Enhancing intelligent urban road transport network and cooperative systems for highly automated vehicles

Newsletter No. 2 (July 2017)

Introduction

MAVEN (Managing Automated Vehicles Enhances Network) was launched on 1 September 2016. The project investigates future traffic management of connected, cooperative and automated transport. It will provide:

- management regimes for automated driving in urban areas;
- monitoring, support and orchestration of movements of road users to guide vehicles at signalised intersections; and
- further enhancement for ADAS (Advanced Driver Assistance Systems) and C-ITS (Co-Operative Intelligent Transport Systems) applications.

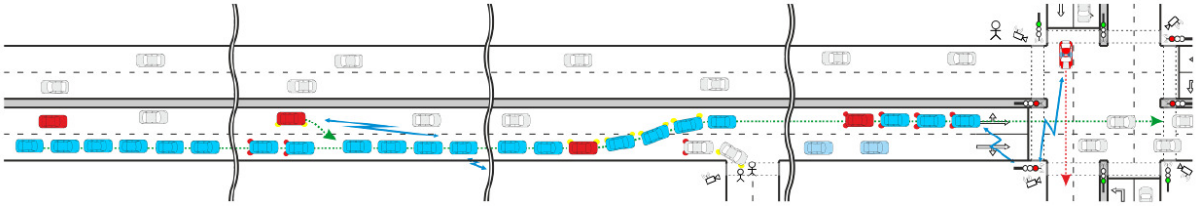

Illustration of MAVEN use cases

Preliminary results and related activities

Generic concept, use cases, requirements and specifications

MAVEN has provided a detailed system design, including use case descriptions, requirements and specifications and engaged road authorities in this process. A stakeholder consultation workshop was organised in Barcelona in November 2016, for discussion and review of preliminary MAVEN results. The workshop audience of 34 persons was made up primarily of local authority representatives – mainly working on traffic management - and project partners. For many participants, this workshop was a first occasion to learn about and to share views on automation and urban transport. Hence, the discussion largely remained at a rather general level, covering the potential advantages and dis-benefits of automated vehicles in the urban environment. Nonetheless, some requirements and recommendations emerged from the discussion that have bearing on the use cases, the demonstrations and impact assessment. These requirements, have been used as an input for the requirements collection step.

Findings from the workshop together with the resulting use case descriptions and system requirements can be found in the report "User needs, conceptual design and requirements" which is publicly available on the project website. In total 16 use cases are described which can be categorised into roughly 3 clusters: platoon management, signal optimisation and vehicle-infrastructure communications at interaction. When combined these provide infrastructure-initiated guidance of highly automated vehicles (HAVs) using negotiation proto-

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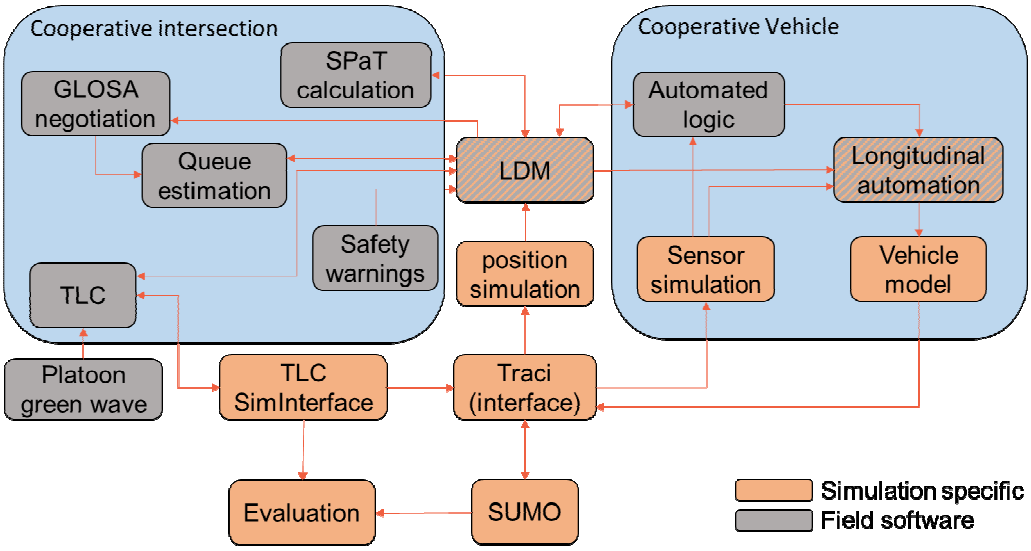
cols between vehicles and the infrastructure through which, iteratively, HAVs receive advice and/or commands from the road infrastructure to adjust their trajectory and manoeuvring policies, while the infrastructure dynamically adapts the traffic light timing of single or multiple signalised intersections based on the anticipated vehicle arrival pattern.

