Traffic Management 2.0 (TM2.0)

"Enable vehicle interaction with traffic management"

2014 Report of the

Task Force 2 on Enablers and barriers

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1. Introduction

Traffic Management 2.0 (TM2.0) is an open group of actors from the global traffic management and mobility services market that aims to "Enable vehicle interaction with traffic management". This will inevitably lead to drive faster the development of individual mobility services and improve effectiveness of accurate and efficient traffic management and control integrated with the growing use of navigation systems inside the vehicles. The TM2.0 group aims to create an interface, which will facilitate the exchange of data between vehicles and TM procedures supporting the entire value chain for consistent traffic management centre and traffic information services.

Among the activities of the TM2.0 group, the Task Force 2 focusses on the identification of relevant enablers and barriers to which it shall propose in the future possible mitigation measures. As enablers the trends that are expected to boost the development of such services are denoted, while barriers are the issues that need to be carefully tackled in order to facilitate these developments. This report presents the enablers and barriers identified at this stage by the members of this Task Force. Moreover, it presents a prioritisation of enablers and barriers according to their importance and a prioritisation of barriers according to how easy it will be to overcome them. The identified enablers and barriers have derived as a result of discussions among experts from the TM2.0 members, which have focused on five areas, technical, organisational, business-related, legal and conceptual one. External stakeholders, not members of the TM2.0 platform, were also consulted, in order to collect the opinions and experience from as many experts as possible.

2. Technical enablers and barriers

2.1 Enablers

High penetration of Navigation Devices

Nowadays traffic information services can be provided to drivers via in-car devices. More specifically, drivers can receive real-time traffic information on incidents, congestion and weather before and during their drive. This has been greatly boosted due to the Global Navigation Satellite Systems (GNSS). In-car devices can be in-dash satellite navigation systems, personal navigation devices (PNDs) or smartphones. They all function as receivers in either or both communication protocols: TMC and/or TPEG. The market penetration of equipped vehicles is rising: "The market penetration rate of RDS-TMC receivers is expected to reach 100% by 2020 (i.e. 1 device per vehicle)."[1]

[1] p.12, Commission Staff Working Document *Cost-Benefit Analysis Accompanying the document Commission Delegated Regulation supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to data and procedures for the provision where possible, of road safety-related minimum universal traffic information free of charge to users*, Brussels 15.5.2013 [SWD (2013) 170 final. See also table in Annex V (http://ec.europa.eu/transport/themes/its/news/doc/swd(2013)0170.pdf).

The presence of receivers in the car environment will greatly support the concept of TM 2.0 as it is based on the optimal flow of data in and out of the car. The GNSS can serve as the main enabler for innovative Traffic Management, which could serve the current transport policies, which are more and more demanding in terms of low impact and seamless mobility. The high penetration of Navigation devices can definitely function as an enabler for Traffic Management Plans and Procedures to be effectively communicated to the individual driver/car taking into account her individual travel plan.

Increase in penetration of reliable traffic information

Nowadays more and more live traffic information is being distributed to the general public with no additional costs, not only on web portals but also through mobile devices, for example smart phones. The exponential increase of usage of such information is directly correlated with the degree of awareness of the end user who is making the final use of it. The higher the usage of such services, the better the quality of the traffic information will be, because the probe data generated by such "mobile" users (estimated to 70% - 80% of generated traffic volume) may be used to enhance the quality of the provided service. Smart phone connected services, like social media, can accelerate the subscription adoption rate, which in turn will facilitate the use of other connected services, such as traffic information services, this will especially be the case outside Europe.

2.2 Barriers

Lack of compatibility with legacy systems

Traffic Management Centers (TMCs) should be upgraded so as to be able to exchange information with vehicles and possibly become interoperable with them. Already existing legacy systems are likely to have technical restrictions or limitations to grow and adapt to new specifications.

Public procurement processes that would be required for such upgrades are usually time-consuming and complicated, especially when there is not a consolidated or premature business case behind. With the automotive industry evolving much faster than public administrations, this may become a major barrier.

