Transition Areas for Infrastructure-Assisted Driving

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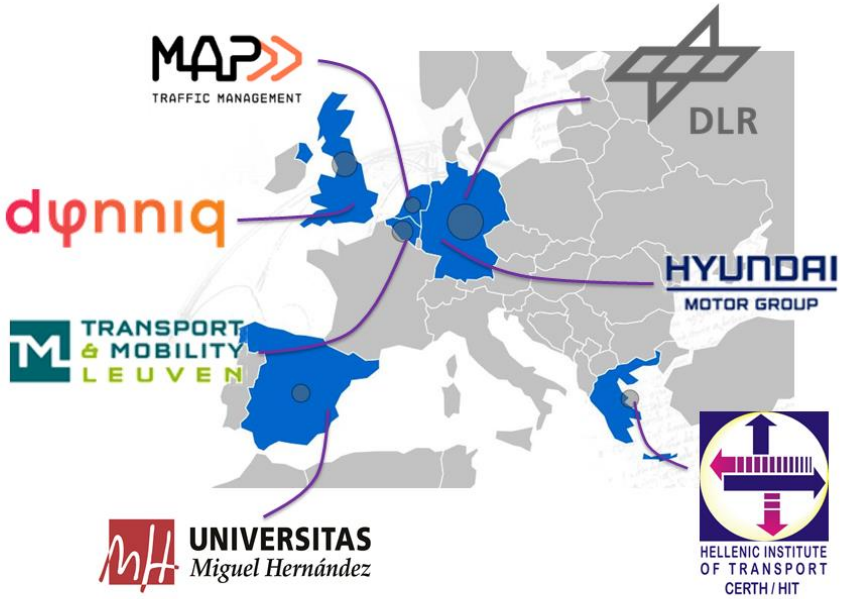
Some general information

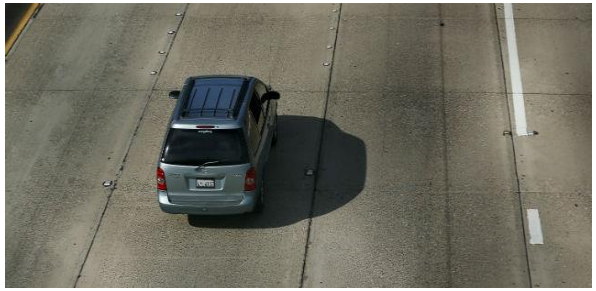
- About the EC call:
  - Horizon 2020 ART-05-2016 (Automated Road Transport)
  - Grant Agreement Nr.: 723390

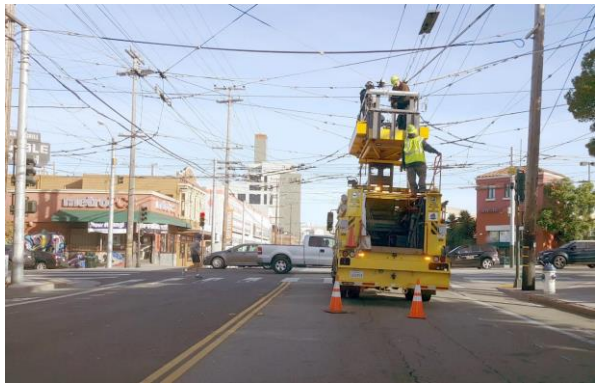
- About the project:
  - Duration: 36 months
  - Start date: September 2017
  - Total budget: 3.8 M€
  - Consortium: 7 partners from 6 European countries
    - ICT infrastructure providers
    - Automotive industry
    - Academia
  - 12 associated partners



