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Data for Road Safety

Safety Related Traffic Information across Brands & Borders

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Abstract

This paper describes the organisational and technical framework that has been set up by the Data For Road Safety (DFRS) partners to ensure a sustainable, cross-brand and cross-border provision of data from vehicles that can be used to generate safety related traffic information (SRTI) according to Delegated Regulation 886/2013 [1]. Both legal concerns (like the terms and conditions of data use) and technical uncertainties (like data categories and formats/standards) have been overcome by multiple EU member states, automotive OEMs and data service providers with a multi-party agreement (MPA) that sets up a governance structure and describes technical roles and responsibilities. With the now established DFRS SRTI data ecosystem a new valuable data source can be leveraged to improve road safety across Europe.

Keywords:

Road safety, vehicle-generated data, connected vehicles, safety related traffic information, SRTI, data ecosystem

1. Introduction

On 15 February 2017 in Amsterdam, European Transport Ministers, European Commission and industry representatives assembled in the first High Level Meeting on Connected and Automated Driving. One of the conclusions on that day was that a dedicated public-private task force shall be set up that will set the first steps to deploy data-sharing for safety related data in real life situations. The 'Data Task Force' was founded shortly after with several EU Member States and industry representatives from the fields of automotive and data services. On the 3rd of June 2019 at the ITS Europe conference in Eindhoven a Proof of Concept (PoC) was launched to take the first steps towards a harmonised exchange of vehicle data with the aim of generating Safety Related Traffic Information.

During the 16-month long runtime of the PoC, the basic principles of the data sharing partnership have been discussed and both organisational and technical ways of implementing a SRTI data ecosystem have been discussed, fine-tuned and tested. In November 2020, the successor of the PoC was created: a multi-party agreement that defines the 'DFRS' partnership.

In this paper, the organisational and technical challenges as well as the principles found to tackle them are laid out in some detail. Furthermore, a description of the technical SRTI data ecosystem gives insight into the way data is shared and used [2].

2. Challenges

2.1 Organisational challenges

The organisational challenges that will be described in paper are not exhaustive but will give a general feel of some of the issues that arose but will give a general feel of some of the issues that arose.

The organisational goal of the 'Data Task Force' was: Trying to get together so many different parties (e.g., Member States, road operators, car manufacturers, service providers) in trying to create a public/private partnership where all parties were willing to freely share data on basis of reciprocity with the purpose to develop a sustainable environment which could be used after PoC as well.

To reach this goal there were quite some challenges:

- Cooperation of competitors in the automotive field needed – do OEMs want to share information with their competitors?
- Different goals of the various stakeholders (OEMs/service providers/Member States)
- Data privacy – the main premise of the 'Data Task Force' was that the data provided was not related to an individual person. The data privacy has been a factor in the group from the beginning and still is.
- Terms and conditions of data (re-)use (possible commercial applications of data) – Parties are not allowed ask money for services that are solely based on the data provided within this group
- Who gets access to the data – who can access the data within the ecosystem and under which circumstances?
- Other legal issues – e.g., discussion on license vs. multi-party agreement to regulate the above)

It took a lot of meetings and discussions before the first collective agreement was reached for parties to be able to participate. The parties of the 'Data Task Force' signed a Memorandum of Understanding 1 and entered a proof-of-concept phase which started at the ITS Europe Congress in Eindhoven on the 3rd of June 2019 and lasted for sixteen months.

Parties are aware that the SRTI Ecosystem is only as good as the sum of its parts. However, there will be a difference on how the Parties contribute to this SRTI Ecosystem as they have different levels of capabilities in this field. Parties are committed to support the SRTI Ecosystem to the best of their abilities to improve road safety for all road users. As all parties recognized that there are numerous different interpretations regarding Regulation 886, it was left up to the Parties themselves which data they wanted to provide.

