

TM2.0

Enabling vehicle interaction with traffic management

TF3 Principles for data

Report

July 2015

## Outline

The focus of *Task Force 3 - Principles for Data* (TF3) is to provide the basis for data exchange between traffic management and in-car service providers, which should enable TM2.0 services. This includes identifying the necessary data sets, determining quality requirements for these data sets, and defining requirements concerning privacy and security. It is essential that all stakeholder groups are involved in this process, so the requirements from all parties are covered. This is ensured as TF3 members (road operators, traffic management solution providers, mobility service providers, research institutions and public authorities) cover the main elements of the information chain.

TF3 started in September 2014. The results of TF3 reflect the current situation with regards to data and its principles. However, it should be easy to add new data sets and services at a later stage and to apply the elaborated principles also to these new data sets and services.

The focus of TF3 is:

- Definition of data sets and sharing data being used for providing added valued traffic information and management
- Address critical issues related to the sharing of data (including privacy, security and legal issues)

In *Task Force 3 - Principles for Data* the following tasks were carried out:

- Collection of data sets that are necessary to close the loop between traffic management and in-car service providers
- Characterisation of the identified data sets
- Identification of the most important TM2.0 services (based on a voting among TM2.0 members)
- Visualisation of interrelations between services and data sets
- Definition of the use case – *Traffic measures and individual routing information based on PVD*
- Graphical representation of potential data exchange links
- Identification of the data sets that are most important to be exchanged
- Identification of critical issues

The results of these tasks are described in this report. Detailed information is available in the document *TM2.0\_TF3\_Annex draft report\_Collection of data elements* which is attached to this report as an annex.

The conclusion of TF3 is that the information concerning data is available on a general level, but for going into the details a decision on TM2.0 level, on what the most important issues are, is needed. It is not possible to cover each aspect and each combination of aspects in this task force. Additionally, the clarification of the identified critical issues is necessary (on TM2.0 level), as they cannot be solved by TF3 only. Scalable, simple implementations would help to focus the work on the aspects that really have to be solved.

In the first part of this document the results of the work carried out in TF3 are presented. In the last section information on identified critical elements is provided together with recommendations.

## Identification and characterisation of data sets

The first task carried out by TF3 was the identification of those data sets that are necessary to close the loop between road authorities/traffic management and in-car service providers. This task started with the collection of possible data sets by the members of TF3. Every member had the possibility to add data sets that could be provided or that would be needed. So the members of TF3, each with its specific view and experience (including the projects in this area), contributed to an extensive collection of data sets. After that and partly in parallel a more detailed description of the different data sets was elaborated, and the table of sets has been consolidated so that the single data sets are comparable. This was particularly necessary because there have been overlaps between the data sets. As a result an agreed list of data sets with a characterisation of the different sets is available.

The following data sets have been identified:

- FCD (Floating Car Data)
- PVD (Probe Vehicle Data)
- Event driven cooperative vehicle data
- Post processed traffic data
- Individual route plans
- Stationary detectors data
- Traffic management measures according to traffic management plans
- Traffic management relevant measures
- Scheduled events
- Safety critical messages
- Social media data

For these data sets detailed information concerning the following aspects has been provided:

- Short description of the data set
- Data elements in the data set
- Source of the data
- Receiver of the data
- Which is minimum frequency for the intended purpose
- Is there a willingness to share these data and who is willing to share it
- Preferred way of exchange of data (raw data, aggregated data, service)
- Service which is facilitated by the data set or to which the data set will contribute
- Time frame for realisation of a data exchange (near term / mid term)
- Are standards already available
- First indication of possible sharing models

As mentioned above detailed information on the data sets is available in the document  
*TM2.0\_TF3\_Annex draft report\_Collection of data elements.*

Additionally, the data elements have been classified into groups with similar properties (see Table 1). This allows deriving requirements for groups of elements instead of only single elements. Solutions and findings concerning these properties (e.g. for privacy) can then also be transferred to other data sets of the group.

	individual locations	aggregated measurements	events	itineraries	traffic management strategies
FCD					
PVD					
Event driven cooperative vehicle data					
Post processed traffic data					
Individual route plans					
Stationary detectors data					
Traffic management measures according to traffic management plans					
Traffic management relevant measures					
Scheduled events					
Safety critical messages					
Social media data					

Table 1 Clustering of data sets according to their properties

### Identification of the most important TM2.0 services (based on a voting among TM2.0 members)

It is important to have a clear view on the services that should be realised, as it is essential to know what shall be realised to be able to decide on how it should be realised. A first summary of TM2.0 services was available (from TM2.0 presentations), but to obtain more clarity, a poll on the most relevant TM2.0 services was carried out among the TM2.0 members at the end of 2014.