Lack of interface standardization for route/traffic management plan data between vehicles and service providers

The standardization of the interface for data transfer and share of route plans, from connected navigation systems in vehicles, and Traffic Management plans, from TMC's, will enable a seamless and provider/brand-independent interactive communication between vehicles and service providers.

A state-of-the-art analysis is needed to identify already existing standards that partially support that need (e.g. DATEX II), to identify the gaps and to build on concrete scenarios and use cases, with the final aim to develop the required standards and specifications. This should be done in close cooperation with the involved stakeholders, like Standards Developing Organisations (SDOs), suppliers of navigational devices, automotive OEMs, Tier 1s, service providers.

Lack of common standards for vehicle probe data and slow progress in standardization

Probe data and its applications are already being standardized by several international and national SDOs. Nevertheless many of these standards are still not finalized and others will be needed. Furthermore the relevant standards are developed by multiple SDOs and are not always consistent with each other. Excerpt of applicable standards are: ISO 22837- Vehicle Probe Data for Wide Area Communications specifies the architecture and data format for probe messages sent from vehicles, ISO 24100:2010 - Intelligent transport systems -- Basic principles for personal data protection in probe vehicle information services, ISO/TS 25114:2010 - Intelligent transport systems -- Probe data reporting management (PDRM), ISO/TS 25114:2010 provides a common framework for defining probe data reporting management (PDRM) messages to facilitate the specification and design of probe vehicle systems, ISO/TS 29284:2012 - Intelligent transport systems -- Event-based probe vehicle data specifies the probe data that shall be transmitted in the case that the event is happened, SAE J2735 - Dedicated Short Range Communications (DSRC) Message Set Dictionary defines standard data element and message contents and formatting for V2V and V2I information exchanges used in the U.S., ETSI TS 102-637-2 defines the standard message formats that are transmitted by every vehicle onboard- unit in a C-ITS environment. Message types also used for probe data include the Cooperative Awareness Message (CAM) and the Decentralized Environmental Notification Message (DENM).

It should be ensured that the same data are sent in the same format from all sources, namely from all vehicles and mobile platforms. This can be achieved via harmonized standards, which would enable an open and vendor-independent collection of probe data both for road operators and service providers. More generally, standardization with regard to cooperative traffic information for drivers (e.g. “In-Vehicle Information” service) is needed to ensure regional independence of such services.

In addition standardization within the different SDO’s has to speed up in order to facilitate the swift deployment of cooperative ITS and enable interactive Traffic Management applications. Currently the standardization progresses very slowly due to different opinions about protocols to be used. Members in the relevant working group WG16 in CEN should decide on a usable protocol for data transfer soon.

Need for a mechanism for open location data

The map on which information is presented to the user may differ among applications and solutions, among partners and actors (present and future). Shared maps are not used by road operators or by Traffic Management Centres, who on the contrary use their own network maps, which they have themselves developed over the years or using a proprietary digital map provided by one of the map providers.

If it can be ensured that the information provision is independent of the map, this would ease the exchange between TMCs, vehicles and mobile units. A mechanism to facilitate this exchange between public-public, public-private and private-private actors should be put in place and agreed by involved actors (e.g. exchange of information between public and private service providers). TN-ITS mechanism is a good example that is viable to be further extended. Open and shared location data could be an enabler to enhance the exchange of traffic information independently from the map on which it is presented to the end customer.

Long transition period to reach sufficient penetration of vehicles and compatible TMC's

Interactive Traffic Management will benefit from reliable real-time data on individual route plans and vehicle traffic data (probe data). In addition these data have to be combined with traditional sensor data and may finally even be processed in the vehicle navigational systems. Comparable to the deployment of cooperative ITS, a quite long transition period will be needed until a sufficient penetration of equipped vehicles together with TMC's which can process these probe and route plan data is reached.

A good way to showcase the capabilities and benefits of interactive Traffic Management and to prove its technical and commercial feasibility are lighthouse projects with limited scope. The TM 2.0 prototype initiative is a good starting point for this.