2.2 Technical challenges

2.2.1 Abstracting data

The first technical challenge comes when Parties are about to transmit data. Preferably this should be done in one of the standardized data formats. Decisions needed to be made on how the data from sensors should be represented in a standard. Often the case is that there are several ways to express the data in the standard and all of them could be correct. The standard authors could also be successful in conveying the intentions of attributes and elements which adds to the challenge of picking a suitable representation.

2.2.2 Interpreting data

One of the greatest technical challenges in the eco-system is the problem of interpreting data from different sources in a particular context. At the same time this is a challenge that all parties need to tackle on their own as soon as there is data from multiple not identical sources. This happens as soon as there are several models of measuring equipment used, regardless if that is in a vehicle or in road infrastructure equipment.

2.2.3 Aggregating data

When using multiple standards (for different purposes) it is essential that the content is mapped as good as possible, so that translation from L2 data to L3 Information is as easy as possible. For the definitions of L2 and L3 see the next chapter. Still even when it is well understood (interpreted) what the data means, joining it together with similar, but not the same, data with the goal of determining a common situation, can be difficult. This is part of the continuation of the Data Task Force in the DFRS.

3. Principles

Underpinning the success of the eco-system are a few key principles that set the basic mindset and level of ambition needed for all participants as well as the expectations of potential joiners.

1. **Reciprocity**: Everyone that is in the DFRS eco-system must be able to contribute to the operating dataset with data from their own domain or play an active role of increasing the value of existing data by enrichment, combination of data or validating data by removing duplicates. This principle is quite controversial and perhaps what makes the DFRS eco-system unique since it puts the emphasis on data sources rather than middleware providers.

2. **Decentralized system:** There is no central node for the system to work, no single organisation is responsible for the success of the whole endeavour. Rather: a decentralized system of nodes (data access interfaces) with data providers and data users. This principle is also quite different and at first glance a weakness of the setup since it once again puts the burden of implementation on the consumers that needs to go out and adapt to the data source chosen method of publication. This is also intentional since it lowers the threshold for producers to join.

3. **Data levels:** The eco-system has defined classifications or levels the types of data that is processed.

    - Level 1 or L1 is the class of raw sensor reading down to electrical signals that never leaves the producing device.
    - Level 2 or L2 is still close to raw sensor readings but now in a harmonized form that can be sent across systems and be interpreted in a receiving system without detailed knowledge of the sensor specifications.
    - Level 2' or L2' is still on the same level as L2 but is in this form aggregated to provide harmonization across sensor devices or just validated to remove duplicates and out of band values.
    - Level 3 or L3 is the final product of the eco-system, this the level of data that can directly be distributed to the public as SRTI. This class of information is produced as the result of aggregation and analysis of lower levels of data or by directly qualifying a specific event.

4. **Data formats:** The eco-system mandates DATEX II [3] for L3 Information as this is what is defined by the Delegated Regulation and provides a standardized profile for this [4]. For L2 and L2' data there is no mandated format, but a recommended mapping is provided for the SENSORIS standard format [5].

5. **Roles:** To be able to assign requirements and duties to each partner as well as providing input to potential new members the eco-system has defined a set of roles where each partner can choose to take one or more:

    - **Data Source**
        - A Party that generates Data (L2), Data (L2') and/or Data (L3).
        - The Data Source is responsible for contributing original, new Content into the ecosystem.
        - A typical L2 Data Source would be a vehicle OEM contributing L2 Data to the ecosystem.

    - **Data Access Interface Provider (L2)**
        - Provides access to L2 data.
        - For vehicle L2 data usually executed by an OEM or a delegated entity.
        - For public authority L2 data usually executed by road operator.

    - **Aggregator (L2 to L2')**
        - A Party that consumes Data (L2) to create Data (L2') e.g. by harmonizing and cleansing L2 data from L2 data sources.

    - **Data Access Interface Provider (L2')**
        - Provides access to L2 prime data.

