

VOLKSWAGEN

AKTIENGESELLSCHAFT



Car-2-Car Communication Consortium, Applications Working Group – Current Status

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19.11.2006



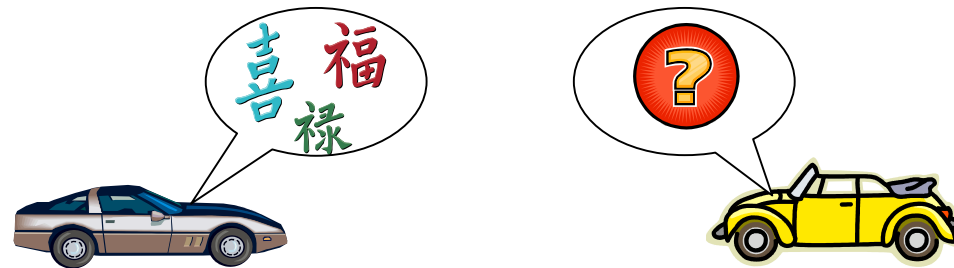
CAR 2 CAR
COMMUNICATION CONSORTIUM

Who we are...

- Composition:
 - Group of 44 people
 - $\approx 50\%$ working for OEMs
 - WG speaker: Cornelius Menig, Audi
- Meetings:
 - First meeting in 2004
 - Frequency: \approx every 2 months
 - Last meetings: ≈ 20 Attendees



What we do...



Goal: **Interoperability of implementations** of V2X-C use cases

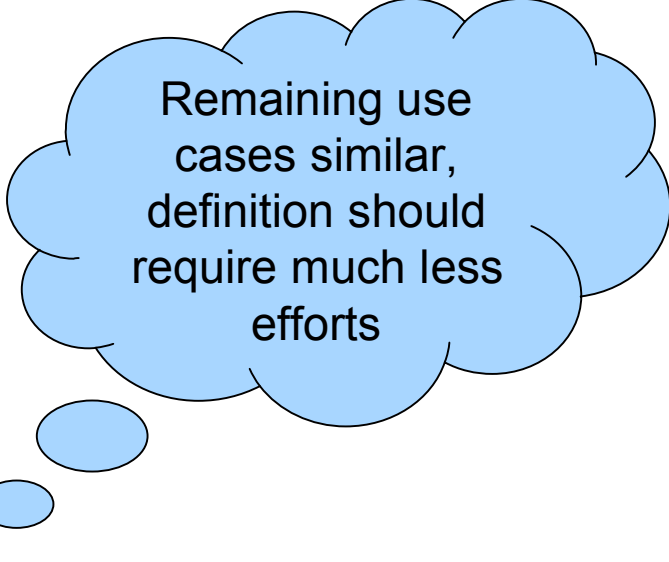
- Define use cases completely and unambiguously
- ⇒ Use case implemented by A can interact with same use case implemented by B
- Work Results consolidated regularly in the **Application Document**

Progress

- Defined six types of **V2X**-communication
- Researched possible use cases for these

⇒ List of \approx 120 use cases

- Closer consideration revealed **47** different use cases
- Current task : For each type of communication define **a few** use cases in **full detail**



Remaining use cases similar, definition should require much less efforts

Some terms we agreed on

- Six Types of communication (excerpt)
 - Vehicle-to-Vehicle Cooperative Awareness
 - Vehicle-to-Vehicle Unicast Exchange
 - Infrastructure to Vehicle
- Use of the above ways of communication (excerpt)
 - V2V Merging Assistance
 - V2V Intersection Collision Warning
 - Green Light Optimal Speed Advisory

„Applications“

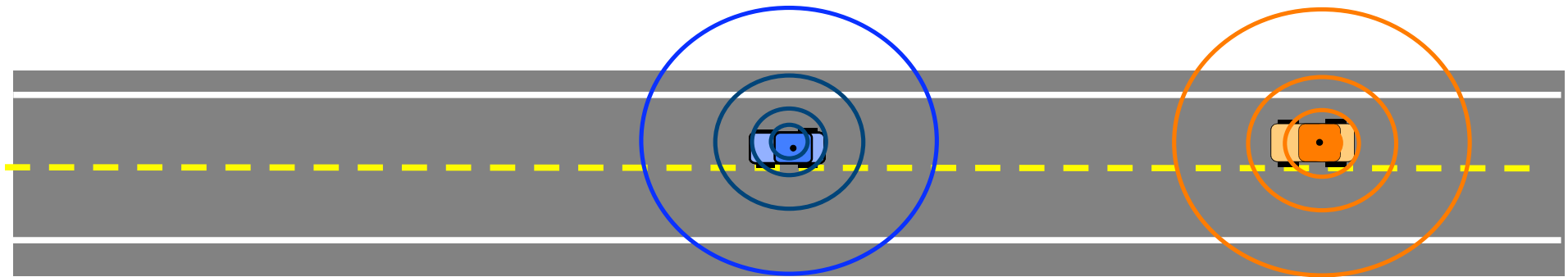
„Use Cases“

Structure of Application Document (work in progress)

- Introduction
- Methodology (Definition of terms, etc.)
- Applications
- Use Cases
- Appendix (Glossary, Common Message Elements, etc.)