Need for correct mobile network dimensioning

Several traffic solutions are based on mobile networks and might affect the service providers of cellular-based solutions for traffic information systems and location data services. Other solutions use real-time data extracted from the signaling of the mobile networks and active mobile phones. Furthermore, in a Traffic Management system, position and speed of the vehicles are usually sent over the mobile network to the traffic control center.

A 100% mobile strategy should be always followed for innovative Traffic Management services. The accuracy of these services will depend on the availability and quality of the network coverage. This, in turn, will greatly depend on the correct dimensioning of the mobile network according to the estimated data traffic for the expected number of users of such services. It is however envisioned that the mobile networks will continue to expand all over Europe.

3. Organisational enablers and barriers

3.1 Enablers

Progress of Cooperative ITS data policy in Europe

Cooperative vehicle data, in particular probe vehicle data provided via a future C-ITS infrastructure, is an important prerequisite for an interactive TM. To fulfill their traffic management mission, road operators need cooperative probe data, possibly even in raw format. Probe data are vital for ensuring traffic flow, thereby supporting also traffic safety.

Due to the memorandum of understanding signed by 11 major European OEMs (CAR 2 CAR Communication Consortium / C2C-CC) for the deployment of V2X technology in the vehicles in 2015 and the letter of intent of the Amsterdam Group (C2C-CC, ASECAP, POLIS, CEDR), to define standards and foster deployment in cooperation of road operators, cities and OEMs, it is expected that real-time traffic data as a Day One application will become a reality soon. The open data policy for cooperative probe data, as it is supported by the EC, the ITS Action Plan and the Priority Actions b and C as well, are therefore important enablers.

3.2 Barriers

Lack of Security Infrastructure for Cooperative Vehicle Data

Vehicle probe data provided via broadcast media must be secured via a complex security infrastructure, which is not in place yet. The security principles needed to ensure the integrity and privacy of vehicle data are currently being standardized. However the required Public Key Infrastructure (PKI) with the defined hierarchy of Certification Authorities (CA) and the business model for these entities is not in place yet.

The C2C-CC intends to tender a Root CA which has to serve as the center of trust for the entire PKI. In the long run, a European-wide neutral body should be responsible for this important function. OEMs will probably take the role of the long-term CA, responsible for providing certificates assigned to vehicles during production. The short-term CA's which are needed to ensure the privacy should be managed by private companies. The financing of the CA's could be done in a PPP model, where long-term certificates are part of the vehicle cost and the remaining parts of the PKI are financed by the public.

Need for common data formats for intermodal traffic information

Intermodal traffic information for drivers is a complicated issue, as it requires cooperation and standardized data exchange as well as dynamic interaction between transport operators and road operators. This is even more true for international routes. Currently only a few countries provide transport data in an exchangeable format at all.

Public authorities have to regulate transport data exchange between data providers. Transport service providers and road operators have to agree on common data formats.

4. Business-related barriers

No clear return of investment for involved actors

The big question is who will afford the investment needed to upgrade the required systems. The TMCs should be convinced about the expected value from investing in innovative Traffic Management services. It is expected that handling probe data will be cheaper and easier for the TMC than maintaining own sensors. Still, in order to provide innovative Traffic Management services several additional transactions will be needed, some possibilities are the following. Some applications might require "extended data" that implies some pre-processing at the TMC/TIC level. Individual route plans from vehicles will either be directly transferred to Road Operators or via Service Providers, who will consolidate multiple route plans for use by Road Operators. Road Operators may have to be reimbursed for managing the communication network (e.g. DSRC) and providing traffic information. Road operators may require individual probe data, they may have to cover the costs for pre-analyzing traffic data and may be reimbursed for providing traffic data to Service Providers. Traffic information Service Providers may provide traffic analysis to Road Operators, they may have to reimburse Road Operators for traffic information and they will provide traffic information to drivers.

In order for the involved stakeholders to proceed with the required investments, the return of investment should be clear, possibly considering the above required transactions. A very clear understanding and harmonisation of use cases by all involved stakeholders is needed, in order to reach consensus among them. The return of investment should not be based only on monetary profits. It should also take into account societal gains and benefits, like for example provision of better services to citizens and customers and the impact from them.