What if…

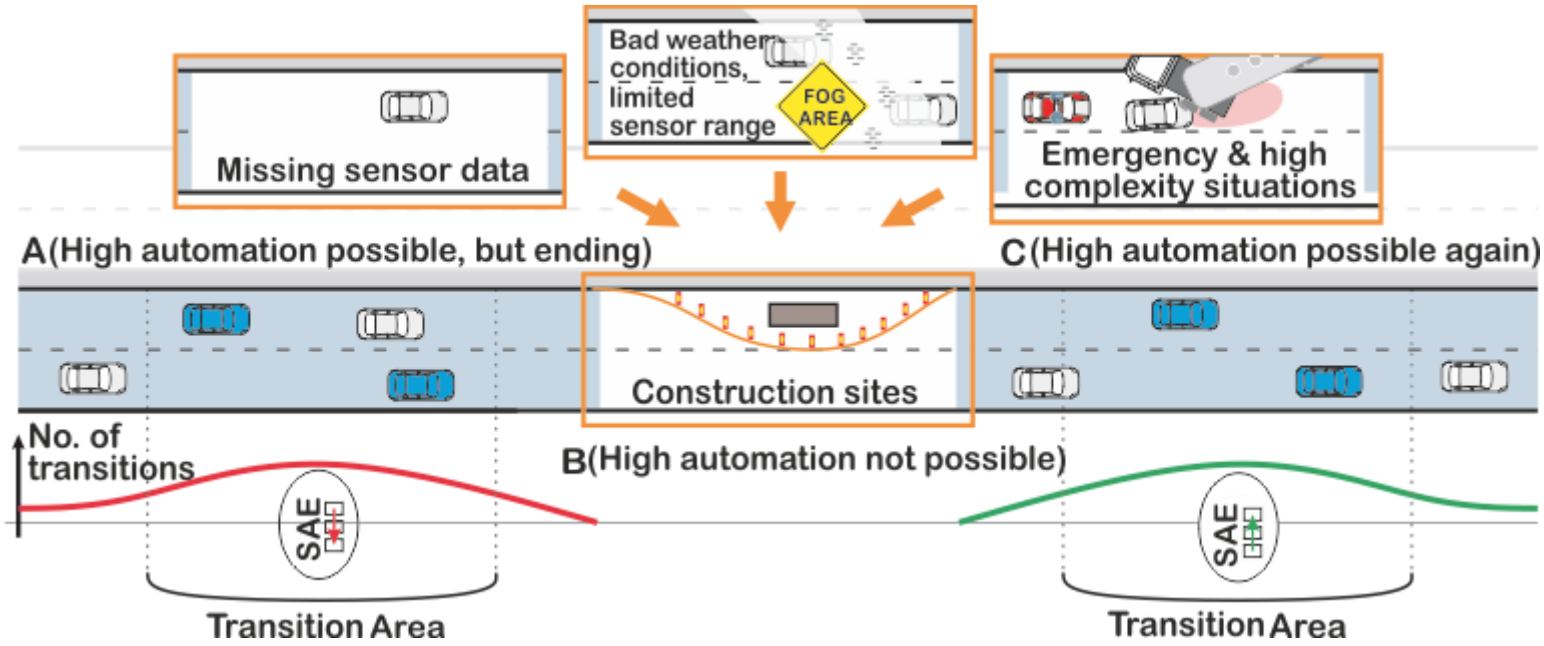
- …your automated vehicle is not able to solve the situation ahead?


- …this happens not to single vehicles only, but to several?
- …it always happens at the same location?

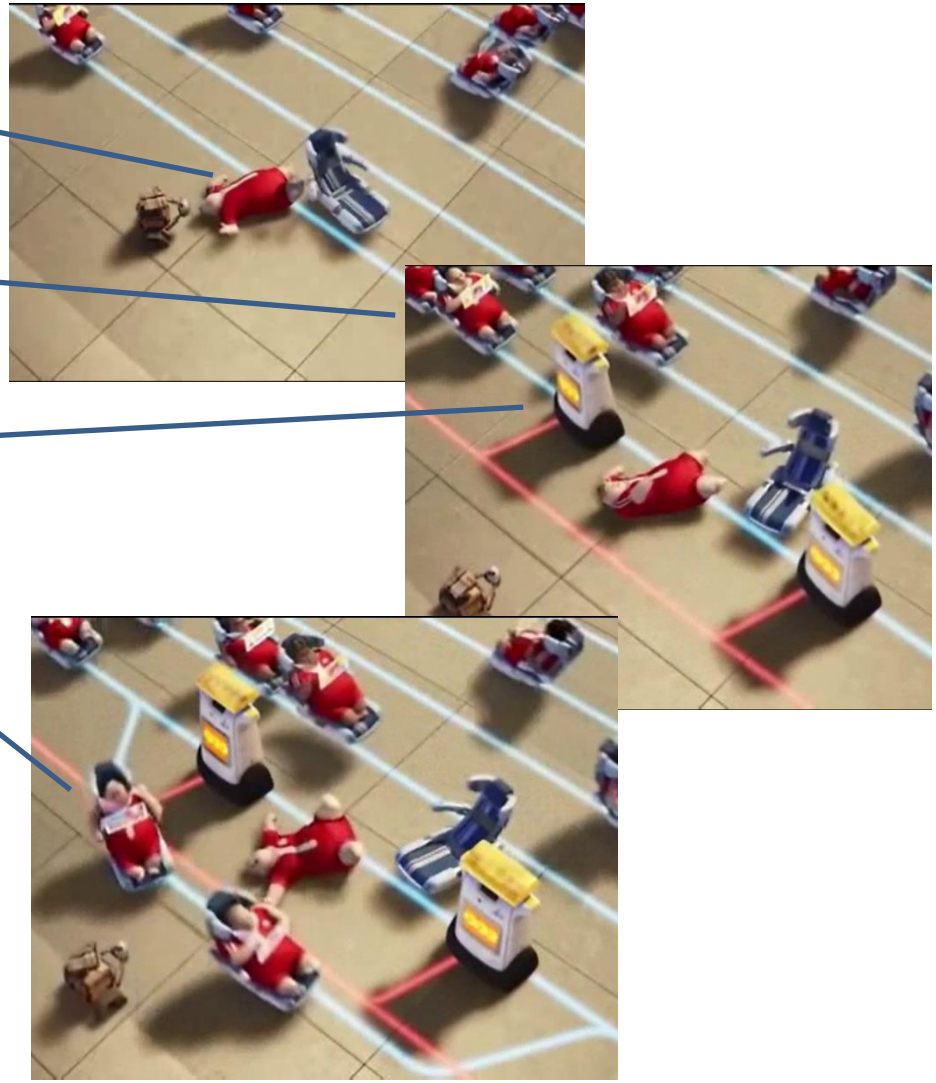
Transition Area



Transition Areas are areas on the road where many highly automated vehicles (blue) are changing their level of automation due to various reasons.