Following this definition work, a state-of-the-art review of previous projects and scientific literature was conducted, system architectures for real-world and simulation implementations were developed and verification criteria were defined. The literature review is available in the report "System architecture, specifications and verification criteria".

The first MAVEN stakeholder consultation meeting with local authorities and urban road stakeholders on 15 November 2016 in Barcelona, Spain

MAVEN Architecture

Within the project, a high-level system decomposition and hardware architecture, as well as a software architecture for simulations have been developed.



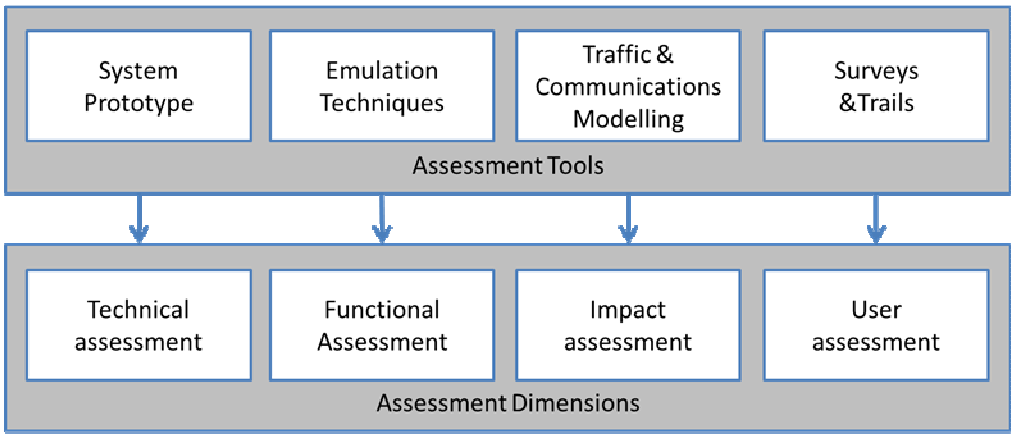
High level simulation architecture

The main actors involved are the cooperative vehicle and cooperative intersection. The figure above-left also shows the actors outside the boundaries of the architecture that interact with the system. These are non-cooperative vehicles and Vulnerable Road Users (VRU) that only interact in traditional ways with the system. Cooperative priority vehicles are vehicles who request priority in a traditional way from a functional perspective (using check-in and check-out points), but use new cooperative technology as communication channel for this. The Traffic Management Centre (TMC) is an external actor that may change policy parameters in the intersections and coordinates green waves over multiple intersections. The road authority or traffic management software can trigger this. For details about vehicle architecture and infrastructure architecture see: [Blokpoel, et al., 2017], which will be published on the website.

A simulation architecture (see the figure above-right) is developed by keeping maximal compatibility and re-use of real-world systems, while enabling retrieving sensor information from the simulation environment and changing states of traffic lights and vehicles according to the actuator outputs. Components that are identical to the real-world implementation are marked in grey, simulation specific components are marked in orange and adapted elements are marked in grey/orange striped. The interfaces to the grey elements should stay the same. Both the vehicle and the intersection have a shared Logical Data Model (LDM), as the communication units have been removed, saving a lot of computational time for encoding and decoding messages. Systems connected to this LDM will not notice a difference, the same data is still present in the same format.

Impact assessment plan

The MAVEN consortium experts have made an impact assessment plan to define particular steps, tools, roles, deadlines, requirement or prerequisites. It covers technical impacts (e.g. meeting of the technical requirements), functional impacts (e.g. covering the needed functionality), impact analysis (e.g. evaluating the impact of platoon organisation, negotiation algorithms, penetration rate of automated vehicles and others) and user impacts (e.g. addressing the acceptance and compliance of drivers and citizens of the MAVEN related use cases). A detailed description can be found in the report "Impact assessment plan", which is a living document.



