

Taskforce on TM2.0 as a Trusted Network final report

---

**Document Name:** *TM2.0 as a Trusted Network final report*

**Contributors:** *Taskforce on TM2.0 as a Trusted Network, Chaired by Jop Spoelstra, Technolution.*

---

## Table of Contents

Taskforce on TM2.0 as a trusted network .....	2
The Extended Trust Model .....	2
The TM2.0 Trust Model .....	4
Stakeholder Behaviour.....	7
TM2.0 collaboration Values and Collective Goals.....	8
Stakeholder categories and individual goals.....	9
Level 1 behaviour.....	9
Level 2 behaviour.....	11
Level 3 behaviour.....	13
Data Character and Communication.....	15
Data required for achieving collective goals .....	15
Data and measure/service availability assessment.....	15
Collaboration Structure.....	16
Evaluation Structure .....	17
Service Quality and Availability .....	18
Service Quality and availability requirements .....	18
Service Impact Assessment and KPI's.....	18
Service Quality and Impact Measures.....	19
System Security and Confidentiality.....	19
Trust .....	20
Established Trust.....	20
TM2.0 trusted approval .....	20

## Taskforce on TM2.0 as a trusted network

The taskforce on TM2.0 as a trusted network has started in February 2019 with the main aim to define the role of Trust in TM2.0 collaboration and to work towards stepwise implementation of this notion. Trust is seen as a binding factor in TM2.0 collaboration to establish effective collaboration between public and private stakeholders with different backgrounds, which exceeds what legal contracts might be able to entail and enforce. Moreover, Trust is something that is designed into a collaboration scheme beforehand, and is difficult if not impossible to add later on.

The findings of this taskforce have been presented during the ITS Europe congress 2019. In approaching what the role of Trust is, from what elements Trust is established, and where the balance lays between contractual agreements and trust, the Extended Trust Model<sup>1</sup> is used as starting point. This model finds its origin in implementation of collaborating distributed computational systems, and will be translated towards application in the TM2.0 domain. Below, this original model is explained in its original form. Thereafter, the different levels on the model and the elements constructing these levels are further explained in TM2.0 context, working towards implications for stepwise implementation.

### The Extended Trust Model

The Extended Trust Model<sup>1</sup> by Bruce and Dempsey (1996) is established within the context of implementation of distributed computational systems, where different systems from different stakeholders will have to align and understand each other's functionality, quality levels, security requirements and availability requirements for the whole system to successfully collaborate. Given the similarities in multi-stakeholder collaboration within the context of enhanced traffic management, this model is used as starting point in our approach of Trust.

The model is designed from the understanding that unless all components that make up a system meet the required trust level, the system will not be used, or only partly. Trust is established when each stakeholder feels that all of the specified qualities have been satisfied. As with any collaboration, there is a need to define what the boundaries of trust are. However this is difficult to pinpoint exactly, as the boundary must be wide enough to be able to promote the collaboration functionalities (which may vary) without introducing too many risks (which may vary).

---

<sup>1</sup> From Bruce, G., Dempsey, R., (1996) 'Security in Distributed Computing', *Prentice Hall*, New Jersey, US

The Extended Trust Model consists of four levels:

1. Functionality of the system enabling the intended behaviour
2. Quality of operations of the system
3. Security of data handling and communications
4. Availability of the system

