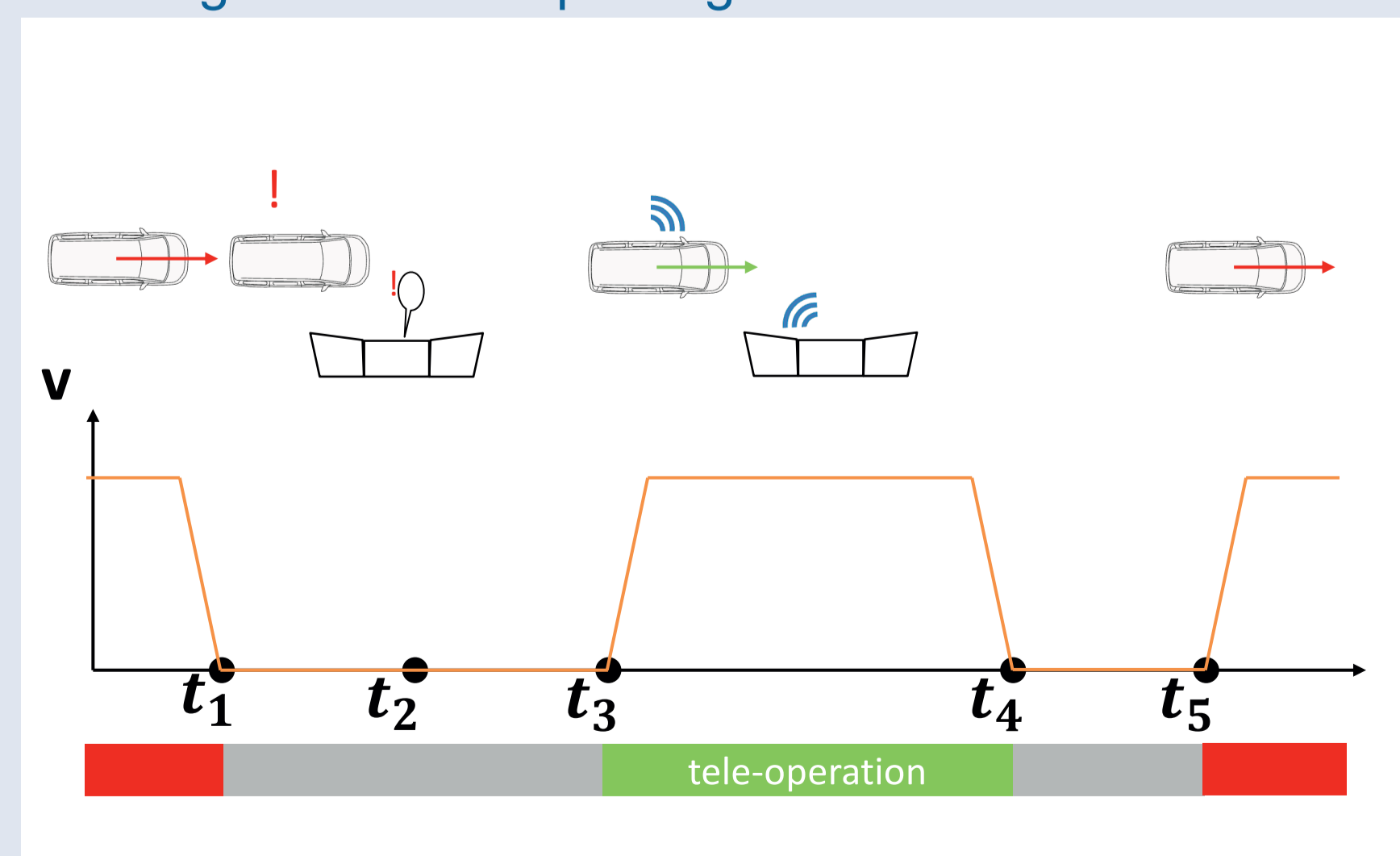Scenario 2: Traffic jam detection by incoming V2X messages (CAMs from vehicles within traffic jam)