Vehicle-to-Vehicle Cooperative Awareness

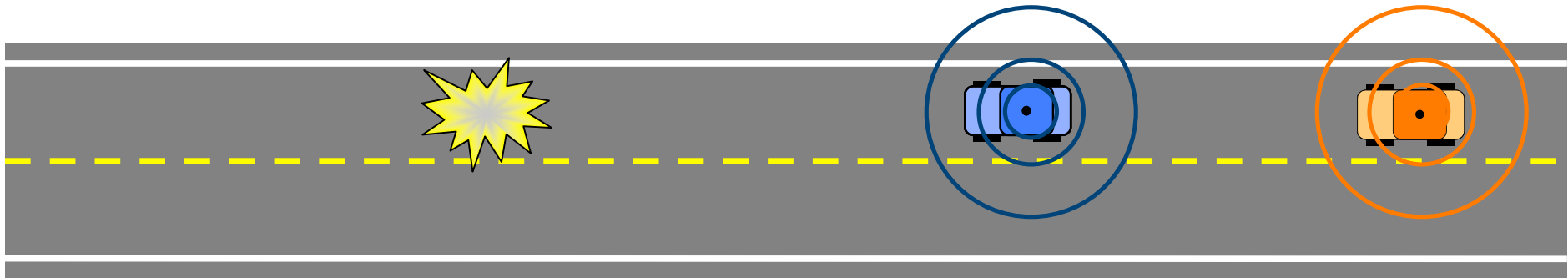
Picture by
Chris Kellum,
Opel



- Broadcast communication
- Sample use cases: Forward Collision Warning, Intersection Collision Warning

Vehicle-to-Vehicle Unicast Exchange

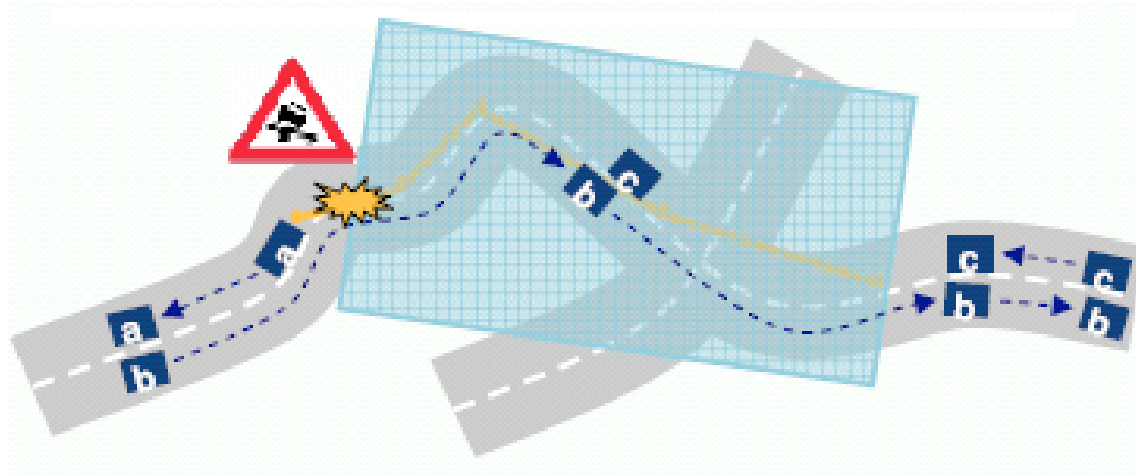
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- Connection between two cars is established
- Sample use case: Pre-Crash Sensing