Users' Privacy concerns

The users' willingness to share data has to be definitely taken into account, when designing innovative Traffic Management services, as well as their concerns about privacy. Accurate traffic information is perceived as a standard service by drivers. Experience in Europe has shown that systems that can track location have been broadly accepted when there are clear advantages to using the system and when the consumers trust service providers to handle their personal data securely and responsibly within an explicit voluntary system.

Probe data is subject to EU national laws, specifically laws transposing EU Directives 95/46/EC and 2002/58/EC as amended by Directive 2009/136/EU into the national laws of the EU28 Member States. "Collecting probe data from a car using a public telecommunications network requires freely given, prior, informed consent in those cases where the probe data is not strictly necessary for the delivery of an information society service explicitly requested by the driver".[2] According to the law in EU, location data

[2] Extract from Interim report. Probe Data Working Group (iMobility)

continuously obtained from a car is also to be regarded as sensitive personal data. Location, speed data and g-force data obtained through probe data should not be kept in identifiable form for a period longer than 24 hours.

Most of the Service Providers are able to fully comply with privacy laws and they make use of some sort of 'privacy by design' schemes. For example, a short text will always appear when the Personal Navigation Device (PND) or in-dash solution is turned on in a vehicle, informing the driver on the planned use of data coming from this device and asking for the driver's consent. If the consent is indeed granted, the data received by the device are anonymised and not stored in the device.

These procedures should be made very explicit to users, so as to settle down their concerns. Still, apart from probe data themselves, it has to be secured that privacy is not undermined by fusing probe data with data from other sensors (e.g. traffic cameras).

5. Legal barriers

Liability problems in case of wrong data provision

The provision of erroneous data may have legal and liability implications for some of the involved service or data providers.

If the information service is considered as a recommendation to the driver which is not safety-relevant, the service will only be a decision support and there will be no liability issue, as in case of malfunctions it may be considered as a bad service. Still, all possible liability issues need to be clarified through relevant consultation and working groups among legal experts.

Unspecified ownership of data

Many stakeholders are interested in vehicle data. OEMs are interested in vehicle diagnosis data, traffic service providers and road operators in vehicle probe data, insurance companies in vehicle data related to the driver behavior. There is still an ongoing discussion amongst car manufacturers and road operators who owns the data originating from the vehicle.

It currently seems that the vehicle data will belong to the car-owner, although this has still to be agreed on an official basis. GM made a commitment in this direction at the ITS World Congress in Detroit. Moreover, an agreement for anonymous open use of probe data between OEMs and road operators is quite likely due to the public interest in such data. Chances are quite good that vehicle data needed for traffic management purposes will be

open for use by road operators. Even if the car owner will be the legal owner of the vehicle data, he/she probably will have to sign up for insurance or OEM specific services, but probe data should stay open data.

6. Conceptual barriers

Concerns about the reliability of exchanged data

Traditional sensors on the road network, used by most TMCs, can give high quality information, but their acquisition and maintenance cost is very high and their road network coverage is very limited. Probe data, on the other hand, is cheaper to collect and obtain and can cover the entire road network, but their quality and reliability always depends on the service provider offering it. Traffic Management Centres are sometimes concerned about the reliability of probe data coming from connected devices and vehicles. A major question raised by some TMCs is why they should rely on information coming from external sources and how to measure the reliability of such data by using commonly agreed quality indicators.

The Traffic Flow Q-bench Task Force within TISA is in part tackling this issue, although it is not appropriate for raw data. The developed methodology still needs to be improved so that it can be consistently applied to various markets and environments but it is commonly accepted by both OEMs and service providers as the quality standard to be used in assessing the reliability of exchanged data. TMCs should define minimum requirements for data to be used by them. Before being able to broadcast raw data, a Service Provider should be somehow certified, while data coming from TMCs should be also certified.

Political acceptability

There could exist a lack of political or public acceptance of innovative Traffic Management, while restrictions imposed by pressure groups, and cultural attributes, such as attitudes to enforcement, can influence the implementation and effectiveness of innovative Traffic Management.