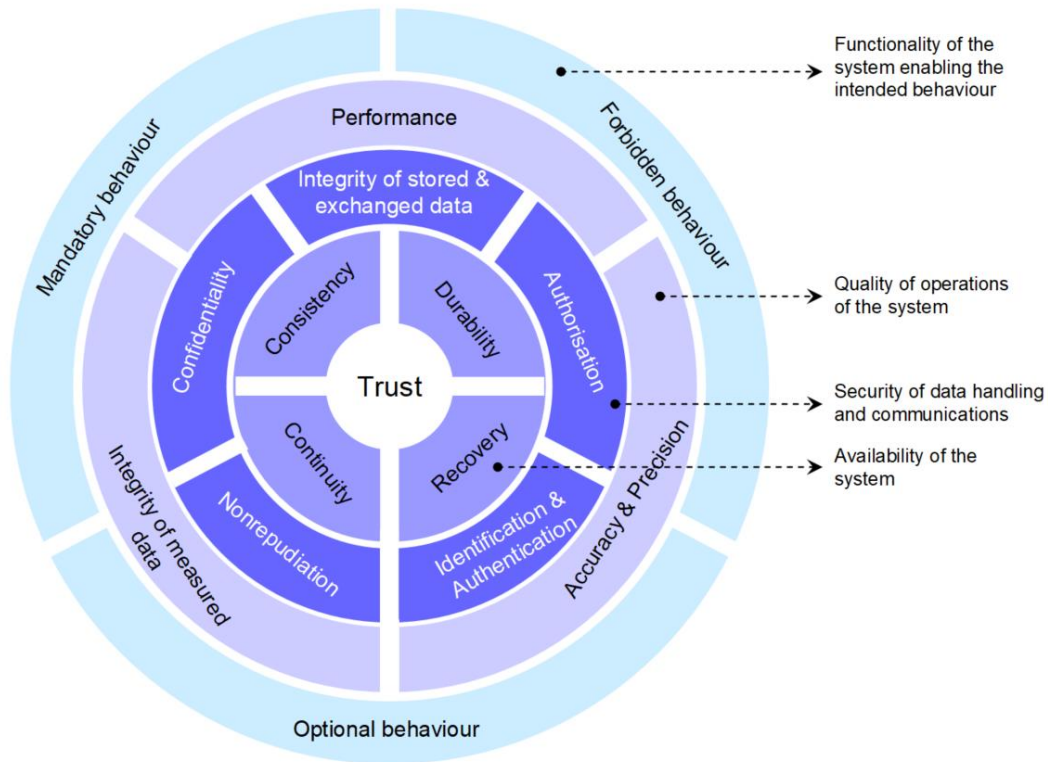


Figure 1. The original Extended trust model as applied in Distributed Computational Systems context (Bruce, G., Dempsey, R., 1996)

These levels can be seen as a stepwise approach to establish trust in any collaborative scheme, whereby first shared values, visions and collective goals are found, together with sharing individual goals for individual stakeholders within the collaboration. From this, an understanding can grow on what to jointly aim for, and what to expect from the others. Based on this, steps can be taken to fill this in more detail, such as defining what levels and quality of data-sharing are required, which services can be exchanged based on this information, and what impact is expected. When these levels are established, even more detailed elements need to be established such as security principles, confidentiality of data handling and availability requirements.

## The TM2.0 Trust Model

When translating the Trust Model towards TM2.0 collaboration in a Traffic Management context, the multi-level approach is continued with step-by-step growing from the higher level towards more detailed levels establishing the notion of Trust. As the level of required trust is dependent on the level of ambition in a TM2.0 scheme, and therefore on the level of interdependency and perceived risk by stakeholders, some trust levels are dependent on the ambition level of a collaboration (level 1, 2 or 3). The structure of collaboration levels and the different trust levels is shown below in the TM2.0 trust model, and are explained after the model in more detail.