Detailed Analysis

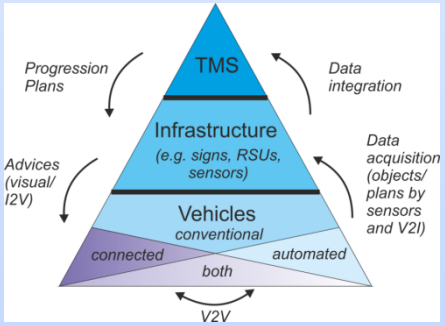
- Severe problem
- Impact on Traffic
- Additional entities help solving the situation
- Solutions for surrounding traffic



Detailed Analysis

Severe problem → abstracted

Impact on Traffic → Assess by simulation



Additional entities help solving the situation → V2X RSU, additional hardware, cameras

Solutions for surrounding traffic → Development, simulation and test of measures

Traffic mixes

Levels of Service

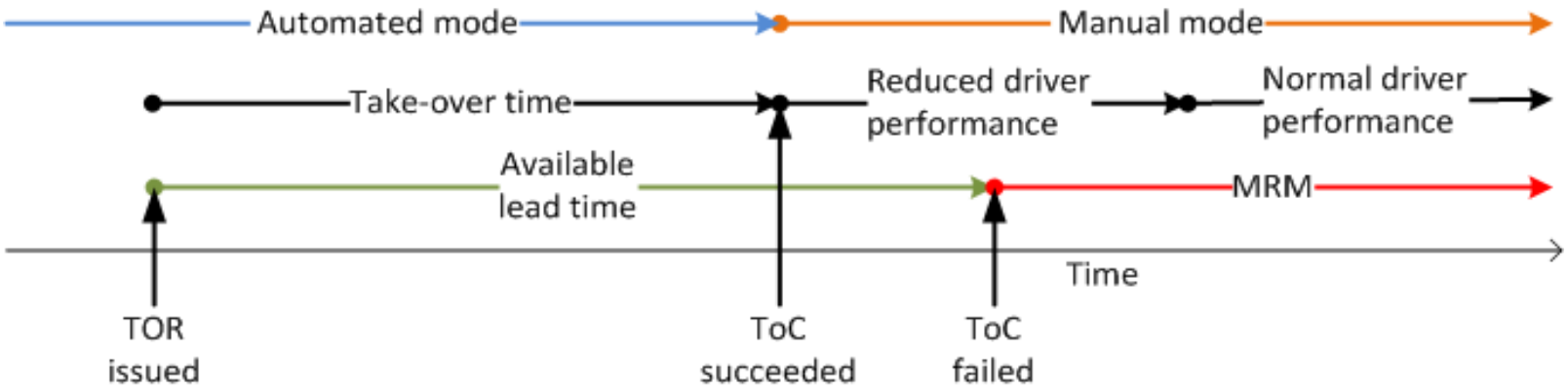
iTETRIS

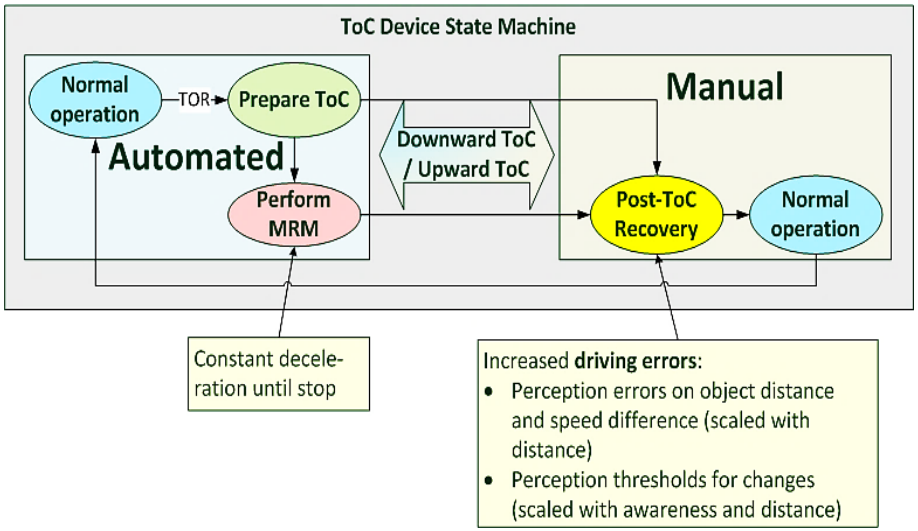
ns-3

SUMO

Roadmap
Guideline for stakeholders

Definition

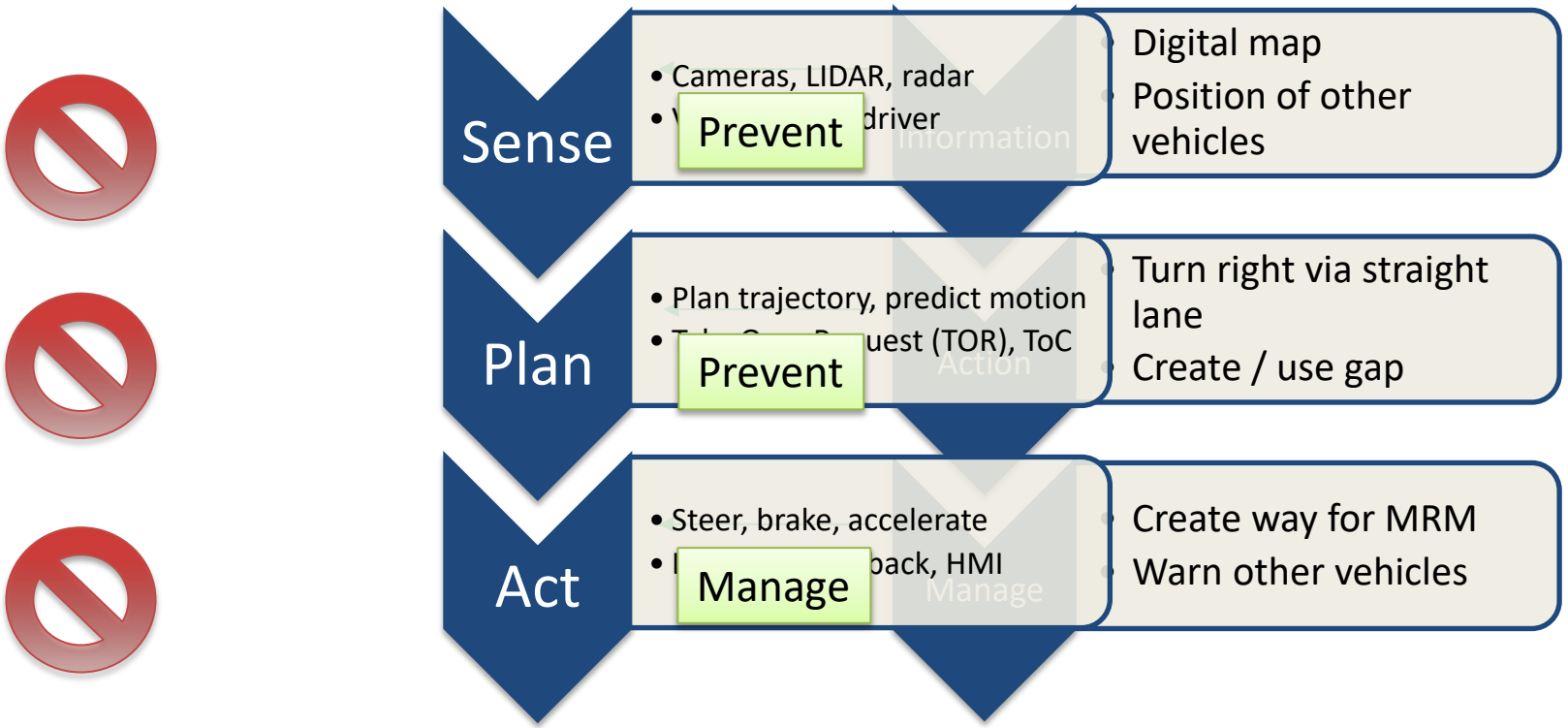




Abbreviations

TOR: Take Over Request
ToC: Transition of Control
MRM: Minimum Risk Manoeuvre

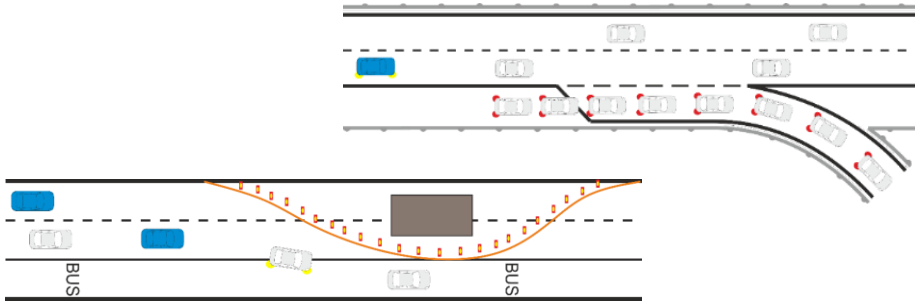
Scenario definition



+ when a ToC is not preventable, but predictable → spread the ToCs in time and space