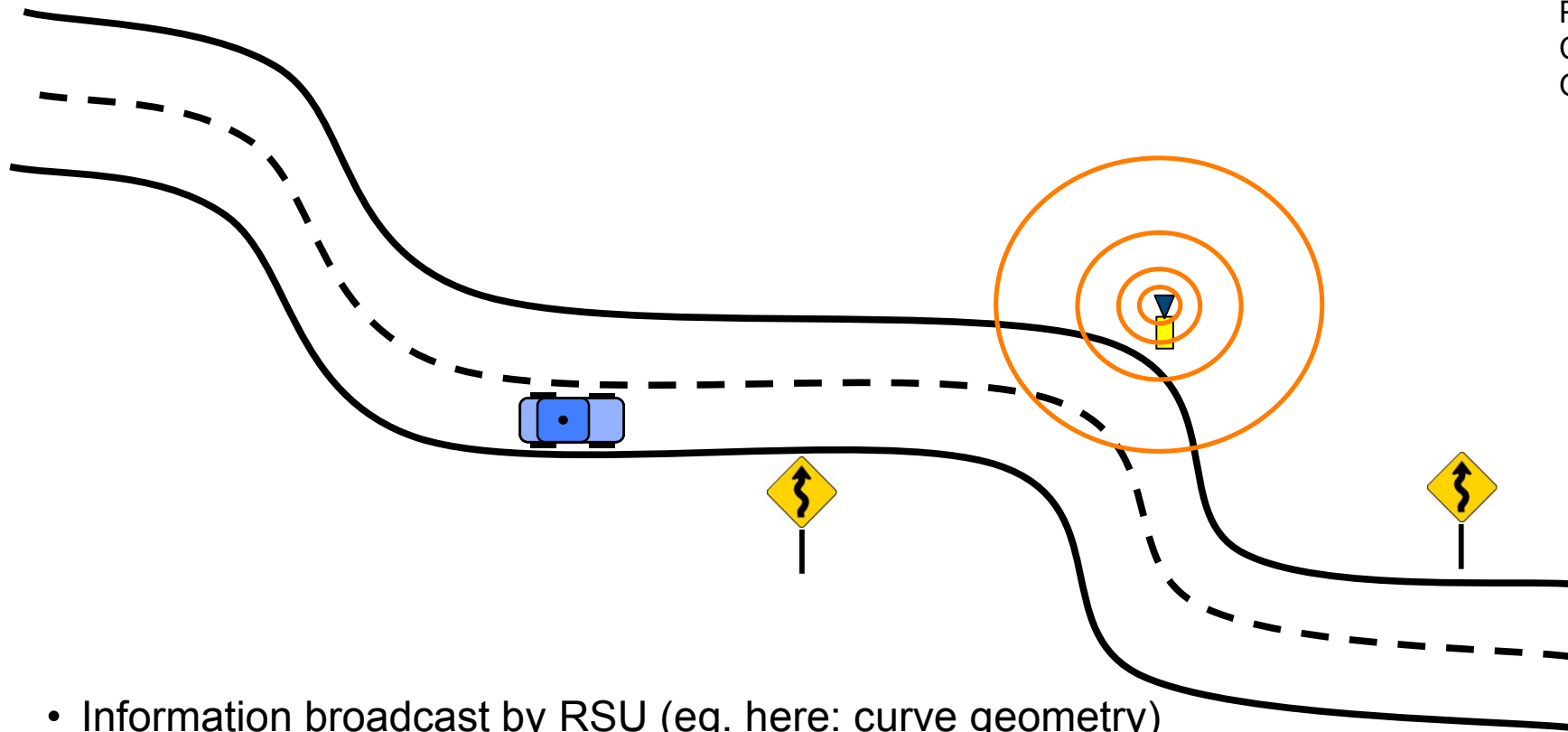
Vehicle-to-Vehicle Decentralized Environmental Notification

Picture by
Andreas Hiller,
DaimlerChrysler



- Sharing and extending roadway information => extended floating car data
- Information is kept in and near that area; RSUs can aid application
- Sample use cases: Road Condition Warning, Post Crash Warning, Incident Detection

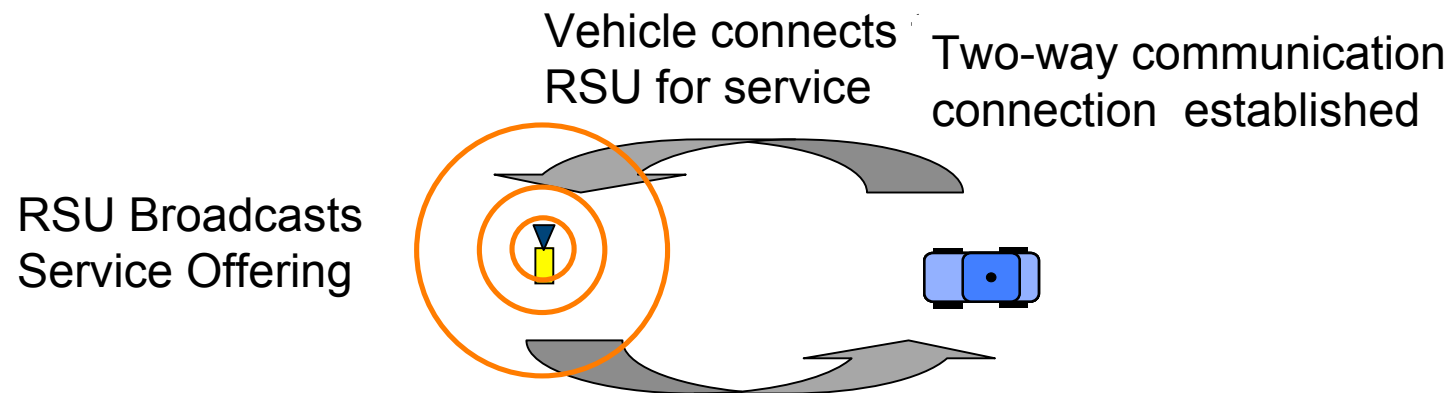
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- Information broadcast by RSU (eg. here: curve geometry)
- Sample use cases: Curve Speed Warning, Location-based Advertising

