C-ITS in Europe

SIP-adus Workshop 2022

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Purpose and Scope of the C2C-CC

- founded in 2002 by European vehicle manufacturers
- key player with high reputation in driving C-ITS developments and assisting to achieve vision zero at the earliest possible date
- enhancing road safety and traffic efficiency by means of Cooperative Intelligent Transport Systems and Services (C-ITS)
- clear focus on tactical level
  - wireless ad-hoc short-range vehicle-to-everything communication (V2X)
  - creating standards ensuring the interoperability and seamless evolution of cooperative systems and services spanning all vehicles classes, across borders and brands
- working with European and international standardisation organisations, e.g. ETSI and CEN but also IEEE, ISO and others
- evolved into one of the key players in preparing realistic C-ITS deployment strategies and next innovation phases towards cooperative automated driving
- establishing the necessary profiling of standards

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Cooperation with C-Roads

During the European ITS Congress 2017 at Strasbourg
the C2C-CC and C-Roads Platform signed a Cooperation Agreement
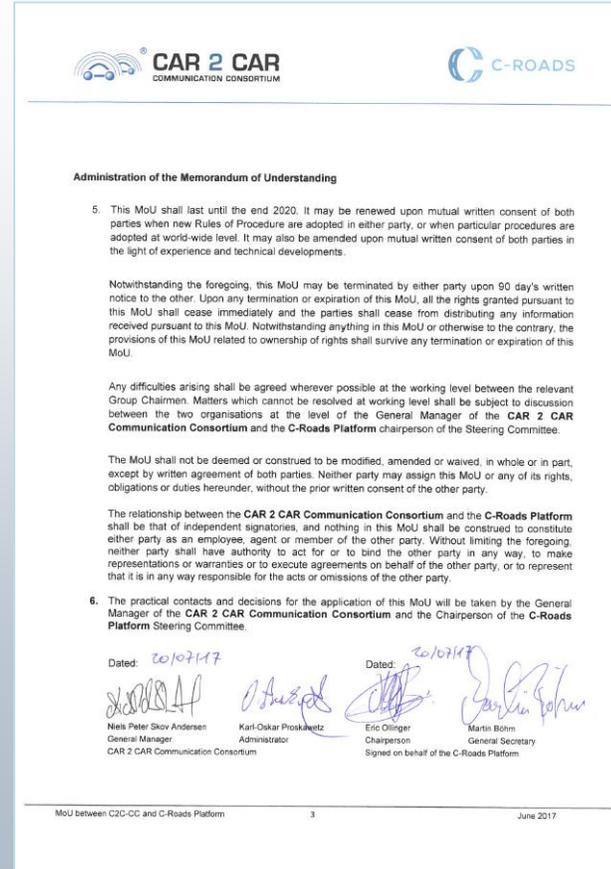
Key elements for the successful deployment of C-ITS

- Engaging with stakeholder about the ideas of cooperative road traffic, outstanding issues and road maps to C-ITS deployment

- close coordination with stakeholders for definition, interpretation and use of standards and system profiles – this to ensure interoperability across borders, road operators and brands

- Interoperability testing with deployment projects

- Focus on security framework

- initial Day 1 deployment started in 2019 – the VW Golf 8 was the first vehicle there as standard was equipped with Car-to-X communication other models have followed

- Definition of Day 2 and beyond is ongoing

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Generalised Automotive Communication Needs

- Tactical information
  - information related to proximity of vehicle, e.g. obstacles, cooperation with nearby vehicles for lane merging, C-ACC, Platooning, VRU protection, etc.
  - ad-hoc **short range**, low latency and high QoS
  - safety critical information – communication becomes part of functional safety (ISO 26262)

- Strategical information
  - information that allows planning ahead, e.g. route, maps, road conditions, traffic information etc.
  - **wide area coverage**, less constrains on latency and QoS

- Infotainment
  - other communication not directly related to the driving
  - **wide area coverage**