    - **Creator (L3)**
        - A Party that creates Data (L3) from varying sources including Data (L2) and/or Data (L2') and/or Data (L3) acquired through the SRTI eco-system and/or external data sources.

- **Data Access Interface Provider (L3)**
  - Provides Access to L3 Information.

- **Service Provider**
  - A Party that renders and distributes Data (L3) acquired through the SRTI Ecosystem directly to an end user (i.e., driver in vehicles).

These principles together are what makes up the rules for participation in the eco-system and are what we believe the foundations of the success of it.

4. The SRTI Ecosystem

The aim of the SRTI Eco-system is to facilitate the data flow from all participating members within the consortium, making the data available to those parties who wish to access it. The SRTI data can originate from any of the following different locations:

- The OEM provider
- The non-OEM provider

For the DFRS technical team, the focus is on the data flow from OEM & non-OEM data providers into the eco-system. Once the data is made available within the eco-system, a member of the consortium will have the ability to access and download the data through a direct API access. The link to the eco-system must be established or developed by the consortium member and as such be able to have a direct connection to the eco-system.

Alternatively, the consortium member can forward their raw data sets (if they wish to do so) to a data aggregator from within the consortium, who will analyse the data and share the necessary L2 Prime data required as per the updated SENSORIS standard. At the moment we have multiple OEMs that are taking this route by sending their data to a data aggregator before it is then injected into the eco-system.