Local Roadside Unit Connection

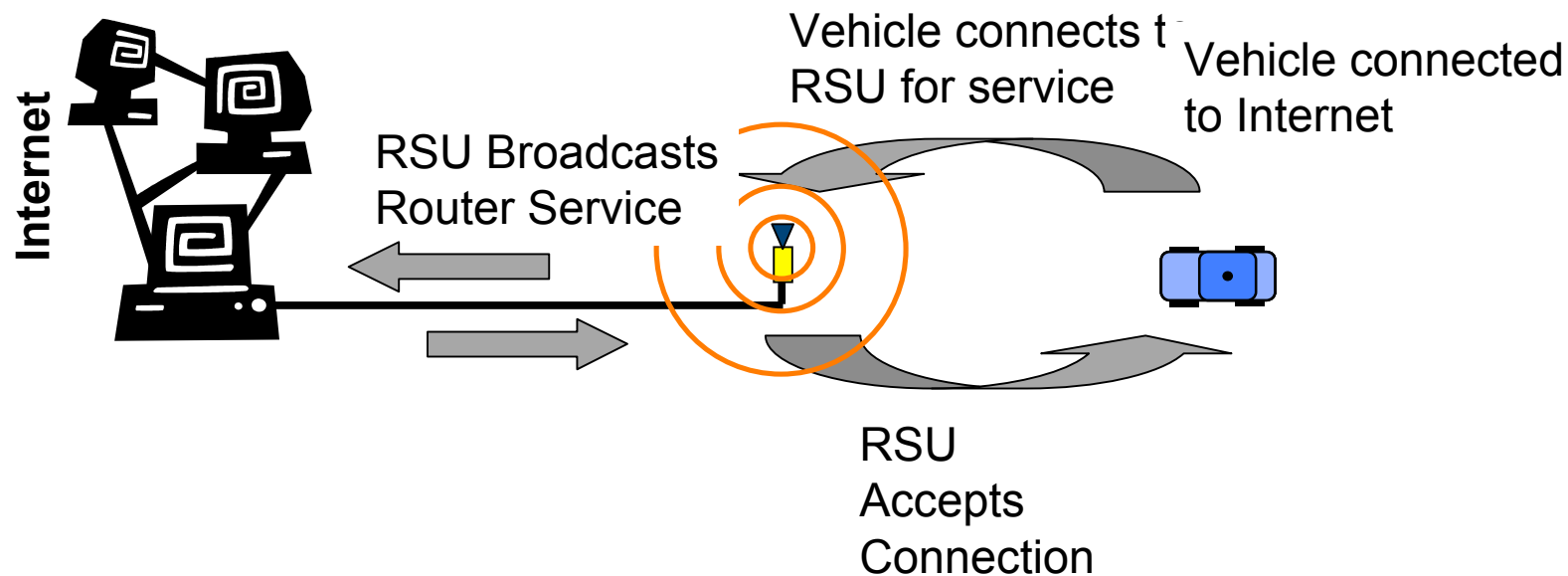
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- Trusted connection between RSU and Vehicle
- Sample use cases: Free-Flow Tolling, Drive-Thru Payment, Software Updates