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Active Safety with CAR-2-CAR Communications
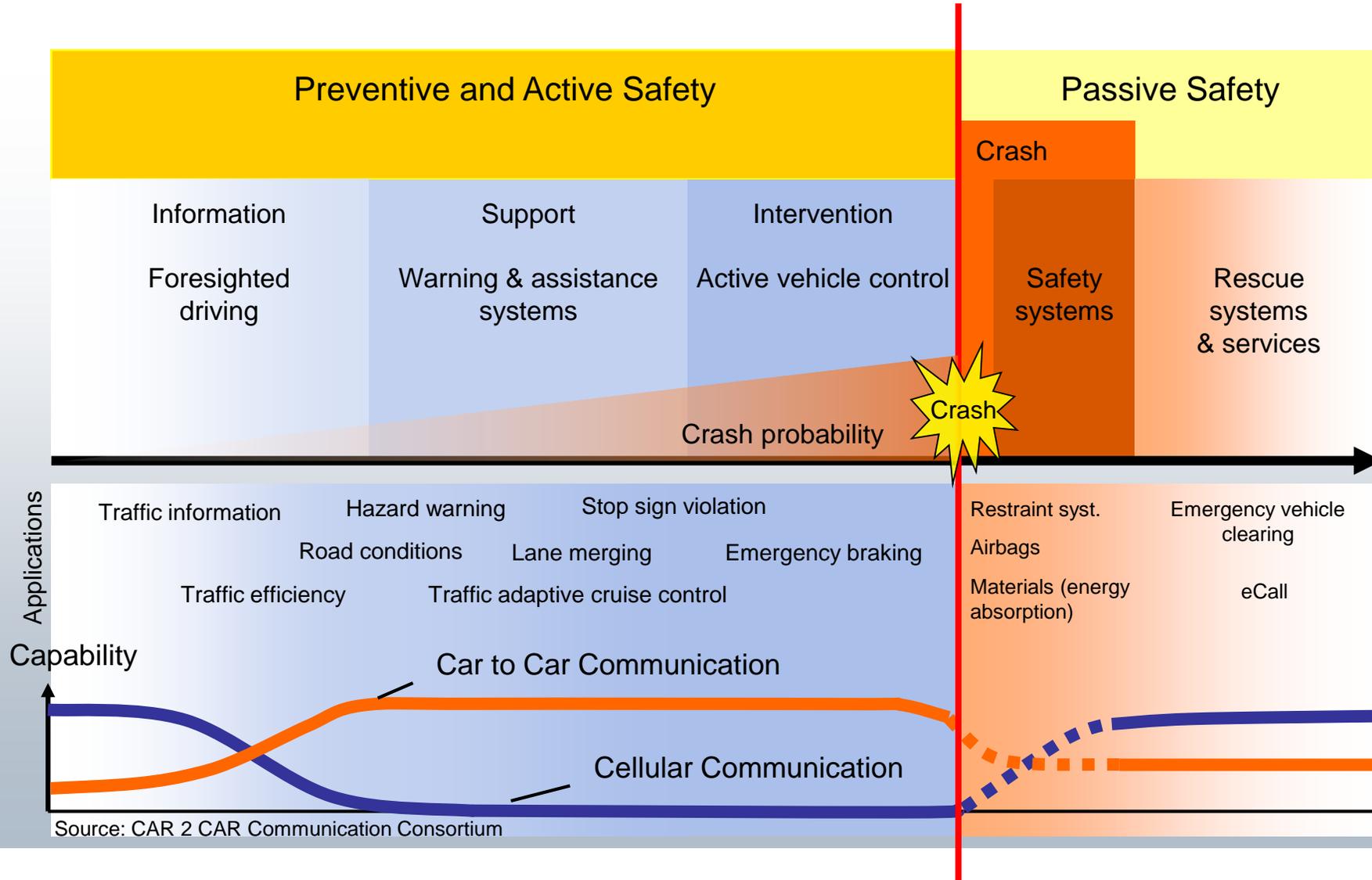
Source: CAR 2 CAR Communication Consortium

Day 1 Use Case Examples

Road Works Warning & Lane Change Indication

Assembling an EWZ - example

C-ROADS

zone #1 | zone #2 | zone #3 | zone #4 | zone #5 | zone #6 | zone #7 | zone #8 | zone #9 | zone #10 | zone #11 | zone #12 | zone #13 | zone #14

