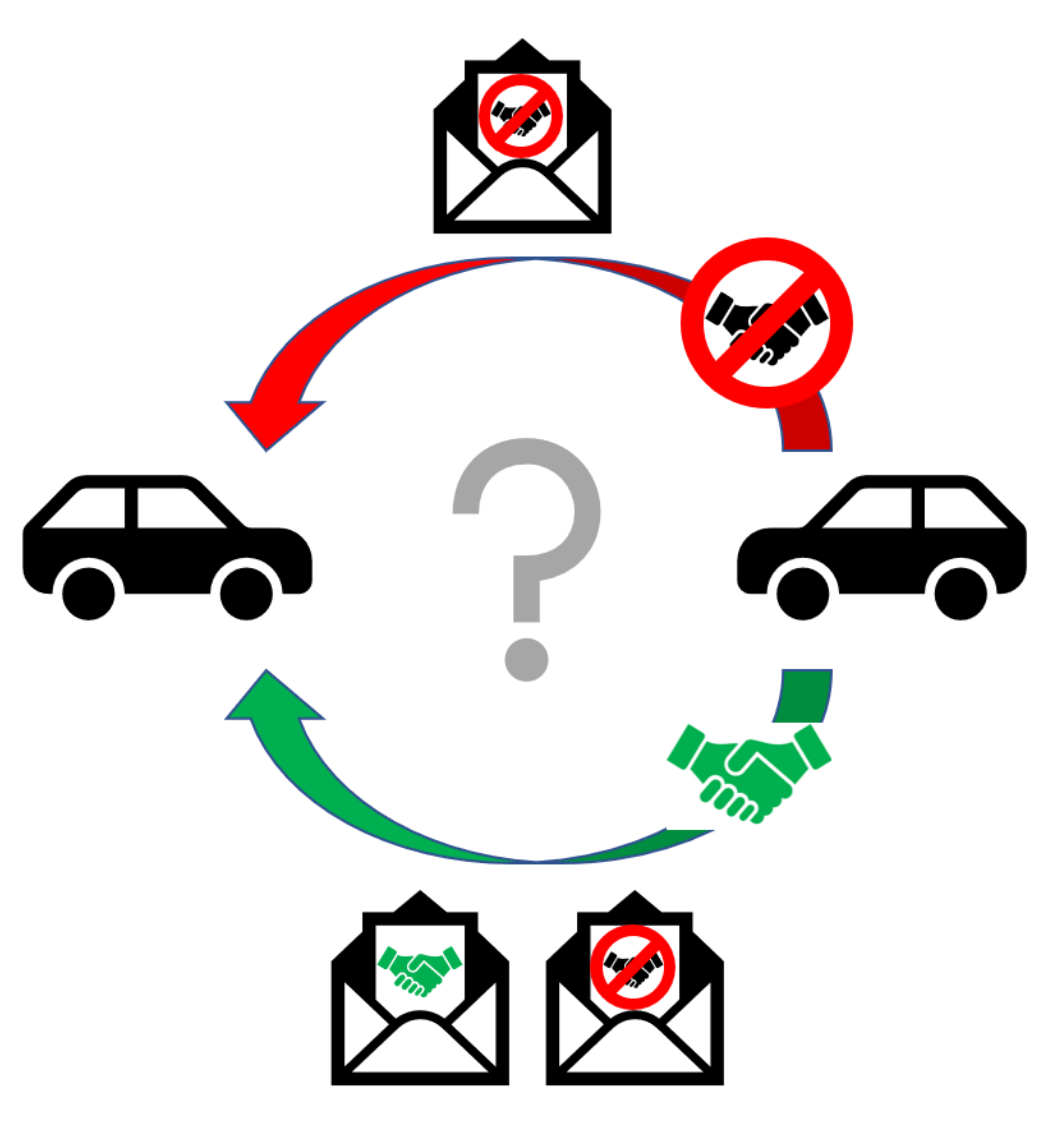


## Use Case 2 – Reliable and trustworthy event-notification via V2X direct communication on