The results of this poll have been clustered into these three categories:

- Advanced navigation services
- Adaptive and dynamic traffic control
- Traffic status and event detection

Detailed information on the poll results is provided in Table 2, Table 3, and Table 4. The right column of the tables shows a short description of the service and the left column shows the number of received votes.

<b>15</b>	<b><u>Advanced navigation services</u></b>
2	Navigation services
4	Advanced Navigation services taking traffic management plans into account
3	Advanced Navigation services taking capacity into account for prediction purposes
3	Individual routing
2	Individual information and advice
1	Enable the delivery of individual information and recommendations to the road users

Table 2 Advanced navigation services

Looking at the results of the poll concerning *advanced navigation services* it can be summarised that the goals in this area are to

- improve the quality of the service (e.g. more detailed information)
- add new information to the services (e.g. scheduled events, TM Plans) and to
- personalise information (e.g. in contrast to VMS information)

The services and the way they are realised lead to several requirements concerning the data that are exchanged. Therefore it is important that the stakeholders realising TM2.0 services are actively involved in the elaboration of the requirements concerning the exchanged data.

<b>18</b>	<b><u>Adaptive and dynamic traffic control</u></b>
5	Adaptive and dynamic traffic control
1	Use historical probe data to analyse the impact of the traffic management control & decisions
1	Aggregate probe data in a traffic management control & decisions as an additional source of real-time sensor information
4	C-ITS services (Traffic light services such as speed advice, count down, Road hazard warning, In-vehicle signage)
3	O-D data for more efficient traffic management measures
2	Legacy and evolution of current systems - Integration of traditional and probe data
1	Traffic management procedures
1	Enable the collection of probe data for the purpose of traffic management with a minimum of data

Table 3 Adaptive and dynamic traffic control

Looking at the results of the poll concerning *adaptive and dynamic traffic control* it can be seen that the goals in this area are to

- be able to set better, more precise measures due to
  - better information on the current traffic situation
  - better understanding of the effects of TM measures
  - prediction based on OD information
- make measures more effective due to personalised presentation of information
- realise new strategies for TM measures due to direct access to single vehicles

Also in this area strong contributions of the stakeholders realising the services/measures are necessary to achieve valuable results in TF3.

<b>8</b>	<b><u>Traffic status and event detection</u></b>
<b>2</b>	Congestion detection
<b>2</b>	Detection of traffic relevant incidents
<b>1</b>	Probing
<b>1</b>	More detailed information on the current state of traffic
<b>1</b>	Privacy, Security and data collection (not a service, but an important aspect)
<b>1</b>	Speed profiles & Traffic Information Services for users/drivers; for OEMs; for Road Operators and Public Authorities
	<b><u>Additional services</u></b>
<b>2</b>	Special vehicle priority (PT priority, heavy vehicles, emergency vehicles using CAM messages)
<b>1</b>	High quality services (real time and reliable)
<b>1</b>	Improved level of services (LOS)

**Table 4 Traffic status and event detection and additional services**

The services in the category *traffic status and event detection* aim to improve the quality of traffic status information and event detection. These services can therefore contribute to improve both categories *advanced navigation services* and *adaptive and dynamic traffic control*.

### Visualisation of interrelations between services and data sets

Services can be realised in different ways, based on different data sets (which can also be on different levels/positions of/in the information value chain). For example a service provider could buy weather data (data set: weather data) from a third party and provide this info along with its traffic info to its customers (service: individual information and advice' under the Mobility services category). The significance of a data set depends on its contribution to services (criteria are the importance of the service itself and the relevance of the data set for the realisation of this service). The services have been clustered into the categories navigation services, personalised en-route information/services, traffic control strategies, traffic management plans, and traffic status and

events detection. Table 5 shows the most important contributions of the identified data sets to the different groups of services (basis: *TM2.0\_TF3\_Annex draft report\_Collection of data elements*).