DENM #1
Lane closure

DENM #2
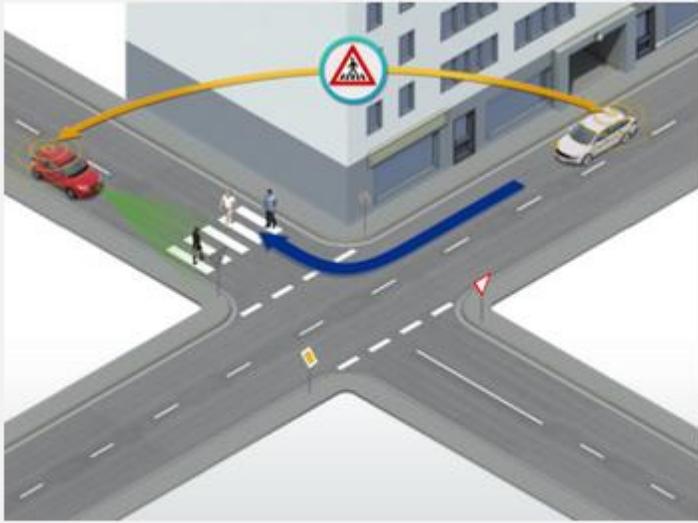Lane closure

Source: CAR 2 CAR Communication Consortium
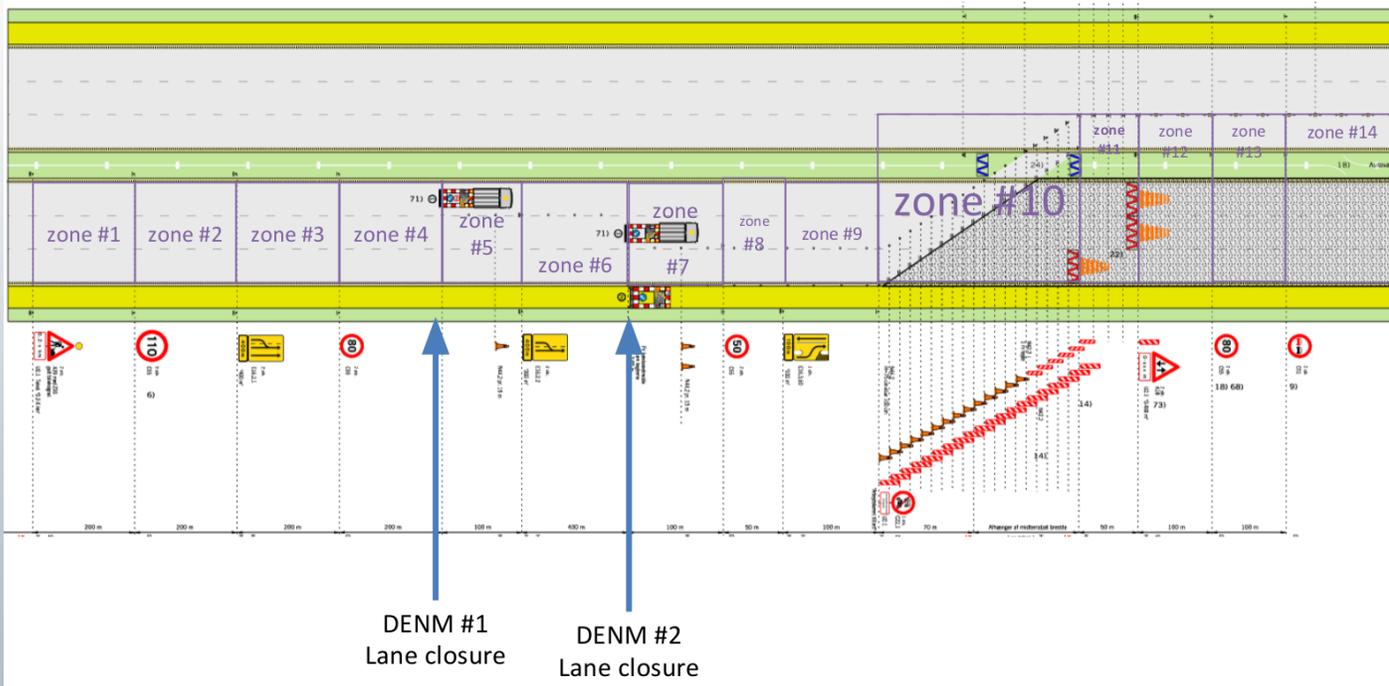
