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ConnRAD – Connectivity and Resilience for Automated Driving

ConnRAD
Connectivity & Resilience for automated Driving Functions in Germany

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UC1 – Safe Left Turn in Urban Intersections

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Use Case 1: V2X communication for cooperative, urban intersection functions

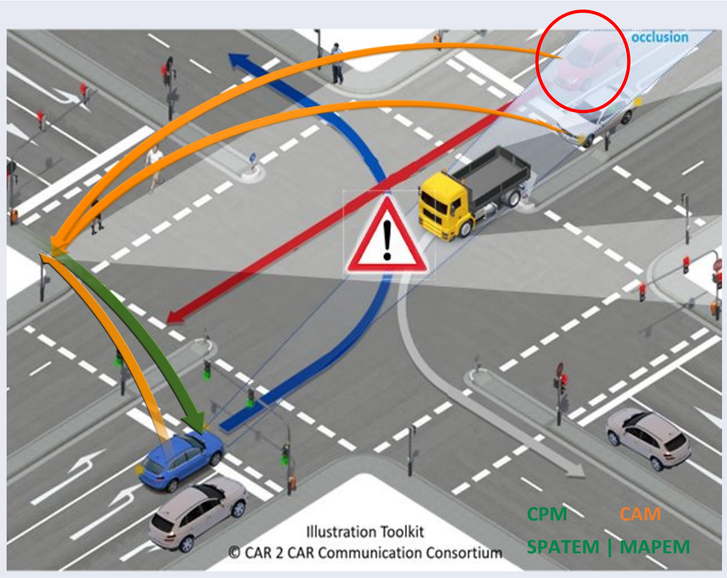
Communication: ETSI ITS-G5, C-V2X; Messages used: CPM, SPATEM & MAPEM, CAM
ODD: urban intersection with traffic lights; velocities up to 50 kph; other road users w/ or w/o V2X

Driving situation on intersection:

- The ego **vehicle** (blue) wants to **turn left.**
- The **view of the onboard sensors is occluded** by an obstacle (yellow truck), hiding the oncoming red vehicle.
- The only **safe maneuver** without V2X input would be to **wait** until the occlusion has gone. Even, when there is no oncoming conflicting traffic.

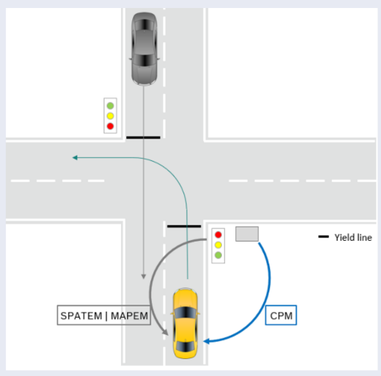
That means:

- The ego **vehicle** needs to **rely on external sensor information** to get a better environment model, so that the turn maneuver can be executed safely.
- **But**: The infrastructure is not built by or in cooperation with the OEM of the ego vehicle. Therefore, the **specification of external sensor is unknown**.



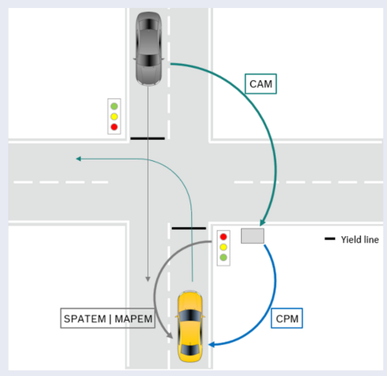
Solution Approach

- We focus on **3 options** for analyzing the trust, trust chain and trust from multiple sources **in concept**.
- We focus on **Option #1** for analyzing the trust into “no vehicle is oncoming” **in PoC**.
  - This information can only be provided in the CPM
  - CAM only gives us information about V2X equipped vehicles