An explicit policy of a city/road operator concerning the informed user should be in force. A policy means to have a clear goal and strategy to provide every user with available and reliable traffic information, which is more than only providing open data. Such a policy would support the acceptance of new approaches like innovative Traffic Management. Awareness about the need for such a policy should be raised, highlighting the potential benefits. Awareness actions could be organized via city-related and other relevant platforms.

3. Prioritisation

The following table summarises the identified enablers and barriers and assigns priorities to them. The **Impact priority** is based on a scale from -5 (very severe barrier) to +5 (very important enabler). The **Implementation priority** is based on a scale from 0 (very difficult to implement or to overcome) to +5 (very easy to implement or to overcome).

Short name of the barrier or enabler	Impact *-5 (very severe barrier) +5 (very important enabler)*	Implementation *0 (very difficult to implement or to overcome) +5 (very easy to implement or to overcome)*
Technical		
High penetration of Navigation Devices	4.7	3.5
Increase in penetration of reliable traffic information	4.3	3.3
Lack of compatibility with legacy systems	-2.6	2.0
Lack of interface standardization for route/traffic management plan data between vehicles and service providers	-3.2	3.2
Lack of common standards for vehicle probe data and slow progress in standardization	-2.4	2.4
Need for a mechanism for open location data	-2.1	1.9
Long transition period to reach sufficient penetration of vehicles and compatible TMC's	-2.7	1.6
Need for correct mobile network dimensioning	-1.3	2.0
Organisational		
Progress of Cooperative ITS data policy in Europe	3.1	2.7
Lack of Security Infrastructure for Cooperative Vehicle Data	-1.3	1.3
Need for common data formats for intermodal traffic information	-1.4	2.7
Business-related		
No clear return of investment for involved actors	-2.3	3.4
Users' Privacy concerns	-1.3	3.4
Legal		
Liability problems in case of wrong data provision	-0.6	3.9
Unspecified ownership of data	-2.0	3.3
Conceptual		
Concerns about the reliability of exchanged data	-1.7	2.6
Political acceptability	-2.1	2.7

5. Conclusions and next steps

The recent technological developments in cooperative systems will enable in the near future the direct data exchange between vehicles or nomadic devices and Traffic Management centres. This will boost the creation and provision of personalised mobility services but also the provision of more accurate and more efficient traffic management services in general.

This report presents several developments and trends that may facilitate the development of such services and the areas where more work is needed and specific actions should be undertaken so as to facilitate the provision of such services by Traffic Management Centres and service providers. The first are denoted as “enablers” and the latter as “barriers” and have derived according to expert discussions. The fact that the listed barriers are more than the enablers should not appear as discouraging. The authors’ opinion is that enablers are the existing opportunities that should be utilised by the traffic management community in the future, while barriers are still open issues where a solution should be given in due time.

In conclusion, it is expected that the provision of innovative traffic management services will be greatly facilitated by the high penetration of navigation devices in vehicles and nomadic devices, by the increase in availability of reliable traffic information by connected mobile users and by the progress already made in Europe as regards cooperative ITS data.

On the other hand, the consensus in the development of appropriate standards will play a crucial role in this direction. Probe data should be possibly open and there should be a commonly accepted methodology ensuring the reliability of processed data. Probe data as well as the interface for data transfer between navigation systems and Traffic Management plans could be standardised and secured by a security infrastructure. This is even more true for intermodal traffic information. Users’ privacy concerns should be respected. Also, an agreement among service providers as regards the exchange of information presented on maps would greatly facilitate such services.

To collect reliable data and to provide reliable services a sufficient penetration should be reached, and the mobile networks should be dimensioned according to the expected data traffic after the existence of such services.

The existing infrastructure of TMCs could be upgraded to become interoperabe with vehicles of several manufacturers and several service providers. The relevant return of investment required for this upgrade should become evident to decision makers, although it should not be based only on monetary profits. Relevant policies should be put in place and wide awareness actions should be undertaken.