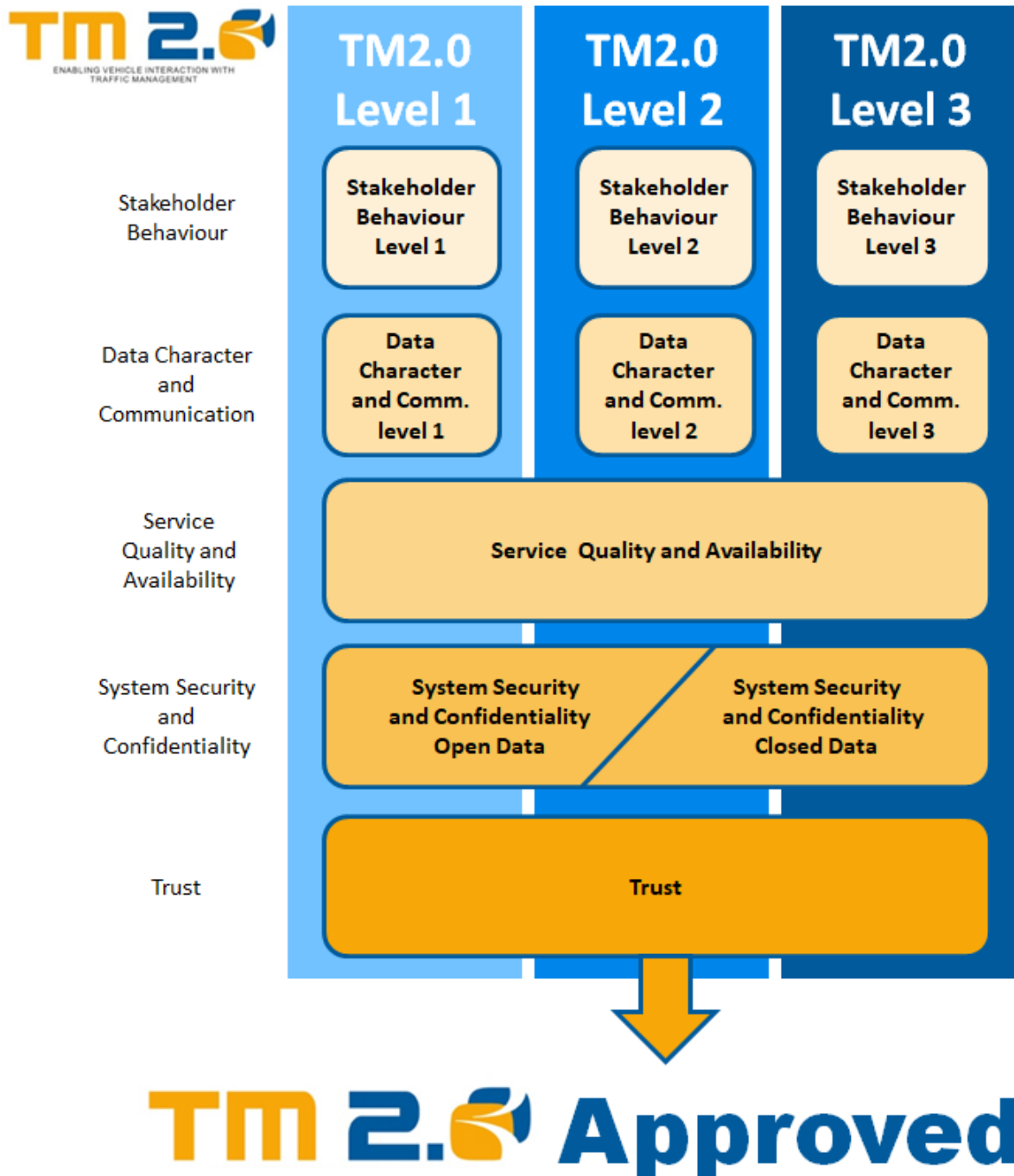


Figure 2. TM2.0 trust model overview

- Stakeholder Behaviour
  - In this level, the collective TM2.0 vision and goals of a collaboration scheme are jointly identified by stakeholders. Also, the individual goals from several types of TM2.0 stakeholders are identified and shared. The alignment of these two different types of goals will establish the win-win equilibrium that will form the incentive for stakeholders to be involved in TM2.0 collaboration. The more complex the level of collaboration, the more concrete and clear this win-win should be. From that 'ground truth' of goals and ambitions, the minimal required behaviour, the optional behaviour and the forbidden behaviour is established per collaboration ambition level.
- Data Character and Communication
  - In this level, a content inventory is done as to which types of data are required for achieving the collaboration goals, and how extensive this data-communication is should be. Again, different collaboration ambition levels will require different forms of data-exchange and communication structures to be implemented. For example, should shared data merely contain traffic related and/or other measured information, or is there also sharing of available traffic management measures and services that are potentially activated by stakeholders, and possibly even data exchange for assessment and valorisation purposes.
- System Quality and Availability
  - In this trust level, requirements are described regarding the quality of the data and communication, and availability of the system and services. It is assumed that these requirements will not differ between different collaboration ambition levels as all levels aim for a reliable and high quality system and collaboration, and are therefore seen as generic for the different collaboration levels.
- Data Security and Confidentiality
  - This level will describe the TM2.0 basic principles of data and communication security, and aligning with data handling and security legislation such as the EU NIS directive. This trust layer is divided in two categories: open-data and 'closed' data communication, as open-data communication will not require aspects such as authentication, authorisation, confidentiality, etc.
- Trust
  - Now that these elements in the levels above are established, a definition of trust and a description how trusted cooperation works within the TM2.0 network will be provided, together with what this trust is and what is gained from it.