SRTI Eco-System Data Flow

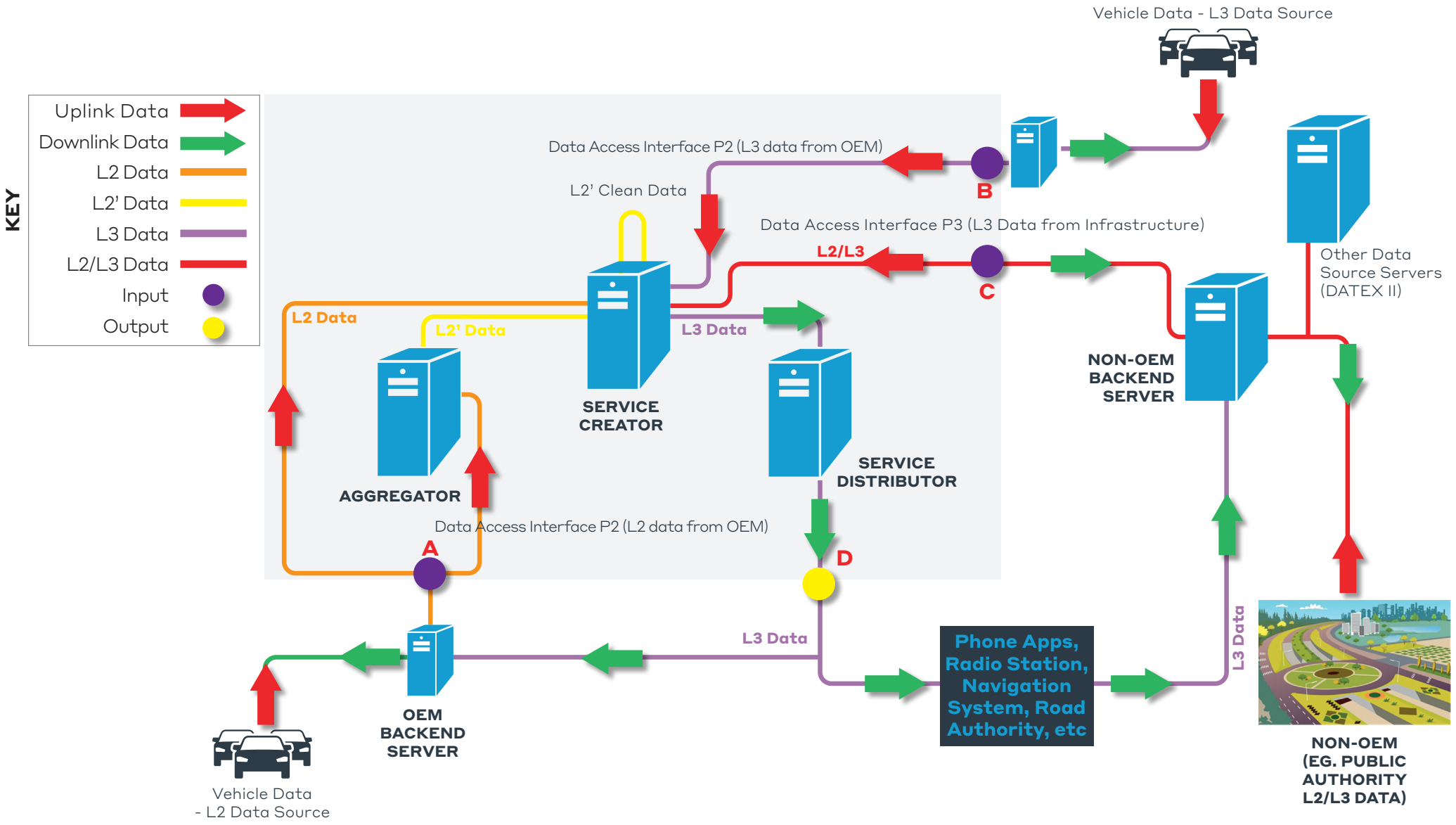


Figure 1 - The STRI eco-system review

A total of four Data Access Interface Points (DAIP) exists within the SRTI eco-system; three primary inputs (A, B, C) and a single primary output (D). Figure 1 shows an overview of the Eco-system's input/output setup. Each of these access points are represented in Figure 2 as nodes within the SRTI Eco-system Architecture. The ecosystem also enables a secondary output feed from point B and C, this data flow is represented in Figure 1 denoted by the green arrows at point B and C.

The inputs and outputs within the SRTI eco-system are as follows:

Input A - L2 Data provided by OEM (e.g., BMW – Binary Windshield wiper status On/ Off)
Input B - L3 Information provided by OEM (e.g., Volvo – Vehicle in difficulty message)
Input C -L2/L3 Data from non-OEM (e.g., Highways England – Weather condition message)
Output D - *L3 Information produced by the SRTI eco-system*