: CAMs
: DENMs

Scenario 3: Traffic jam detection combination of Scenario 1 and 2
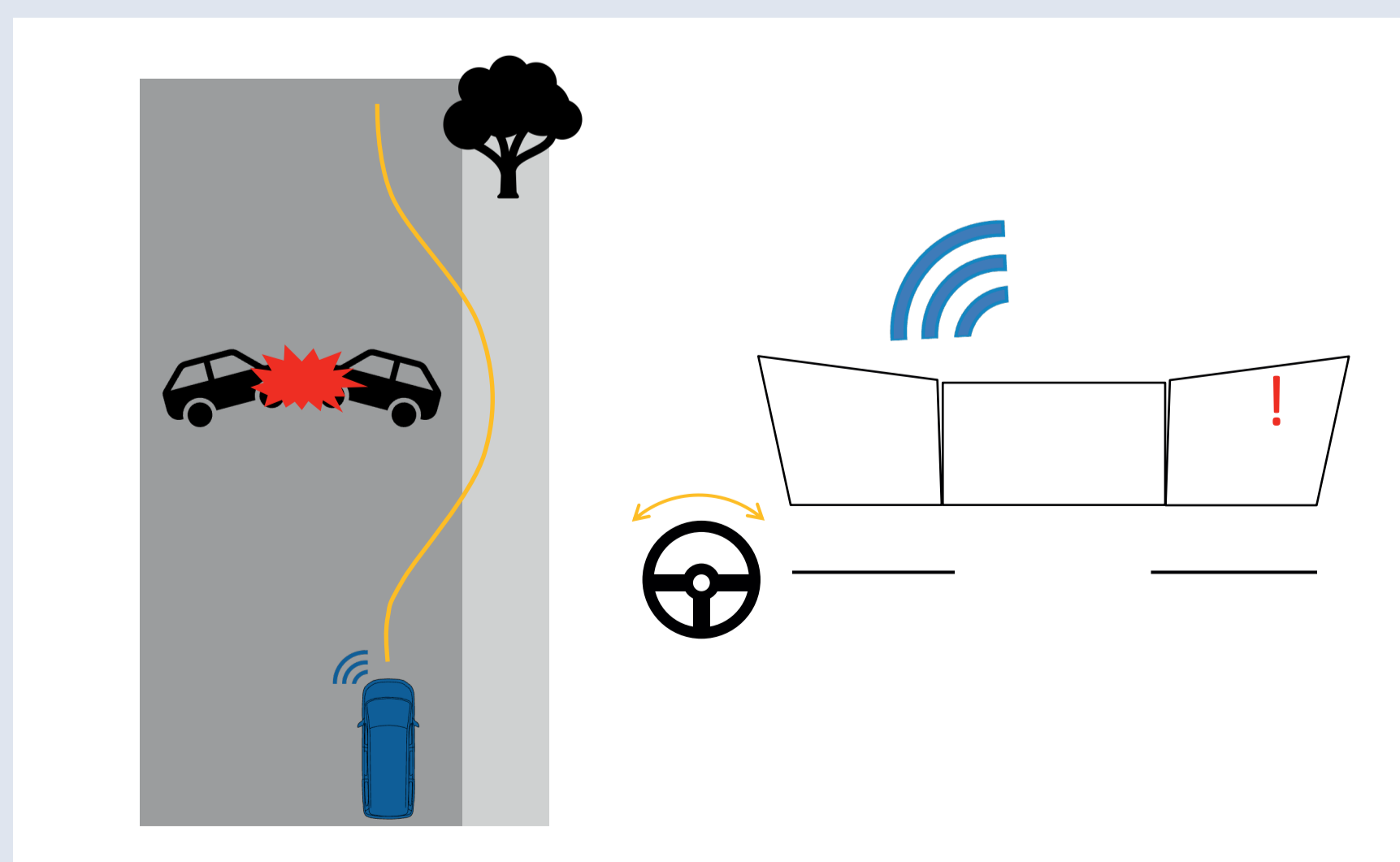

: CAMs
: DENMs

Use Case 3: Teleoperated driving via cellular communication with a cloud backend

Communication: 4G or 5G Public Mobile Network, C-V2X (V2N); Messages used: Custom Message Definitions and Real-Time Video Streaming, Protocols: UDP, TCP, RTSP
ODD: Urban area; velocities up to 30 kph; other road users: cars, trucks, motorbikes, busses

Overview: Teleoperation as a fallback for automated driving or as a valet parking service

tele-operation

Scenario 1: Teleoperation - Direct Control

Scenario 2: Teleoperation - Indirect Control