highways

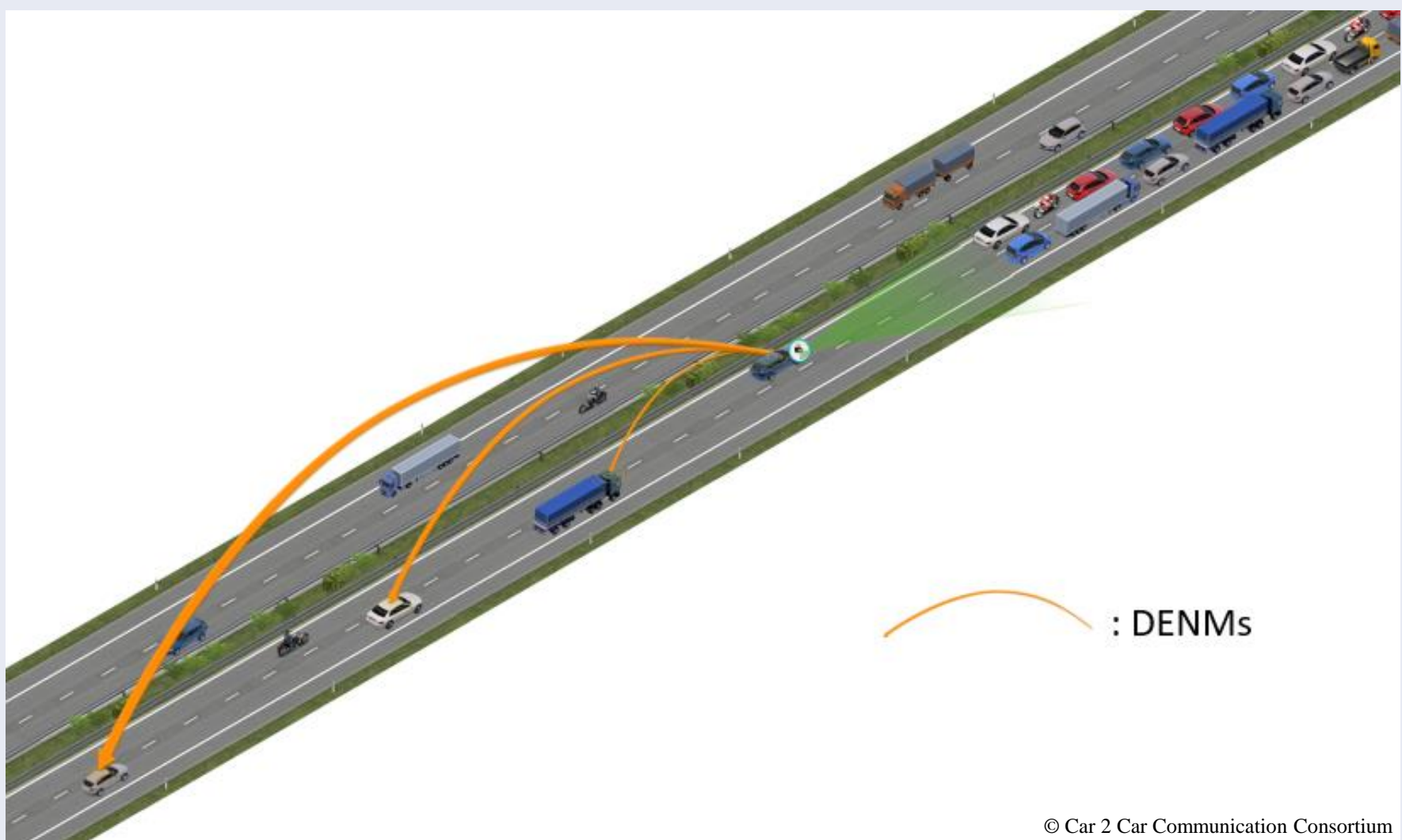
Jens Horn, Daniel Rau; Hochschule für Technik und Wirtschaft des Saarlandes – htw saar