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Phases of Cooperative driving
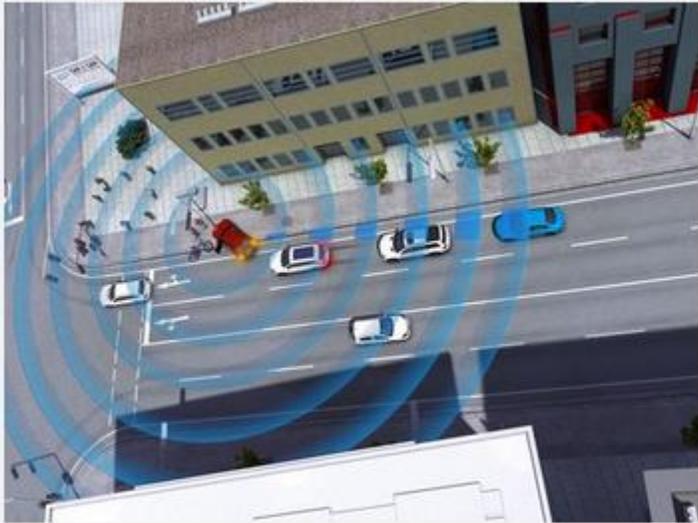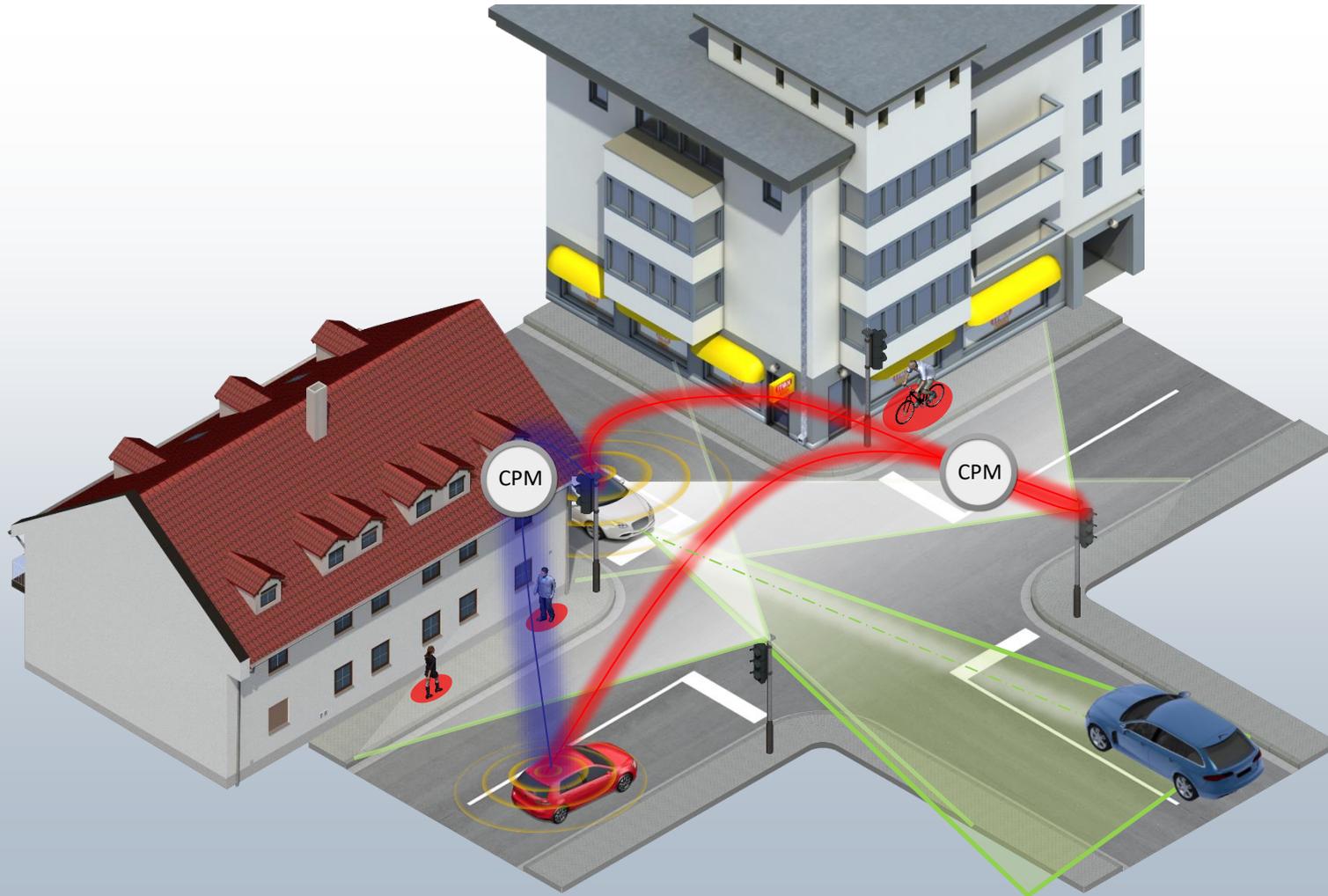