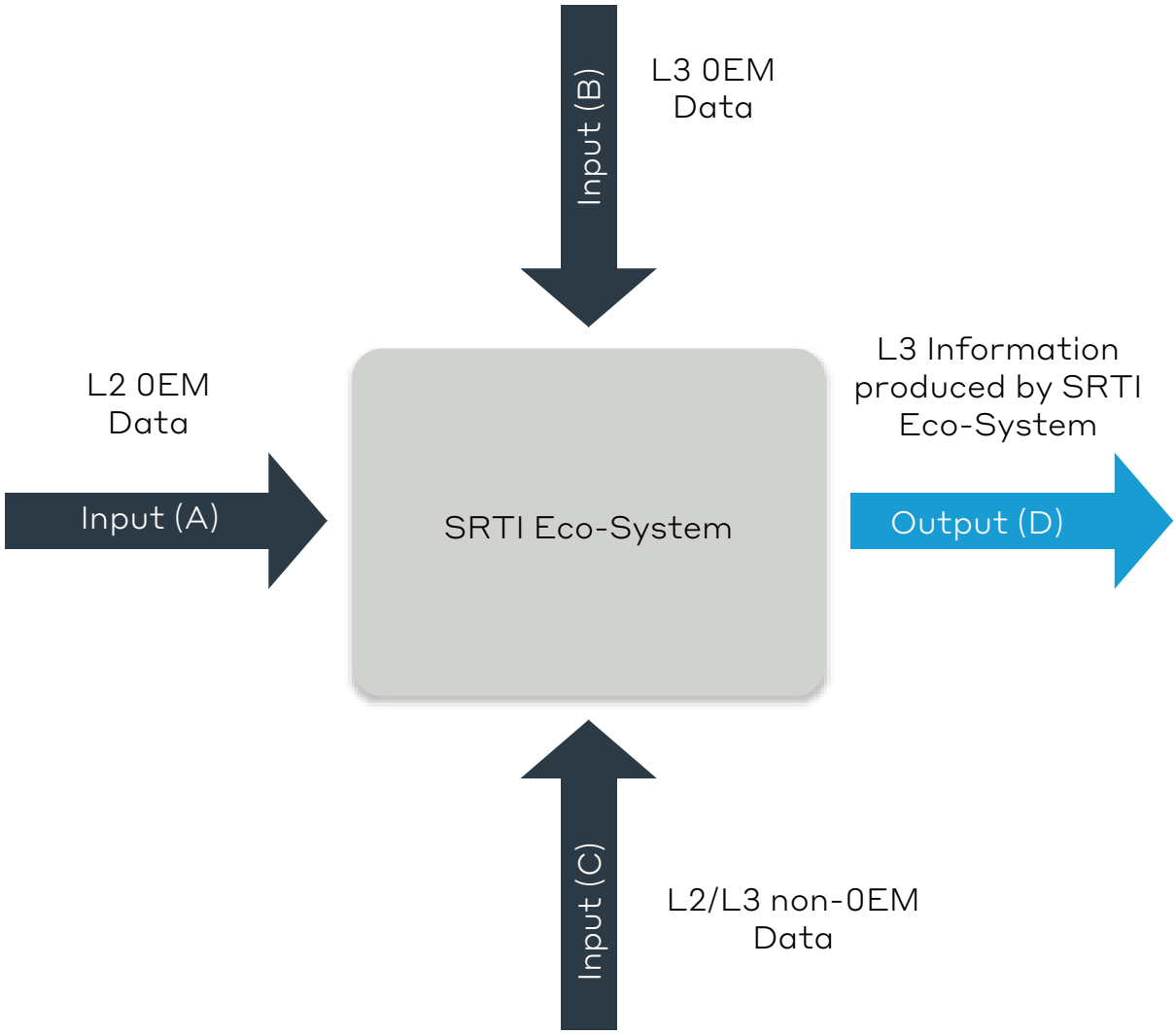


Figure 2 – Input / Output set up for the SRTI Eco-system

5. Active Cross Border Exchange (Successes)

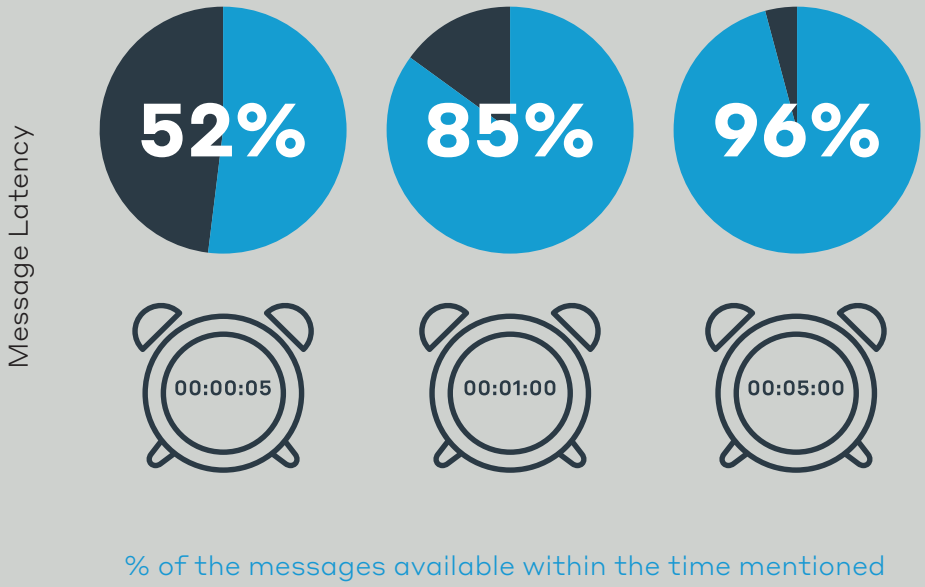
The DFRS multi-party agreement was signed by 15 partners, including four automobile manufacturers. It is estimated, that at the time of writing more than 2 million vehicles deliver safety relevant data to the SRTI ecosystem (the exact number varies, e.g. as new vehicles get activated or owners give or retract approval for data sharing). Even though the vehicle data does not yet contribute to safety relevant traffic information about wrong-way drivers, unmanaged blockage of road or short-term road works, the data delivered can be used to create warning messages for unprotected accident areas, obstacles on the road (broken-down vehicle), temporarily slippery roads, exceptional weather conditions and reduced visibility. With several million data sets received for these hazards per month for locations all over Europe, the potential for an improvement of road safety is huge. As this activity is also endorsed by the European Commission and the European Automobile Manufacturer's Association (ACEA) as well as some of the major traffic information service providers, it is expected, that the partnership will grow, and more data will become available.