### Problems/Motivation

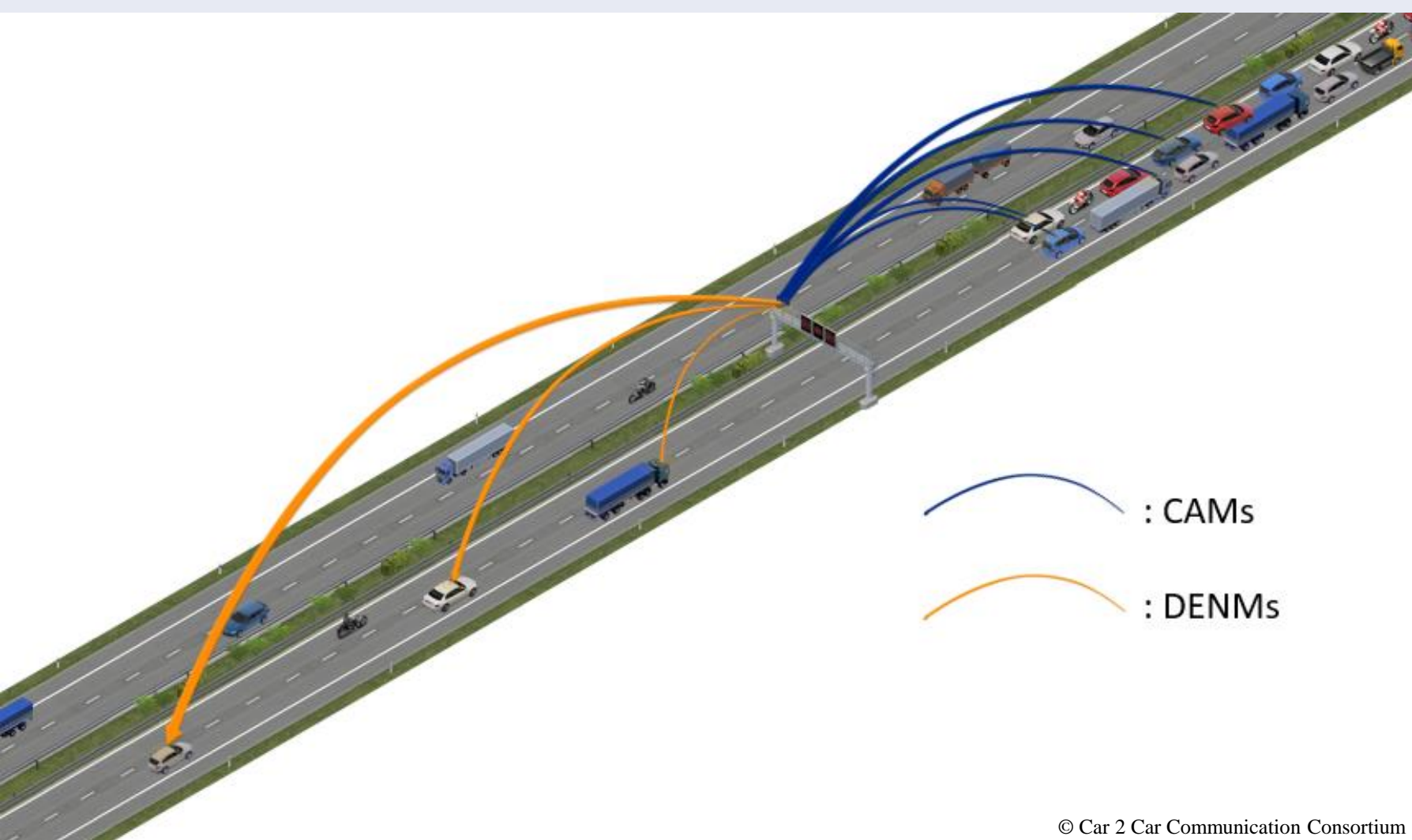
- In general, connected automated mobility represents a distributed system where the communication partners are not necessarily known to each other, so the communicated information is not verifiable and may therefore not be used in safety critical driving functions → how could a traffic participant trust information from unknown sources?
- The highway scenario faces the problems of higher (relative) speeds between potential communication partners, therefore less time to build up trust, potentially even with bad cellular coverage → how can trustworthiness be established in time using no external sources, but just information from own sensors and the communication partner to be trusted?
- Two questions: How to establish trust in the sender, and how to derive trustworthiness in data sent?