Awareness Driving

Sensing Driving

Cooperative Driving

Source: CAR 2 CAR Communication Consortium
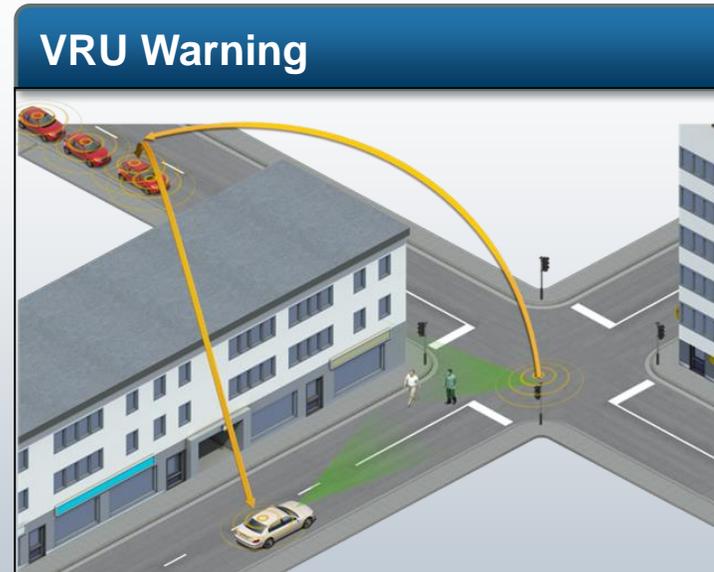
What is Collective Perception?

- Increase awareness by sharing information about locally detected objects

- Enables hidden line of sight applications by raising awareness also about non-connected road users (especially VRUs)

- Vehicle sensors and sensors mounted to infrastructure components can share information

- Collective Perception Service on ITS-S generates Collective Perception Message

- ETSI TR 103 562 published 2019

- Standardization activities now focus on ETSI TS 103 324 expected completed ultimo 2022

Day 2: Collective Perception

- Sharing abstract descriptions of objects detected by vehicle or infrastructure sensors
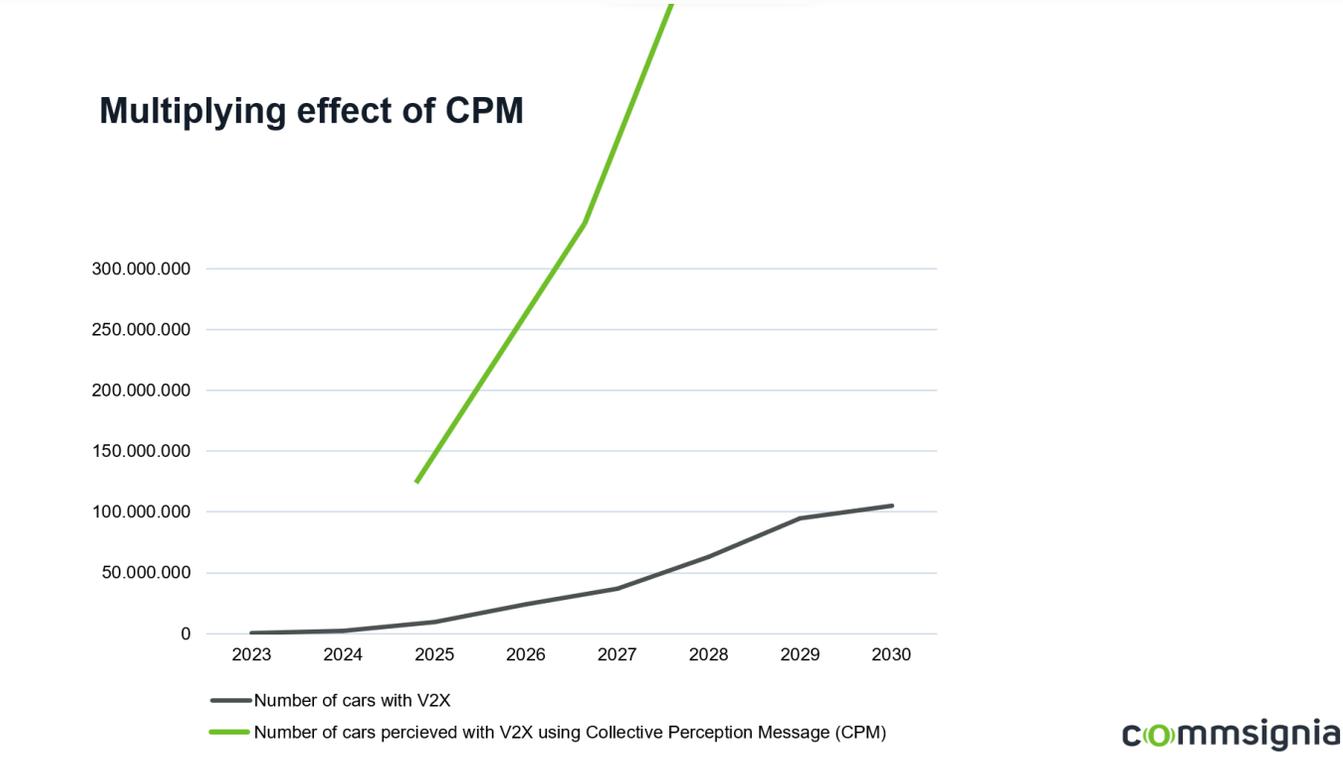- Creates improved awareness even with low C-ITS penetration