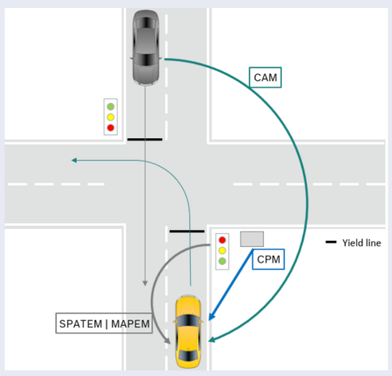
Option #1

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



Option #2

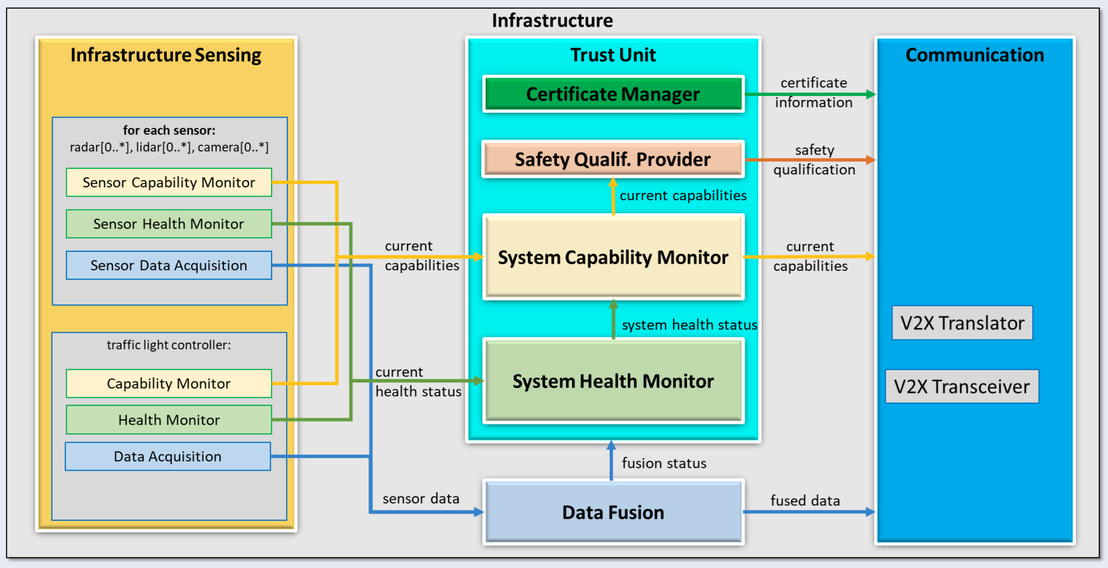
Analyze trust chain: The receiving EGO vehicle evaluates the trust in infrastructure's messages already containing trust into the messages from the other vehicles.