Use Cases & Service Definitions

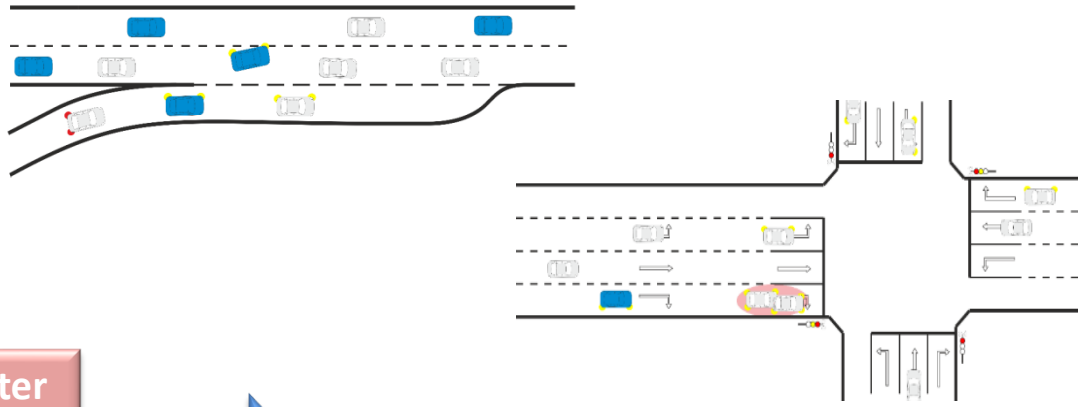
1. Prevent ToC/MRM by providing vehicle path information.



- **Lane not usable for vehicles strictly following rules**
- Vehicles may stop before obstacle

→ Providing path information or temporarily change lane category

2. Prevent ToC/MRM by providing speed, headway and/or lane advice.

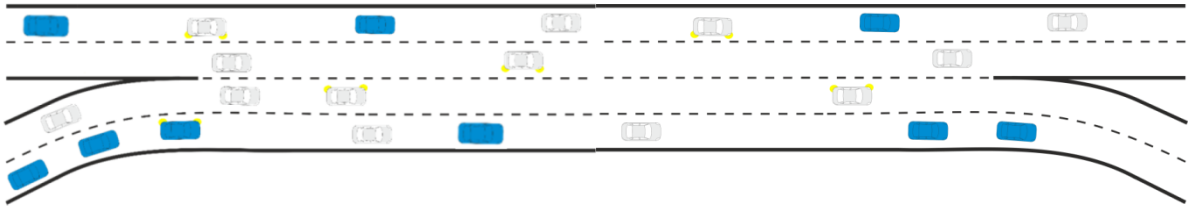


- **Automated vehicles unable to enter highway**
- Vehicles may stop or issue take over request

→ Cooperative lane changes
Speed & Distance information

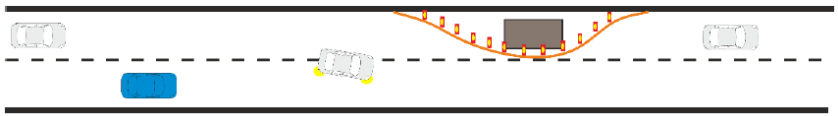
Use Cases & Service Definitions

3. Prevent ToC/MRM by traffic separation

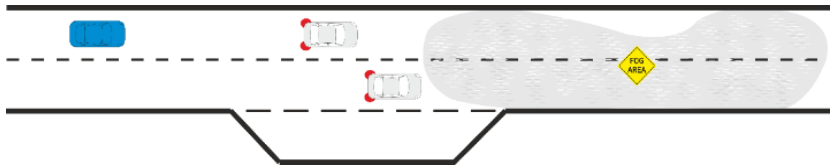


- **Risky situations in highway merge areas**
- Vehicles may issue take over request

→ Cooperative lane changes
Temporal traffic separation



4. Manage MRM by guidance to safe spot.

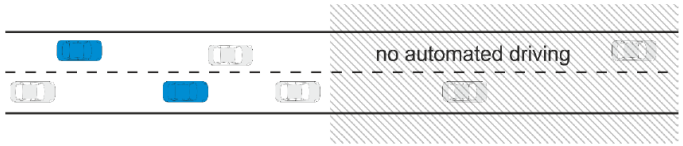


- **Automated vehicles unable to pass area**
- Vehicles may stop (e.g. due to failed transitions) and block free lane

→ Find safe spot for stopping without harming traffic

Use Cases & Service Definitions

5. Distribute ToC/MRM by scheduling ToCs.

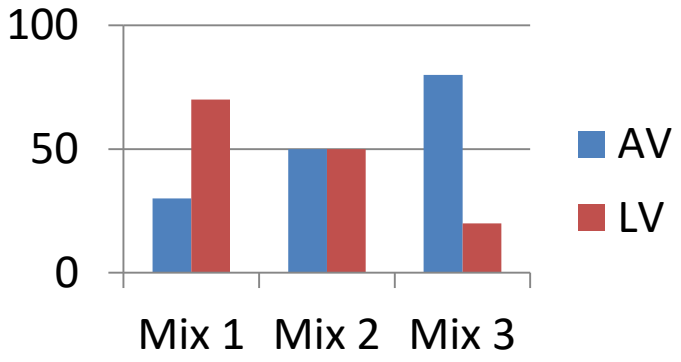


- **Transitions of control in small area**
- Higher risk of dangerous situations

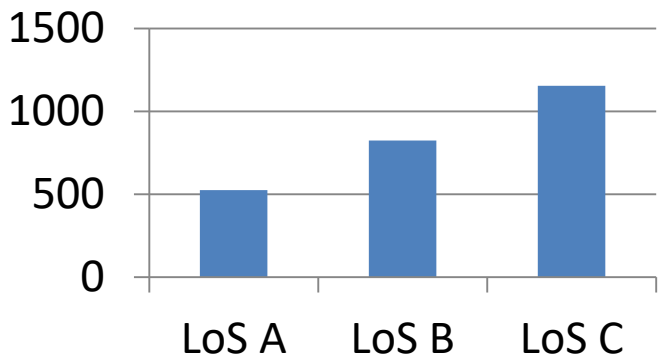
→ Distribute transitions of control to flatten effects