MAVEN assessment method

MAVEN Special Session at IEEE SCSP 2017 in Prague, Czech Republic

A MAVEN Special Session on "Autonomous vehicles for smart cities" was held on 26 May 2017 at the third IEEE (the Institute of Electrical and Electronics Engineers) Smart Cities

Symposium Prague (SCSP 2017), organised by the Czech Technical University (CTU). SCSP 2017 is an international scientific conference with over 150 participants from 13 countries. The symposium received auspices from the President of the Czech Republic, Mr. Miloš Zeman and the City of Prague. The director of the City of Prague JUDr. Martina Děvěrová along with the CTU rector Prof. Petr Konvalinka opened the symposium.

The main objectives of the MAVEN Special Session are:

- Introduction of the EU-funded project MAVEN
- Addressing some technical issues in the field of connected, cooperative and automated transport, as well as non-technical aspect of automated driving
- Discussions of expected impacts of connected, cooperative and automated transport, e.g. potential impacts, evaluation and assessment approaches, next steps, main trends

Dr. Meng Lu (Dynniq) moderated the session. Dr. Reza Dariani (The German Aerospace Center DLR) presented the state of the art of automated driving. He provided some facts about why autonomous vehicles are needed, and introduced different level of automation levels (0 to 5) and some experiments at DLR test track and simulation, e.g. cooperative lane change assistant system and automated cooperative valet parking.

Dr. Ondřej Přibyl (CTU), who also serve as the Chair of the SCSP 2017 Scientific Committee, gave an introduction of MAVEN. He also addressed the motivation for research related to automated driving, briefly reviewed main projects in this domain, and highlighted the automation levels, core technologies and impacts.

Prof. Tomáš Zelinka (CTU) presented telecommunication technologies for automated driving. He provided a very comprehensive overview of connected and cooperative solutions, trends in automated driving, discussed hybrid communication (architecture), and addressed communication system performance requirements.

Tomáš Peťovský (CEO, UBER CZ) provided his view from economic perspective. He analysed various mobility challenges, with which cities are confronting, and especially addressed shared automated vehicles for the future of urban mobility and the impacts.

At the end of the session, a survey was used to collect the views of the participants on automated driving and future traffic management. The session was attended by nearly 40 delegates. According to the opinion of the majority of the participants, safety is the most crucial aspect or concern for implementing and using autonomous vehicles. The MAVEN Special Session was highly appreciated by the participants of SCSP 2017, and received very positive feedback.

		
SCSP 2017 key organisers: Miroslav Svítek and Ondřej Přibyl (CTU)	*MAVEN Special Session: Meng Lu (Dynniq) with the organisers*	*SCSP 2017 organisers (CTU) at the conference social event*

MAVEN Stakeholder Consultation meeting in Brussels on 10 October 2017

MAVEN wants to support road authorities in understanding changes in their role and the tasks of traffic management systems.

In this respect, the project will hold the second Stakeholder Consultation Meeting on Monday, 10 October 2017 at the Polis network premises in Brussels, Belgium. The workshop targets cities and road authorities with the aim to gather views and get input for the MAVEN roadmap for the introduction of vehicle-road automation.

Travel costs reimbursement is available for eligible public authorities. If you are interested, please contact us.

MAVEN Consortium

MAVEN publication list

Blokpoel, R., Lu, M., Přibyl, O., Dariani, R. (2017). Interoperable architecture between simulation and pilots for cooperative and automated driving. Paper ID SP0849. In Proceedings: *The 12th European Congress on Intelligent Transport Systems*. Strasbourg.

Lu, M., Blokpoel, R. (2017). A sophisticated intelligent urban road-transport network and cooperative systems infrastructure for highly automated vehicles. Paper ID EU-TP0769. In Proceedings: *World Congress on Intelligent Transport Systems*, Montréal. (forthcoming)

Pereira, A.M., Anany, H., Přibyl, O., Přibyl, J. (2017). Automated vehicles in smart urban environment: a review. In Proceedings: *IEEE Smart Cities Symposium Prague 2017*. Prague.

Přibyl, O., Vreeswijk, J., Hoadley, S., Blokpoel, R., Horák, T. (2017). Incorporating stakeholder input in EU projects. In Proceedings: *IEEE Smart Cities Symposium Prague 2017*. Prague.

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Vreeswijk, J., Přibyl, O., Blokpoel, R., Schindler, J., Rondinonee, M. (2017). Managing automated vehicle at signalized intersections. In Proceedings: *International Conference on Intelligent Transport Systems in Theory and Practice*, mobil.TUM, Munich.

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You can also follow us via our

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