Internet Protocol Roadside Unit Connection

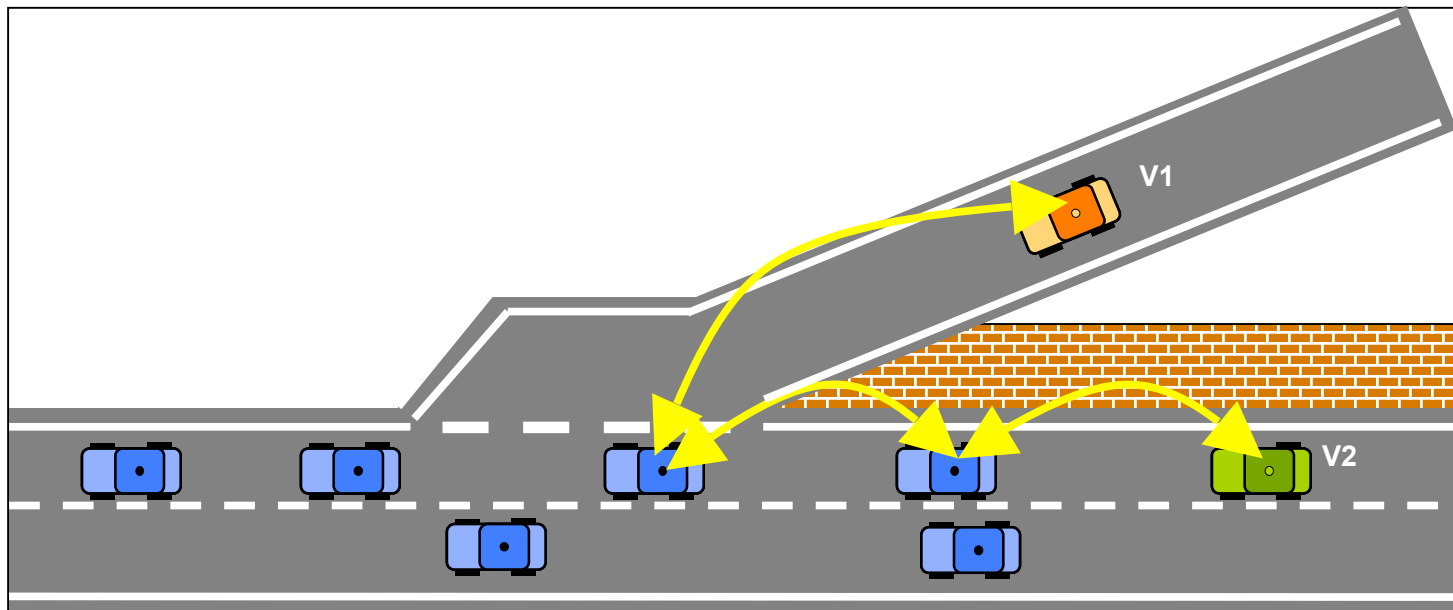
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- Two-way connection with proper routing of IP packets
- Use case: Whatever the internet has to offer...

Some sample use cases... V2V Merging Assistance

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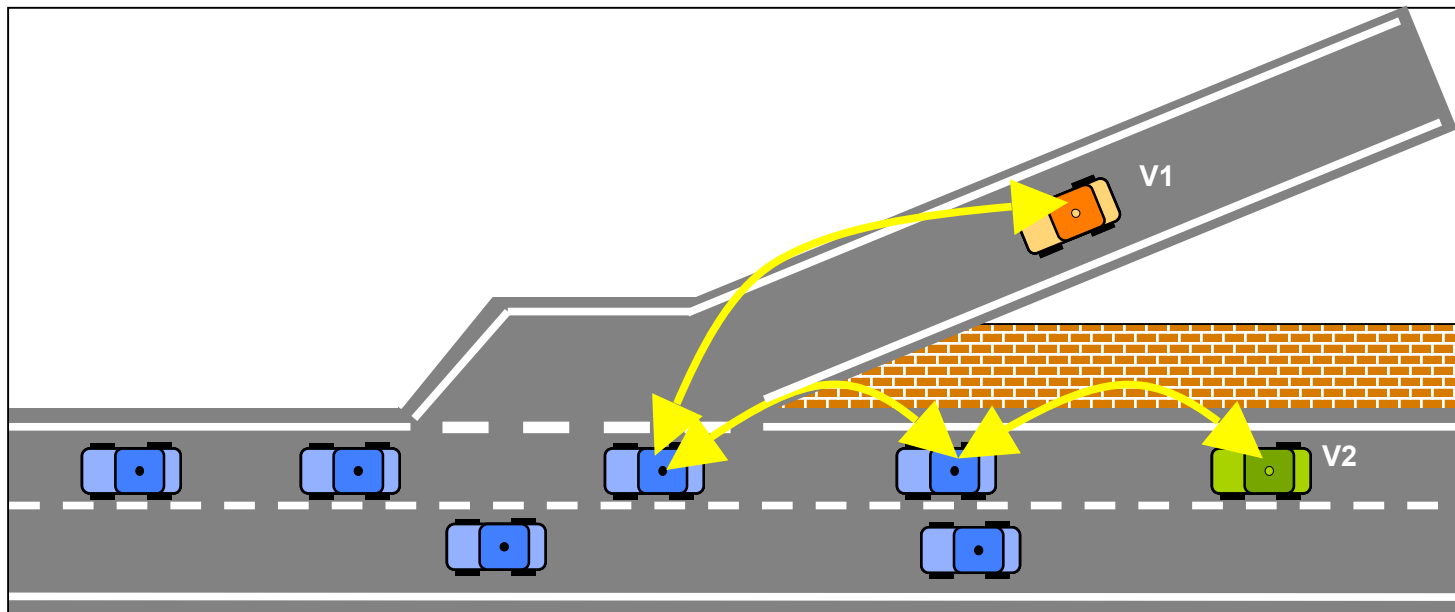