6. Summary

The development of the SRTI Ecosystem was indeed challenging, however, by adopting a fully collaborative approach we were able to successfully prove the possibility of the data exchange between OEM to non-OEM members. As part of this journey we have also strengthened the public-private relationships in the field of ITS. We understand that not all SRTI events can be detected by vehicle data and as such the ecosystem welcomes data from other sources to compliment the vehicle data and thus give us a true representative picture of our roads. The DFRS has proved this during the PoC stages. In a historic event of data exchange between vehicles and NDW we have seen the immediate impact of the SRTI data on Dutch roads. By integrating the vehicle SRTI data with various sources from the Dutch Ministry of Transport we were able to observe the below results which are published at DTF Final Report (Data For Road Safety, 2020) [6].

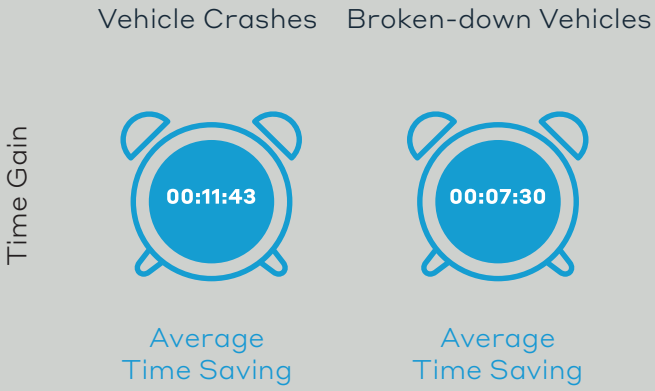
Latency

The time between the incident as registered by the vehicle and the time the message is available on the NAP-server for other parties.



Time Gain

97% of accidents and breakdowns reported by vehicle data could not be compared with existing sources, because there was no information about these incidents in the existing sources.



As of January 2021, the DFRS has managed to establish a pool of c2.6 million connected vehicles and growing across multiple OEM manufacturers, these include but are not limited to BMW, Ford, Volvo, Daimler. Following completion of PoC in October 2020 the DFRS is now undergoing Long-term deployment. The aim of the long-term deployment is to enable more OEMs and non-OEMs to share their data. The view is that the more data the ecosystem ingests the more enhanced the SRTI information that will be produced, thus resulting in safer roads. There is an open invitation to the industry, public and private to seek membership with the DFRS and become part of the consortium to avail of the SRTI that can support in making roads safer. Applications are now open for all OEM or non-OEM members [7]; upon successful application organisations will be introduced to the dedicated technical group where the on-boarding process will be conducted in the most efficient manner.

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