### Scenario Description

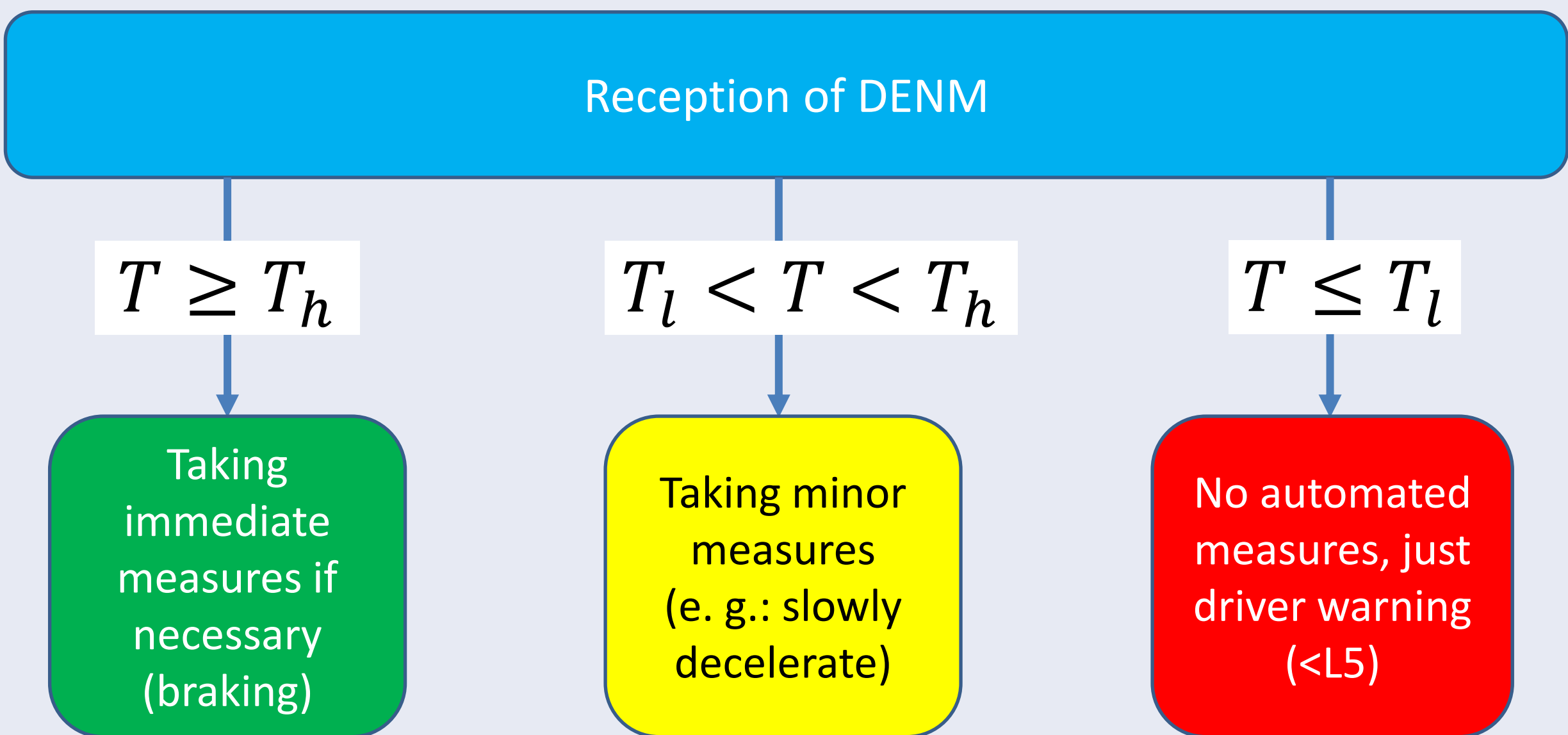


- General description:
  - A traffic jam (TJ) has emerged on a highway, and a connected automated vehicle (CAV) approaches it. Before it gets into the CAVs sensor range, it is detected by another connected traffic participant, who sends out a warning so the CAV can take appropriate measures earlier.
- Detection of the TJ can vary:
  - Infrastructure/Connected vehicle (CV)
    - Either a Road Side Unit (RSU, e. g.: on a gantry sign) or another approaching CV might detect the TJ
  - Sensors/Communication
    - The TJ might either be detected by sensors of the detecting entity, or by V2X-messages received from within the TJ
- ODD:
  - Highway: 2-3 lanes, lane markers present
  - Road users: cars, buses, trucks, motorcycles, both connected or not
  - Velocities: TJ standing or slowly moving (< 20 km/h), approaching vehicles up to 130 km/h
  - Communication: direct V2X-communication; ITS-G5 or C-V2X; CAMs and DENMs
  - Sensors: LiDAR, RADAR (vehicle); video (infrastructure)
  - Weather: no fog/smog/smoke/dust, no heavy precipitation, no darkness, no blinding sunlight
- Trustworthiness
  - Mechanisms to establish trust in the sender need to be implemented in the CAV to enable it to use the received information for safety critical driving functions like braking