4.1 ID 3031: V2V Merging Assistance

Application:	V2V Unicast Exchange	Primary scenery:	Freeway
Time Criticality:	high	Security Critical:	high
Safety Relation:	high	Traffic Flow Relation:	high

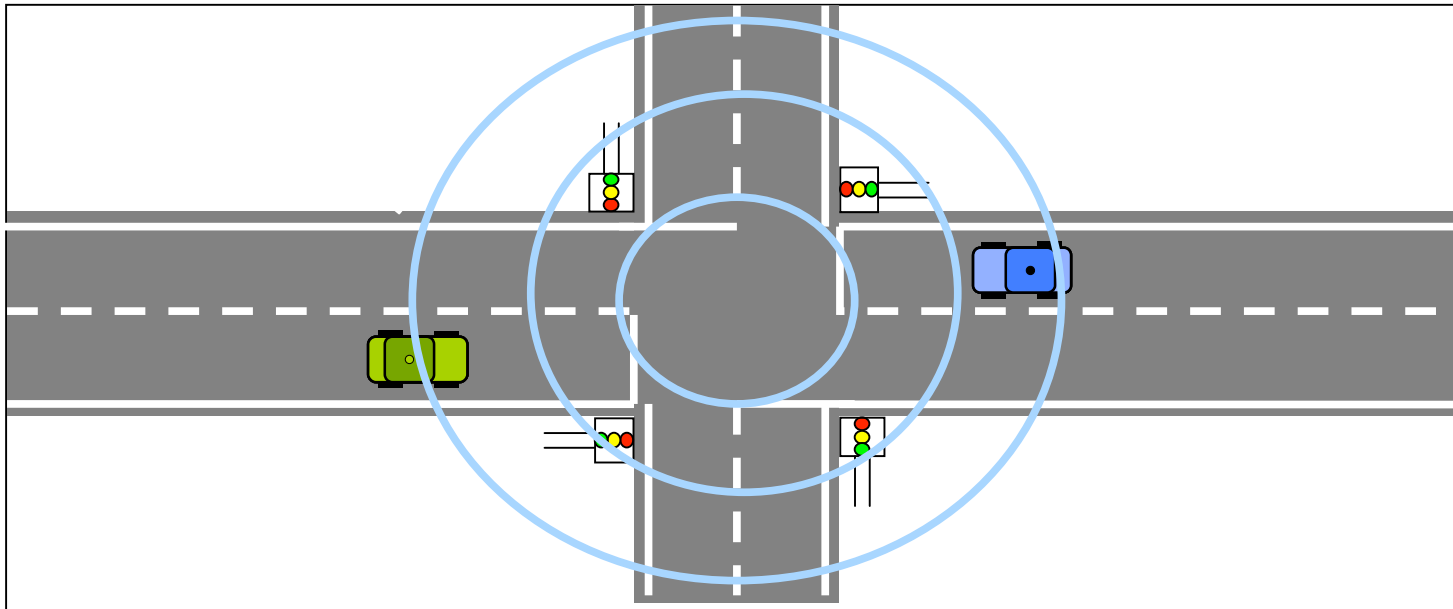
Some sample use cases... V2V Merging Assistance

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- Actors: V1, V2
- Communication phases: Discovery, Connection, Maintenance, Closure
- Required information: IDs, Positions, Speeds, Headings, Acc. Lane Geography