Simulation setup

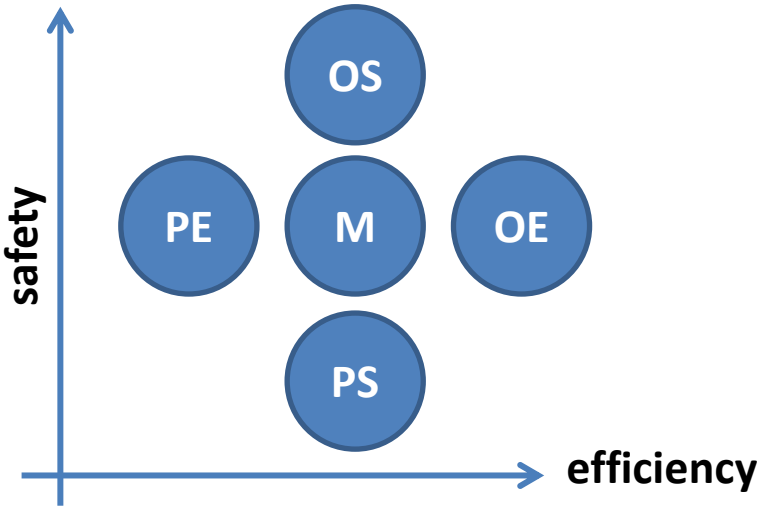
Traffic mix [%]

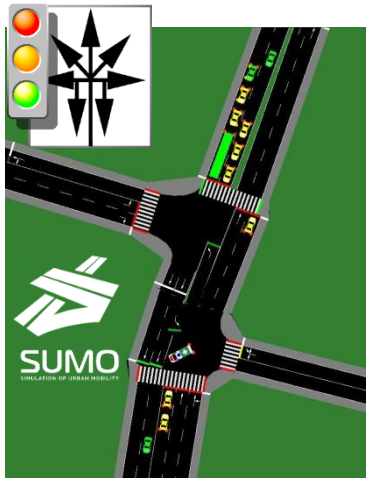


Total demand [Veh/h]

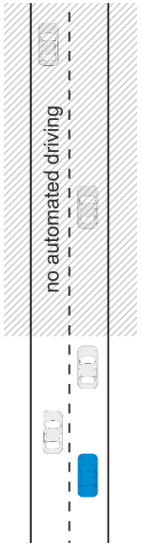


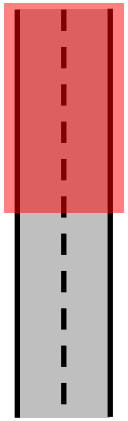
Parameter schemes:



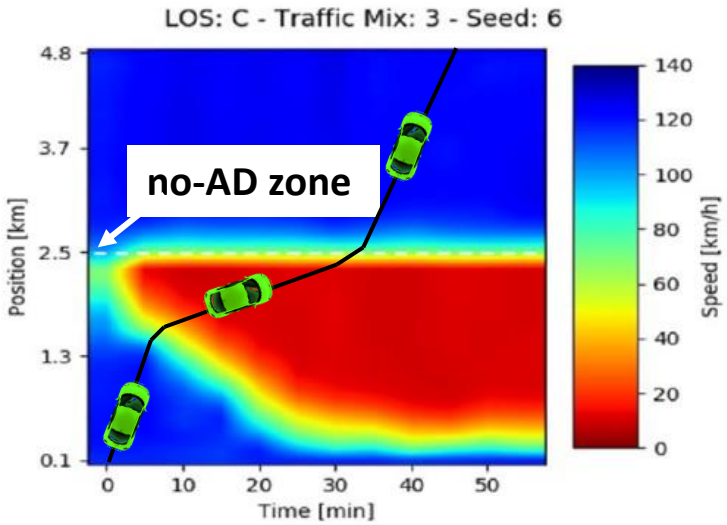


Preliminary simulation results Service 5.1

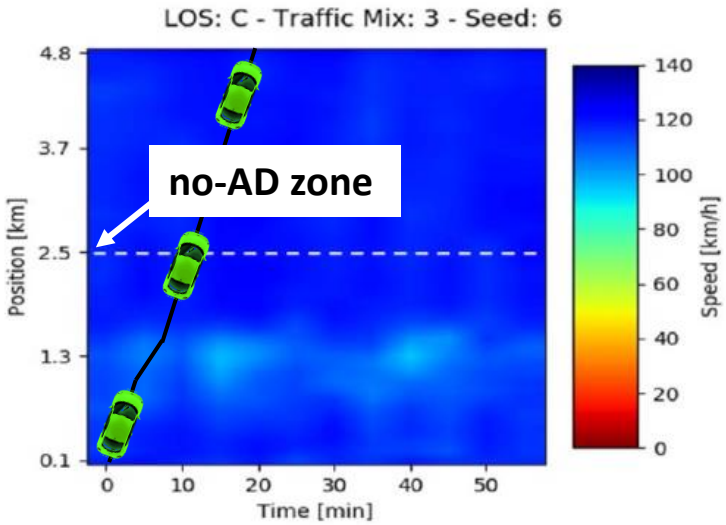




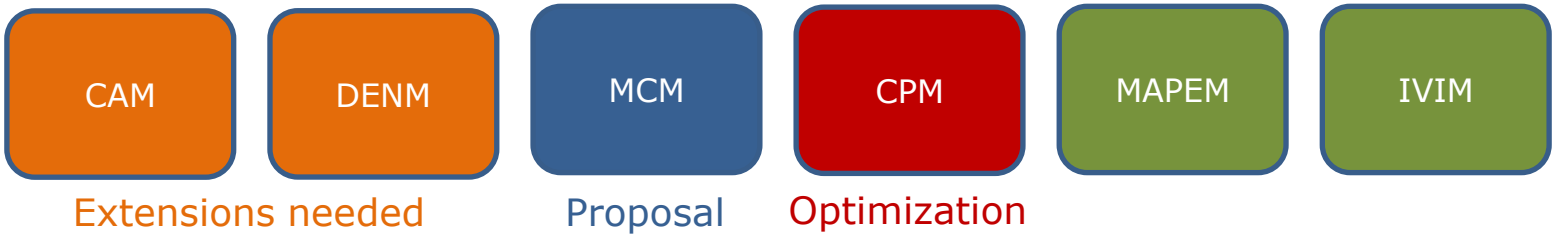
Without traffic management



With traffic management

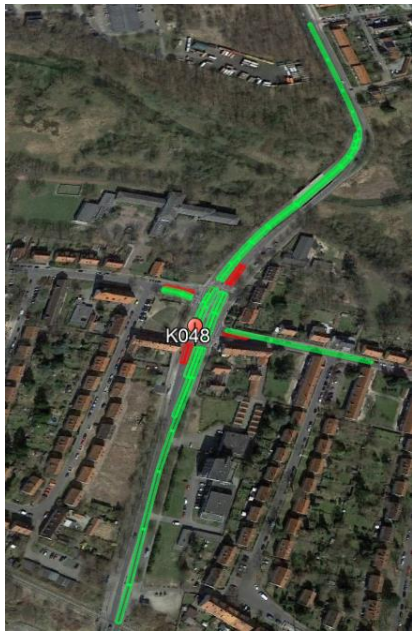


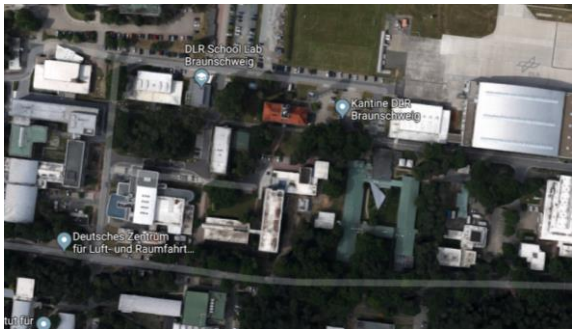
TransAID interim message set



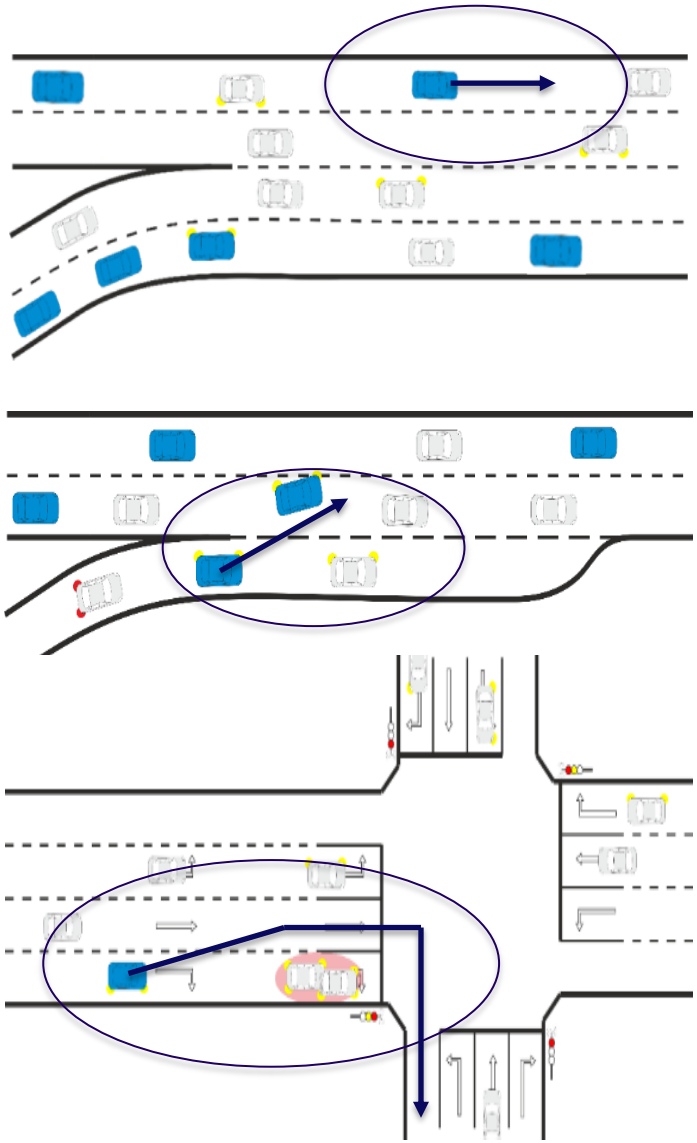
Approach: standard-compliant, backward compatibility and interoperability.