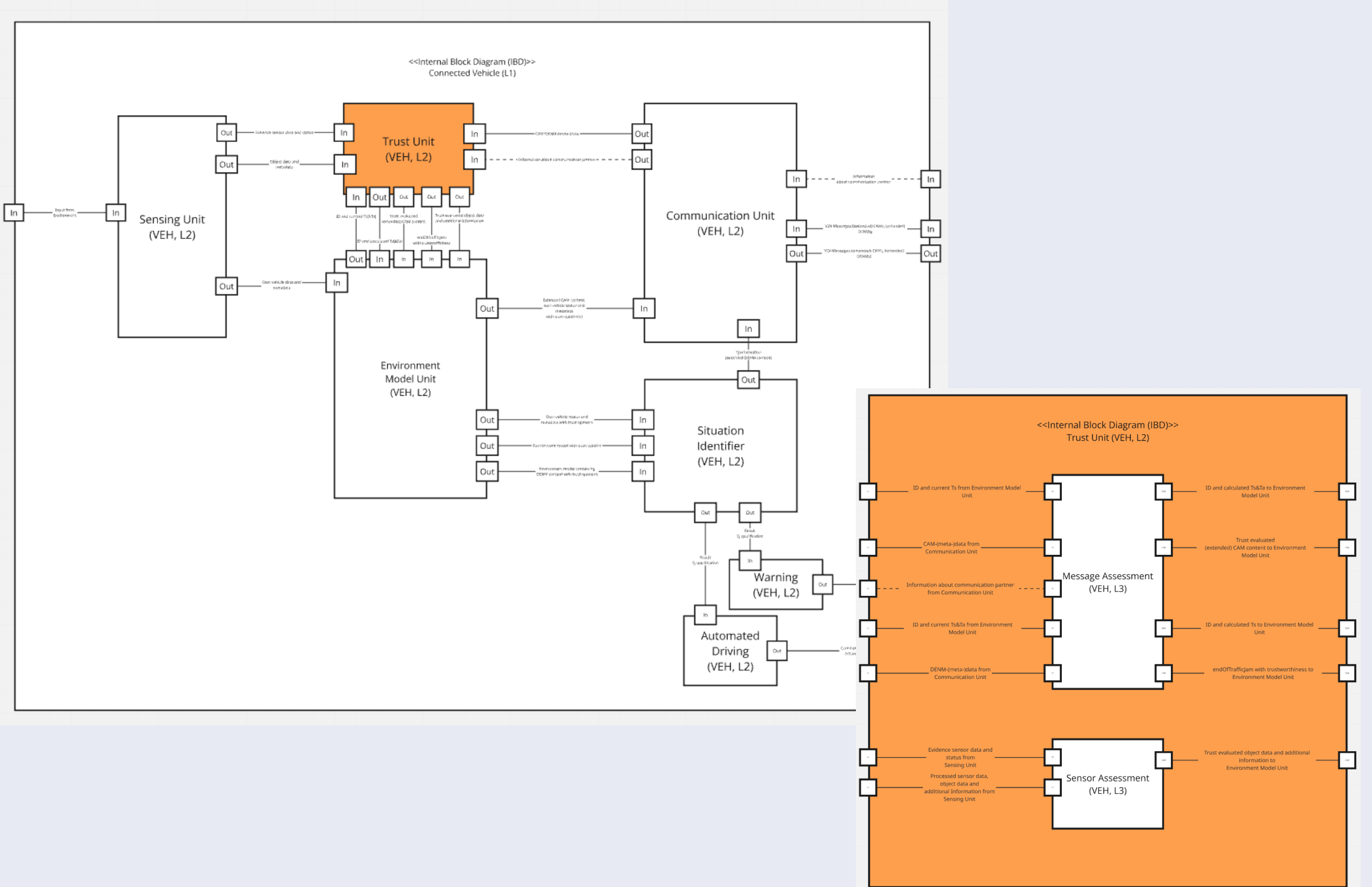


### Solution Approach

- The receiving CAV shall be able to calculate trustworthiness of the sender, or the information sent, using only CAMs and DENMs from this particular sender as external sources
- Certain information given will be checked for plausibility to obtain a trustworthiness of the sender, while given metadata is checked with respect to whether the data sent is trustworthy/useable → see also poster "Extension of CAM and DENM for UC2 – Plausibility Checks and Metadata Evaluation"
- Problem: a not trusted information could be discarded and ignored, not necessarily a good idea for warnings → degradation



### Architecture



- An additional "Trust Unit" is introduced as an agent between sensors/communication and the environmental model
- It assesses information coming from sensors and especially communication and provides outgoing information with trustworthiness
- See also poster "Reference Architecture"