Some sample use cases: Green Light Optimal Speed Advisory

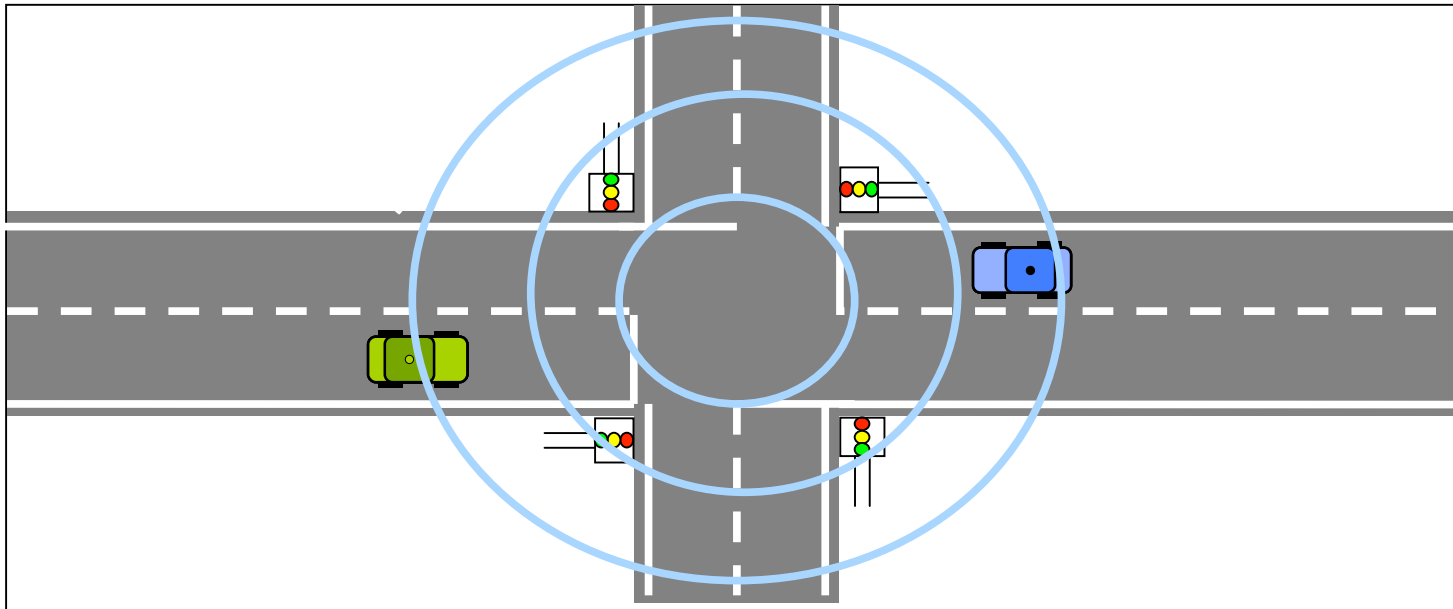


4.2 ID 6150: Green light optimal speed advisory

Application:	Infrastructure to Vehicle (one way)	Primary scenery:	Intersection
Time Criticality:	some what	Security Critical:	some what
Safety Relation:	none	Traffic Flow Relation:	high

Linked to:	[3010] Traffic Signal Violation Warning
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Some sample use cases: Green Light Optimal Speed Advisory



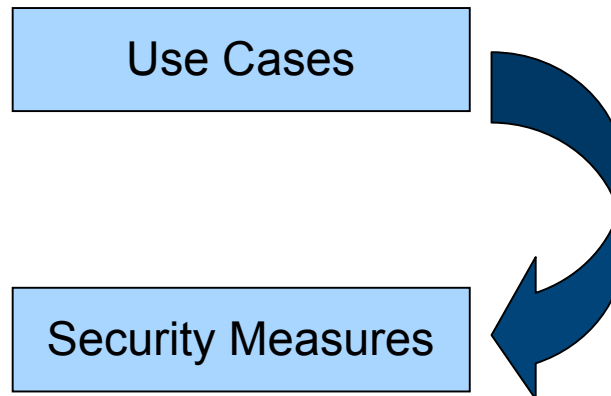
- Actors: Traffic Light
- Communication: Traffic Light periodically broadcasting phase schedule
- Required information: Phase schedule for each holding line, Speed limit

Current status...

- Elaboration of communication mechanisms for selected use cases for each application
 - Message formats, down to bit level
 - Message sequences, leading to exact timing requirements
- „Template“ for definition of a use case is slowly evolving
- Security considerations so far:
 - Rough classification of use case in terms of security criticality

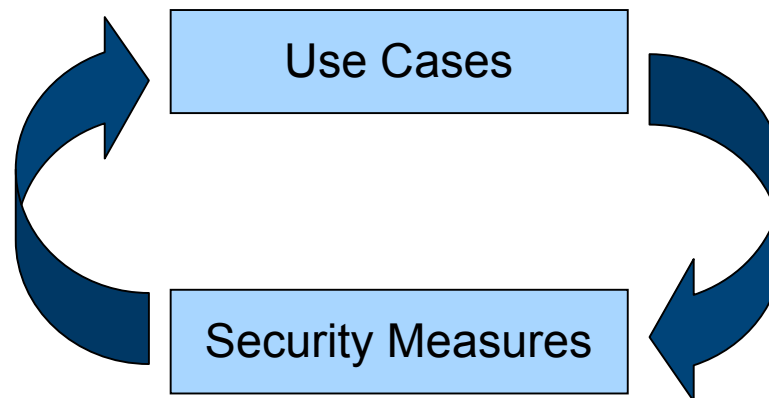
Conclusion

- Current use cases for V2X-Communication have been identified
- Specification of use cases not yet done in required level of detail for implementation
- Use cases are roughly classified in terms of security criticality
- Use cases drive the security requirements of the system



