Enabling innovation through open standards in the transportation domain

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Abstract. Within the transportation domain we see a rapidly growing number of connected vehicles, an increasing importance of on demand mobility services and better insights into the status of the urban infrastructure. As consequence, the amount of available information in each vertical is increasing. The more of information and understanding has a big potential to improve urban mobility significantly. We believe that this only works through collaboration of the relevant stakeholders. In this regard, the key aspects are (1) guaranteed privacy and safety of the customers, (2) open standardisation of data and interfaces and (3) a critical mass of involved stakeholders.

1 Introduction

Future innovation in the transportation domain can be achieved through collecting, interpreting and combining data from various verticals, such as automotive, smart cities or mobile service providers [9]. Besides having access to the data, its interpretation and combination is a critical aspect to success. Missing standards on the data level increase the manual effort and costs of integration and eventually slow down or even stop innovation [1]. The first step forward is the definition of domain knowledge in form of accepted standards within each domain. As consequence, for the automotive domain BMW Research takes initiative in standardising vehicle signal data. Examples for active participation are

1. Maintainer role for the GENIVI project called Vehicle SIgnal Specification (VSS)[1],
2. Developing the VSS taxonomy into an ontology VSSo [6],
3. Being active member of the W3C Automotive Business Group and
4. Defining and promoting the Driving Context Ontology [5].

In the following the current challenges will be discussed and it concludes with raising open questions and possible work items, which need further consideration within the scope of the workshop.

[1] https://github.com/GENIVI/vehicle_signal_specification

2 Challenges and risks

Certainly, the vehicle can be seen as another thing in the Internet of Things (IoT), but with certain constraints. The amount of sensors and their data is enormous[2]. Therefore, one has to be selective, which data is preprocessed onboard to not overload uplink with non-necessary information. Vehicle architecture are usually brand and often model specific and they combine different transportation buses and protocols [3]. The lifetime of a vehicle is bigger than in most other domains and updates are often costly, time and resource intensive [2]. Therefore, an abstraction layer as northbound interface is necessary to bridge legacy and future implementations.

Further, attacks on vehicles are a realistic threat to the customers and their trust [8] - not only in the vehicle and automotive industry itself - but also in future development of new features around driver assistance.[3] Therefore we start with this aspect, followed by the need of standards and the necessity of a critical mass of participants and involved stakeholders.

2.1 Guaranteed privacy, security and safety of the customers and their data

The number of connected vehicles is growing[4], the possibility of vulnerabilities and attacks are increasing with it. Therefore, we believe that a controlled access to off-board facilities in order to interact with the vehicle is the best way to do so. We follow in this regard the concept of the Extended Vehicle [4].

Besides the security and safety considerations, the customers data privacy is important. In order to extend the offering for the customer by interconnecting different solutions in the transportation domain, allowing and tracking the user consent for each use of personal information would be key for a solution. Additionaly, data encryption of the complete data flow would assure that only end consumers with consents would have access to the customer data. We believe, that this question has to be solved in order to unlock the full potential.

2.2 Open standards of data and interfaces

The driving context modelling pattern offers a way to link different domains together, to get a deeper understanding of a driving state or event [7]. To achieve this within the transportation domain by combining vehicle sensor information with insights of the other sectors of the transportation domain, a common understanding of the different domains has to be given. This counts for example for regions in public transportation, companies offering on demand mobility services or Original Equipment Manufacturers (OEMs) of connected vehicles.

[2] `https://www.tuxera.com/blog/autonomous-and-adas-test-cars-produce-over-11-tb-of-data-per-day/`
[3] `https://www.forbes.com/sites/gartnergroup/2016/08/18/top-10-security-predictions-through-2020/#20fabfc75b39`
[4] `https://www.forbes.com/sites/niallmccarthy/2015/01/27/connected-cars-by-the-numbers-infographic/`

As the numbers of connected vehicles is growing, the need for adaptive ways to model vehicle data is growing as well. And this has to go beyond looking into single use-cases. Even though there are great efforts looking at grouping data models around use cases like sensoris[5] , extended vehicle [4]. or through neutral server approaches high-mobility[6], otonomo[7], we at BMW Research believe, that the approach of modelling and serving vehicle data should be more generic. Therefore, we raise the following concerns going forward with the use-case approach:

- Defining data models by use cases creates **unnecessary overlap**. Often use-cases touch parts of different domains. Instead of relying on domain experts and following their modelling pattern, the danger might be to redefine certain aspects in multiple ways instead of offering ways to link domain knowledge.
- Often the solutions are **very limited**. Small extensions to the data model might lead in the worst case to new standards.
- Defining other domains outside the level of expertise to fulfil the use-case definition will result into **little acceptance** in the targeted domain.

We at BMW Research believe, that employing a generic approach focusing on open standards for a specific domain created by domain experts will bring more clarity. Using this as a base for interlinking different verticals helps overcoming the concerns and achieving a better acceptance in the long run.

2.3 Critical mass of users, participants and involved stakeholders

One important aspect of standardisation is reaching the critical mass of users, participants and stakeholders that can improve the quality, focus and simplicity of the standard itself. Moreover, we think that the impact of a standard will be increased,

- if it is usable over domain boundaries, and
- if a more generalised approach is use which is the base for use case realisation within the own domain.

We think, that the efforts undertaken by the W3C within the Web of Things Group help in bridging different domains in the IoT space. Whereas, the Automotive Group makes the automotive domain more accessible to non-experts. These activities support reaching the critical mass for adaptation. Further, we think that transparency and especially the communication of different organisations, standardisation bodies and initiatives help to identify gaps and possible overlap in the automotive domain. Therefore, we support the effort of the GENIVI Cnnected Services project[8] that will help to create the transparency and to open a platform for discussion.

[5] `https://sensor-is.org`
[6] `https://high-mobility.com`
[7] `https://otonomo.io`
[8] `https://at.projects.genivi.org/wiki/pages/viewpage.action?pageId=34963516`

3 Possible working items

As discussed in the previous sections an enabler for a successful definition of the transportation domain is the standardisation work in each vertical. Further we would see tremendous benefit if the listed working items would be addressed by the workshop and its aftermath:

- **Defining cross domain use cases**, involving the relevant stakeholders and verticals as a reference for future work,
- **Identifying solutions for cross domain user identification and privacy**, adapted especially requirements of the verticals that cooperate,
- **Defining rules, guidelines and tools for creating a driving context**, as the common ground on which a standard model could be further developed.

By tackling the challenges as a collaborative effort and fulfilling the requirements of the automotive domain, we strongly believe that open standards thrive innovation in the transportation domain.

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