Overtaking Warning
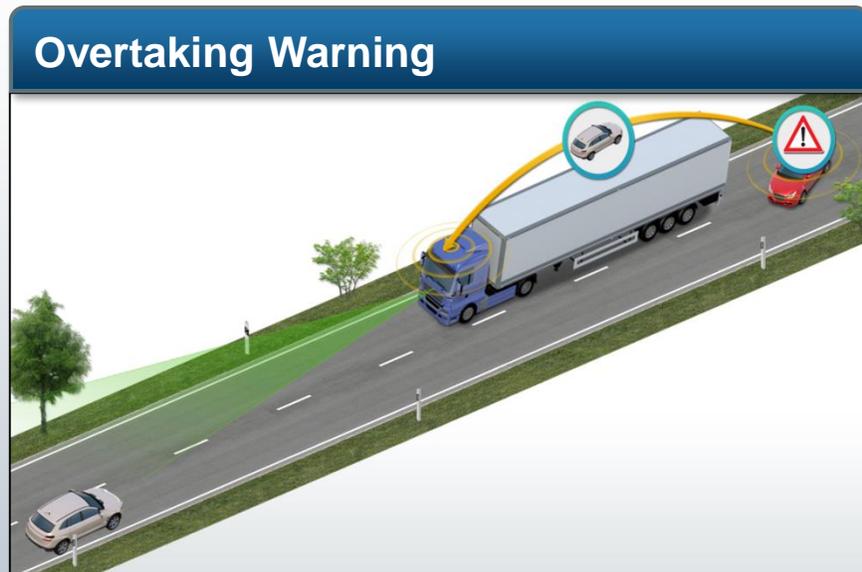
Overtaking car analyses the rx info and warn the driver if necessary

VRU Warning

Turning car analyses the rx info and warns the driver if necessary

Collective Perception

- V2X applications rely on awareness of other (connected) road users
- Collective perception improves V2X safety applications by making non connected road users (semi) connected

Multiplying effect of CPM

- Number of cars with V2X
- Number of cars percieved with V2X using Collective Perception Message (CPM)

commsignia

Day 3/4: Trajectory / Maneuver Sharing

- Sharing automated vehicles' intended maneuvers and trajectories
  Examples (from EU H2020 MAVEN project):

advanced C-ACC strings
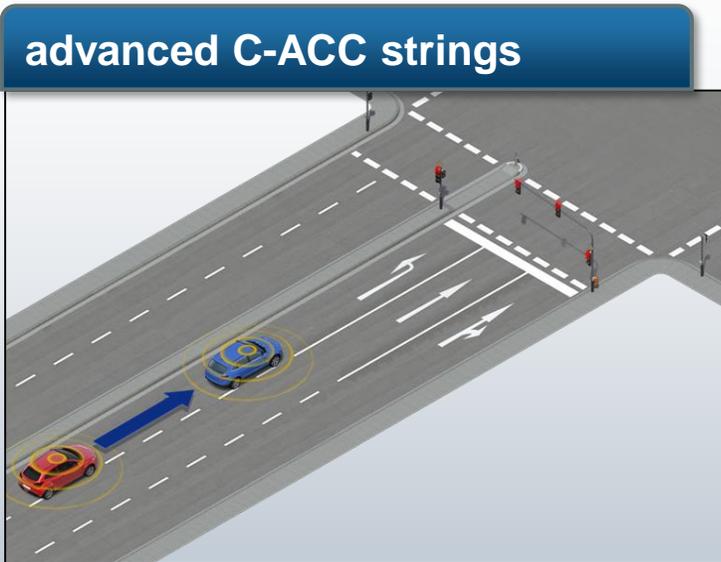
Based on intended maneuver at next intersection, vehicles assess the convenience of building small strings, and keep them using exchanged trajectory for lateral control