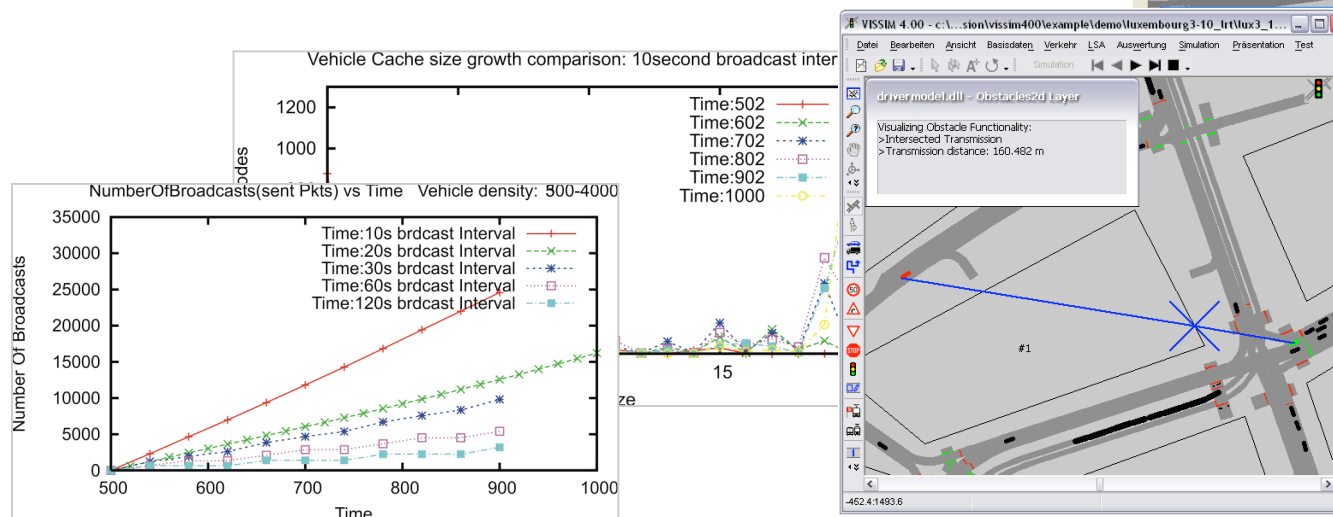
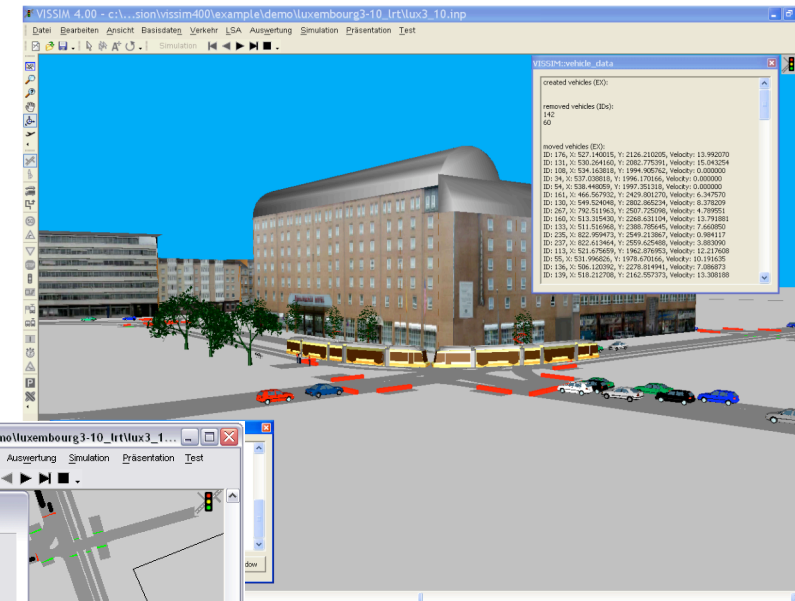
Questions

- How are security implications affecting the feasibility of use cases we defined?
- Can SEC WG adopt the defined structure of applications and use cases and define matching security measures?
- How should cooperation between SEC and APP look like?



Workshop on Simulation of V2X-Communication

- Organization: WG APP, support by COMeSafety
- No details defined yet
- Possible participation by WG SEC / SEVECOM?



Backup Slide: Applications and Use Cases