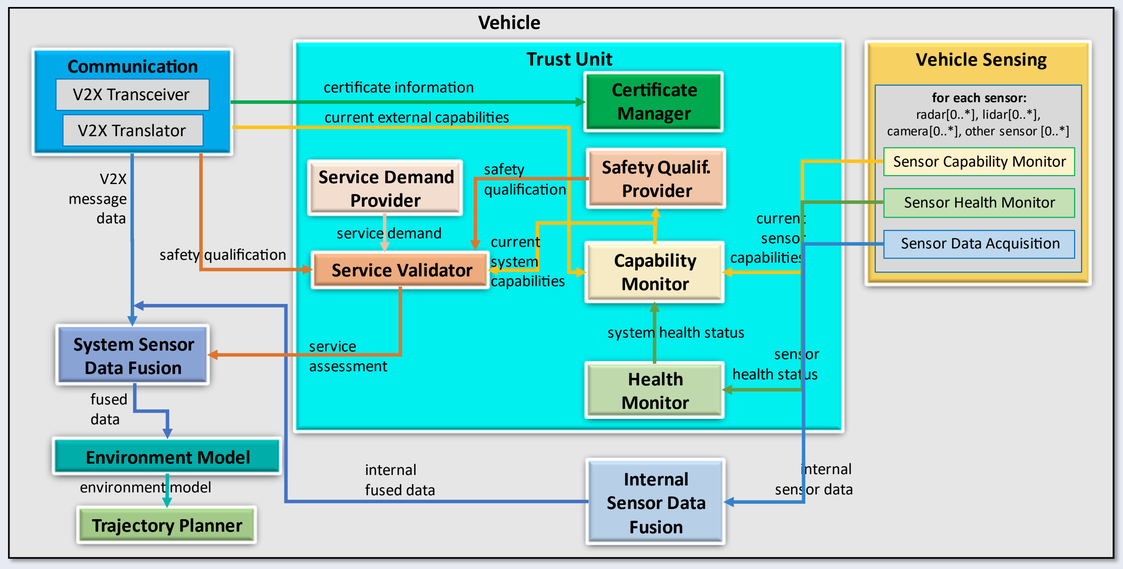
Option #3

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

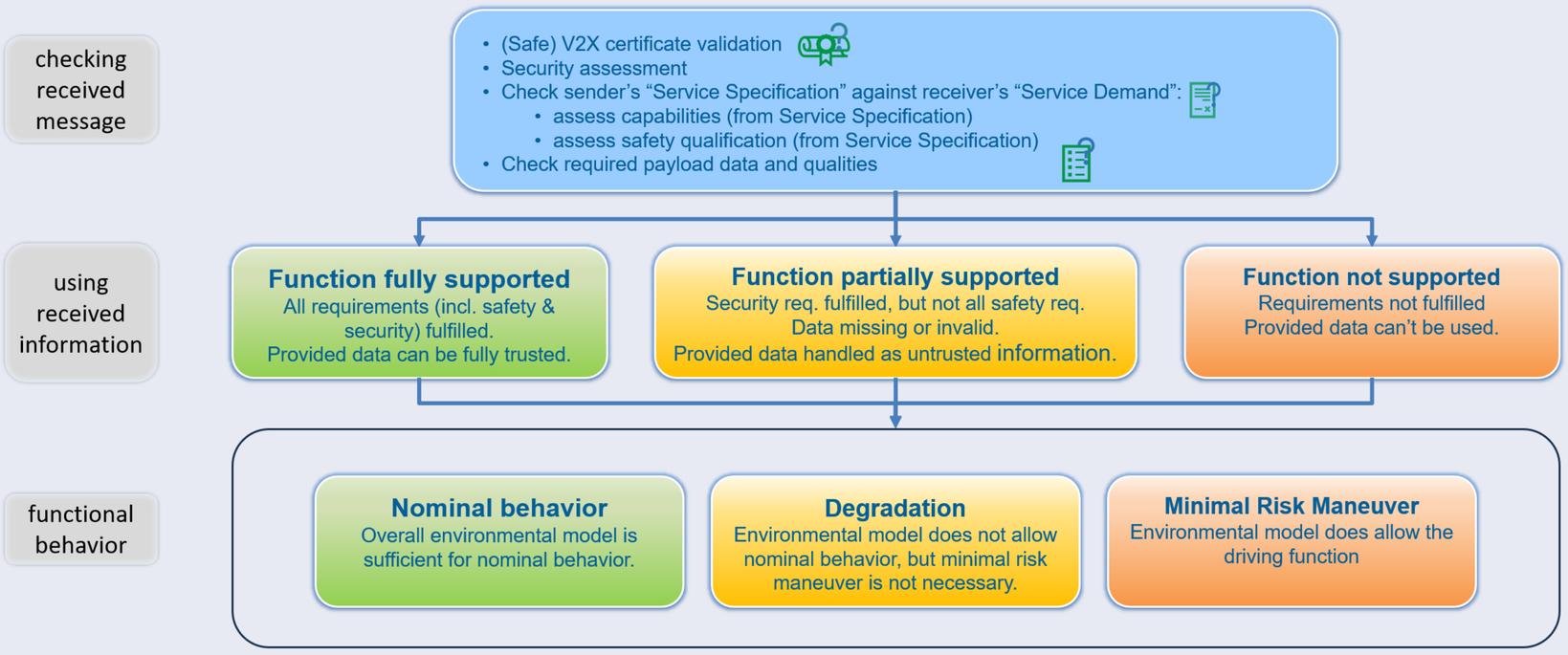
System Overview & Dataflow - Infrastructure



System Overview & Dataflow - Vehicle



Receiver Degradation Concept



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