	FCD	PVD	Event driven cooperative vehicle data	Post processed traffic data	Individual route plans	Stationary detectors data	Traffic management measures according to management plans	Traffic management relevant measures	Scheduled events	Safety critical messages	Social media data
Navigation services											
Personalized en-route information/services											
Traffic control strategies											
Traffic management plans											
Traffic status and events detections											

Table 5 Groups of services and data sets

### Use case Traffic measures and individual routing information based on PVD

It was decided to define use cases to show/define the priority of TM2.0 data exchange links. The definition of use cases should also support the detailed analysis of interfaces, access procedures, privacy and security issues, and quality requirements. Additionally also the reference model developed by TF1 should be validated with the help of these use cases.

In order to support the above mentioned goals the use cases have to be described in a simple, focused, and precise way. Each use case should contain the whole loop, and each stakeholder should be included.

As a starting point the use case *traffic measures and individual routing information based on PVD* was developed by TF3 and then handed over to TF1 for complementation. The use case description is shown in Table 6.

Location of the action	Action
Vehicle	Mr. X is driving on the high level road network.
Vehicle – RSU	The vehicle broadcasts information on time stamp, current position, speed, heading, vehicle class.
RSU – TMC	The information of the single vehicles is collected in the RSU (road side unit) and transferred to the TMC (traffic management center).

Vehicle – ICSP	Information on his current position, speed, and heading is transmitted continuously via the navigation device to the in-car service providers (ICSPs).
ICSP	The MSPs aggregate data from several vehicles and generates (together with other data) information on the current traffic situation.
ICSP – TMC	This information is provided to the TMC.
TMC	In the TMC this information is used to improve the accuracy of the information on the traffic situation (particularly in areas where the density of sensors is low). For example in an area with too low sensor coverage a traffic jam is identified on the basis of the data provided by the MSPs.
TMC	As a measure the current speed limits in this area are reduced. TMC informs about TMP (traffic management plan) in order to avoid new congestion on alternative road.
TMC – MSP	The new speed limits are displayed on VMS and also provided to MSPs.
MSP	The MSPs use the identified travel times, new traffic management measures, and TMP for calculating route updates.
MSP - Vehicle	The MSPs provide traffic information and route updates to the vehicle.
Vehicle	Mr. X sees the new speed limits also on his navigation device in his car. As there is an alternative route to his destination with best travel time this alternative route is recommended to him.
Vehicle	Mr. X follows this recommendation and saves time.

Table 6 Traffic measures and individual routing information based on PVD

After respective experiences with the utilisation of this use case have been made, additional use cases can be defined.

## Critical aspects identified in TF3 and recommendations

Principles on data depend on what data is exchanged, between whom it is exchanged, and what are the conditions for the data exchange. For example, there is a huge difference in the principles that have to be applied, if data is exchanged only bilaterally (as it is already in operation in some areas), or if it is provided to interested stakeholders via a common platform (after it was processed there). As it is not feasible to assess all possible combinations with the resources available, it is necessary to concentrate on the most important aspects . This means that

- (1) it has to be decided which specific data sets should be prioritised for assessment (this does not mean that others will not be assessed), and
- (2) that there has to be an agreement on how data could be exchanged.
- (3) Scalable, simple implementations are very important.

Both points cannot be decided by TF3 alone, but have to be discussed and agreed on TM2.0 level.

## 1.) Data sets to be assessed

As it is not possible to go into the details of the requirements for exchanging all the identified data sets, there should be a concentration on those that are most important for realising TM2.0 services. A first proposal has been made by TF3: FCD/PVD link from in-car service providers to the TMC, and TM relevant measures from the TMC towards in-car service providers. In the General Assembly meeting it was emphasised that the exchange of traffic management plans would be very important to realise TM2.0 services. Another important aspect would be to consider particularly those data sets for assessment that will be realised in first TM2.0 sites. This would have the advantage that the assessment would be very concrete and that all open issues are discovered during the implementation phase.

An important task would be to discuss and develop within TM2.0:

- How the Traffic managers will transfer the traffic plans and measures related data to service providers (what kind of data will they send them? New speed limits? New lanes? New capacities? ...)
- How the service providers will use this data for providing a better service to their users (some of the plans and measures will not create data to be exploited by individual users, such as new traffic lights plan, which will give a better service to the whole traffic, not individually to the ones equipped with TM2.0 devices)

A good starting point for understanding the above two issues could be to list a set of traffic managements plans and measures that would be adopted in TM2.0 and what kind of data would be provided to service providers. Then we would be able to try to figure out what kind of service could be provided or what would be the impact on the existing services.