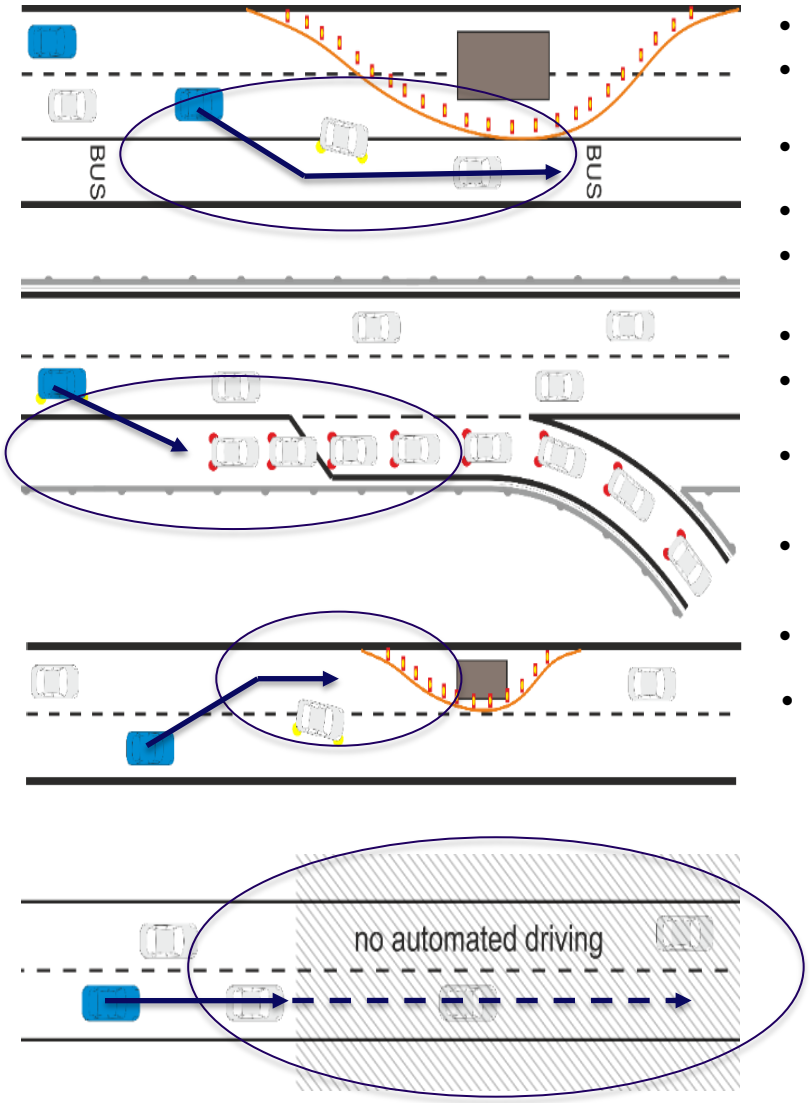
Real world integration





Trust, Safety and Legal Aspects





- Drive on right?
- Cooperate
- Trust gap
- ‘Illegal’ turn
- Trust MAP + SPAT
- Drive on bus lane
- Trust RW info
- Drive on emergency lane
- Trust advice
- ‘legal’ safe stop?
- Trust about no AD zone

Ways to proceed

Service Providers
OEMs & in-car solutions

Road Authorities
central & decentral

Still many open questions

- Will there be no-automated-driving zones?
- Will there be automated-driving-only zones?
- Are OEMs willing to cooperate to identify transition areas / limitations of their automation?
- What possibilities are provided by OEM backends?
- Can road authorities provide advices which conflict with traffic regulation?
- Which circumstances result in a take-over request?
- What do AVs do when their route is blocked?
- What to do about non-connected/incompatible AVs?
- What kind of minimum-risk manoeuvres can be expected?
- When situations are challenging, will AVs:
  - Behave like everyone else (sometimes egocentric, including breaking traffic laws)?
  - Behave exactly in line with traffic regulation?
  - Behave 'optimally'?
- What if information from RSI is wrong?

Any questions? Contact us!

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