Traffic light info optimization
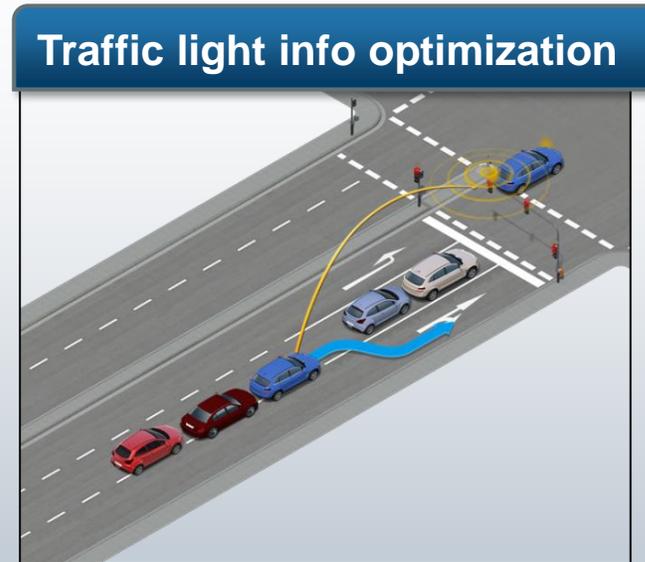
Based on rx intended maneuver at intersection, infra calculates and suggests optimisation info such as lane-specific GLOSA or lane change advices

Day 3/4: Coordination / Negotiation Sharing

- Enabling V2V and I2V interaction for coordinated maneuver execution
- Examples (from German IMAGinE and EU H2020 TransAID projects)

Cooperative Merging on Highways

Based on notification of intended merging, interested vehicles exchange info to coordinate gap opening and merging maneuvers with increased time spans

I2V assisted- cooperative merging

Infra suggest info to coordinate right of way in a way to optimise the overall traffic flow
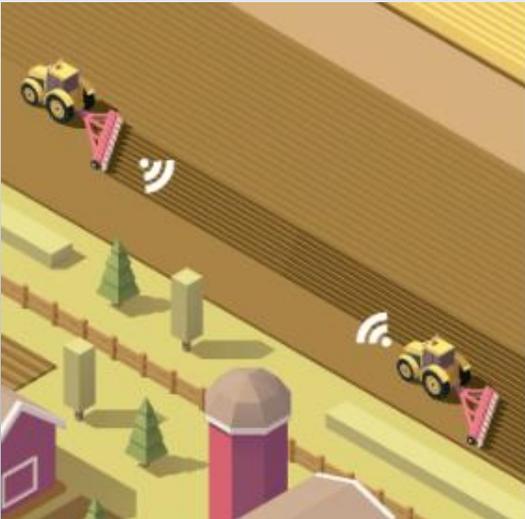
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C2C-CC Roadmap
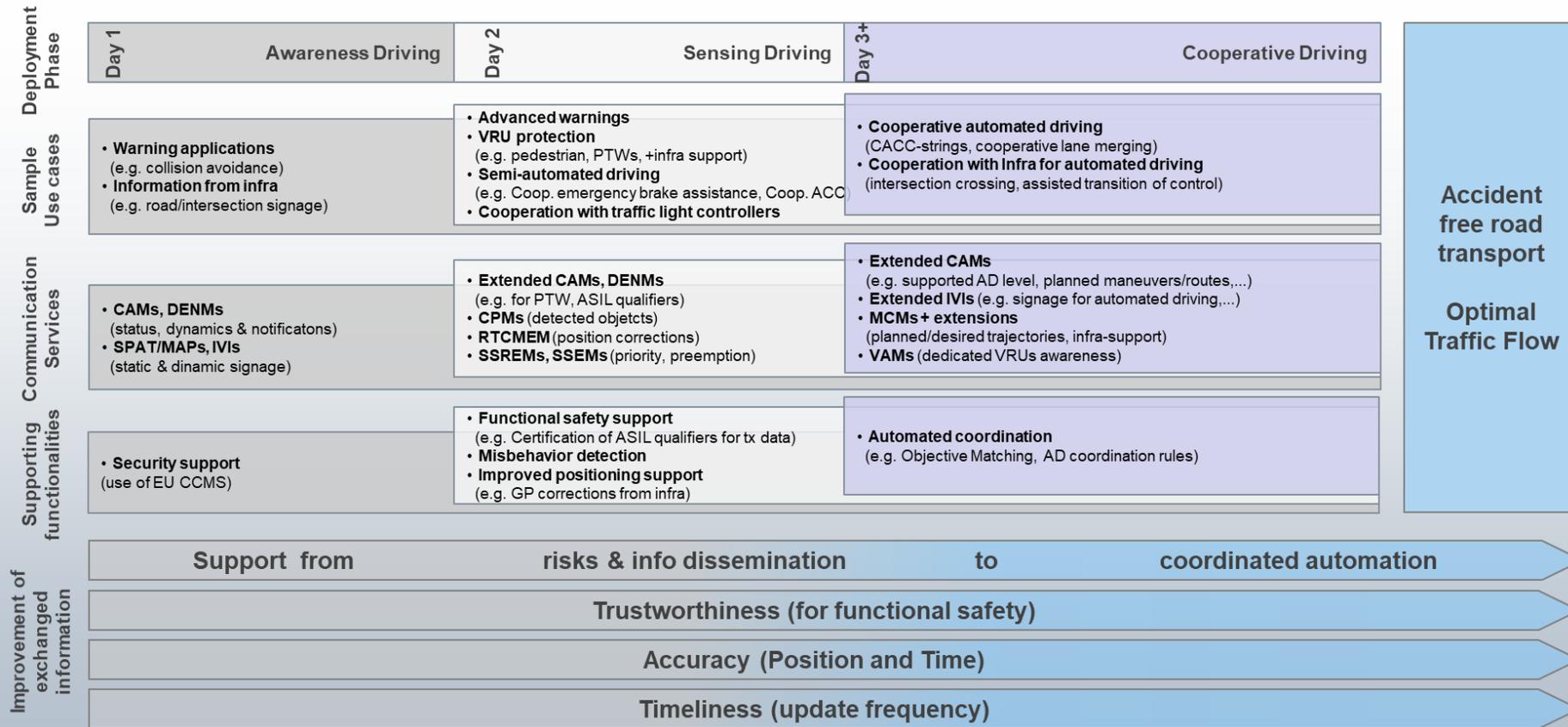
C-ITS beyond the road