## 2.) Exchange of data

As mentioned before there are different aspects which have to be discussed and agreed on to reduce the number of possible use cases so that the next steps can be carried out with reasonable resources.

As open issues and partly as barriers for the realisation of TM2.0, the following aspects have been identified:

- Conditions to use: Conditions for combining different data sources and for the publication of results that have been derived by using data from different providers have to be clarified.
- Quality (with a strong link to conditions to use): Transparency on the data aggregation algorithm and comparison of data is important, as it is essential for the further use of data to have information on the quality of data sources. The simplest solution, however, would be to get raw data, but still labelled in quality.
- Contracts: It is important to clarify the options for contracts. One proposed approach was that there should be one contract that allows combining and publishing data of different sources instead of establishing different proprietary contracts between different stakeholders. This contract could also permit different conditions for different use of data (e.g. number of users).

- Avoid solutions which are depending on single stakeholders.

Connected to these open issues is the question, if it is necessary to have a radically changed approach to overcome these barriers. Questions would be at which level the data exchange has to be carried out and where the added value is generated (see Figure 1) and if it could be a solution to use (common) data fusion engines or TM2.0 traffic management engines (which would guarantee that TM2.0 criteria are met).

### 3.) Scaleable, simple implementations

It was proposed that TM2.0 pilot implementations could be established on existing pilots. Under these circumstances it is crucial to have a business case in order to see how the system can be implemented on that specific business case, including scalability, and options for building extensions. This could start at a small scale and is able to be extended later. These implementations should be integrated in the TMC and in-car services as a permanent procedure.

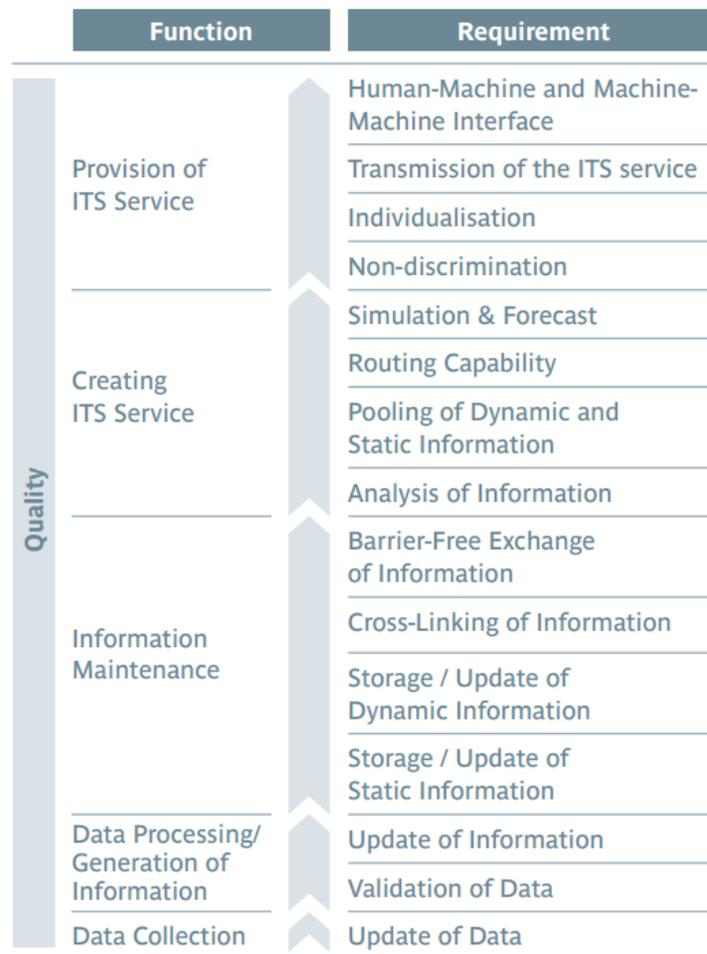


Figure 1 Functional Framework to Describe ITS Services (source: ITS Action Plan Austria – Executive Summary, Federal Ministry for Transport, Innovation and Technology)