- C-ITS is more than road safety – CAR 2 CAR Communication Consortium is engaging with other sectors to obtain synergies - one example is the agriculture domain

Process data exchange

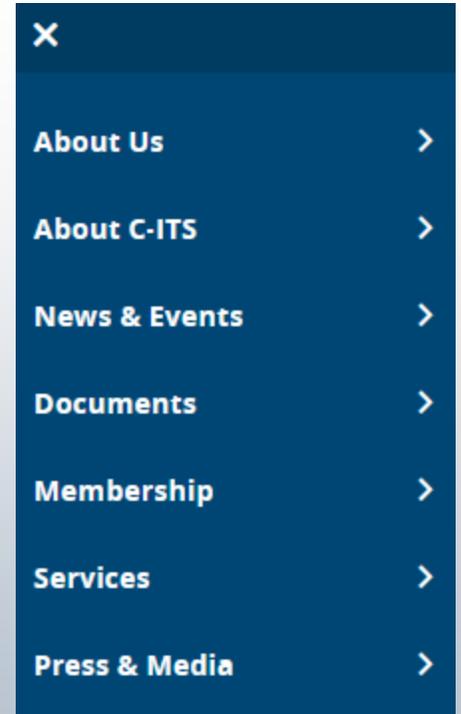**Cooperative machines Platooning**

Road safety

C-ITS - The Challenge of Life Cycles

- Advantages of a common platform
    - could make it easier to get spectrum access and capacity
    - allows to benefit from economies of scale
    - allows to increase safety in cross 'sector' accident cases
    - allows for cross sector use cases that integrate and optimise the multi-modal transport
- But adds new challenges - Is the expected life time the same?

C2C-CC Documentation

○ released documents are published on the C2C-CC website
www.car-2-car.org

- **Basic System Profile**
https://www.car-2-car.org/documents/basic-system-profile/

- **White Papers and Position Papers**
https://www.car-2-car.org/documents/general-documents/?L=-1

- **Other Documents**
https://www.car-2-car.org/documents/publications/

- **Press & Media**
https://www.car-2-car.org/press-media/

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Day 1 - Basic System Profile

- Basic System Profile
latest version 1.6.2 published in July 2022
https://www.car-2-car.org/documents/basic-system-profile/

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