## Levels of Collaboration

The extent of trust that is required for an effective collaboration, and thus to which level of the trust model one aims to grow, strongly depends on how extensive this collaboration is aimed to be. Within the Socrates 2.0 project, different collaboration models are described that range from merely exchange of information without any expectations on what other stakeholders do with information, to extensive collaboration with strong expectations on how the information will be used by other stakeholders. These levels (“collaboration models” are described below and originate from Socrates 2.0 documents<sup>2</sup>.

	• No joint approach • Exchange info	• Exchange info • Common insights	• Joint approach • Common insights • Coordinated services
Situational	CM1	CM3	CM5
Operational			
Tactical	CM2	CM4	CM6
Strategical			

Figure 3. Six cooperation model options from the Socrates 2.0 project

The four levels plotted on the left side of the figure range from Strategic to Situational:

- Strategic
  - The Strategic Traffic Management level is the level in which TM strategy and policy is made. Here, the question is answered: What do we want to achieve with a Traffic Management approach? For example, is congestion reduction on highways more important than on provincial roads, and are emissions important and to which extent?
- Tactical
  - On the Tactical level the TM policy is translated to concrete traffic measures, answering the question: How can we bring the TM policy into practice? This could be by designing coordinator traffic management services and traffic scenario approaches, and really maps the TM policy on the possibilities at hand, or the need for new possible measures
- Operational
  - Operational traffic management is the level in which the results from tactical level (traffic management plans) are activated based on triggers and inputs from the actual (or predicted) traffic state. In this level the actual traffic state is monitored, and based on these observations the different TM possibilities are compared and activated
- Situational
  - Situational Traffic management is very much here-and-now traffic management. This level of traffic management is performed when the available traffic plans and tactics are insufficient (Unexpected incidents or events), or are not available at all.

<sup>2</sup> Socrates 2.0 project, Report Activity 3 Setting The Stage for Interactive Traffic Management, 2019.

### **CM1 & CM2 [Collaboration level 1]**

In both models, only information is exchanged between the partners. What to do with that information is totally up to these stakeholders. They are likely to have more information than before and they can use that to optimise their service. The difference between CM1 and CM2 is the level of detail of the information that is exchanged: situational & operational (traffic conditions, VMS messages active etc.) versus tactical & strategic ('reduce inflow' tactic is deployed, strategic goals of government etc.).

### **CM3 & CM4 [Collaboration level 2]**

In both models information is shared, and from that information a common picture of the current or expected situation is derived. Partners have the same 'picture' in front of them, however what they do with this information is for each partner to decide for itself. The difference between CM3 and CM4 again is the level of detail of the information that is exchanged: situational & operational versus tactical & strategic. An example of CM4 could entail that partners develop common goals and KPIs and individually assess their potential to contribute (impact) to this. This cooperation can also be the basis for an impact driven business model, where partners are incentivised (rewarded) to contribute to commonly agreed goals and KPI's.

### **CM5 & CM6 [Collaboration level 3]**

In both models information is shared, and from that information a common picture of the current situation is developed. Partners have the same 'picture' in front of them, and in this case, they actually coordinate what actions are taken on both public and private side. The idea is that they can strengthen and complement each other instead of sending contradictory messages. And they can have positive impact on each other's (and/or common) goals and KPIs in a coordinated manner. Also, in this case the cooperation can be translated into an impact driven business model. Once more, the difference between CM5 and CM6 is the kind of information that is exchanged: situational & operational versus tactical & strategic.

As such a level of detail is seen as unnecessary for identifying Trust elements, or the sake of identifying elements required for Trust this document will use three levels of trust.

- **Level 1:** CM 1 & 2
- **Level 2:** CM 3 & 4
- **Level 3:** CM 5 & 6

## **Stakeholder Behaviour**

In this chapter the expected and required behaviours are described for the categorised stakeholders and for each different collaboration level, and some approaches to implement such schemes on different levels. As with every level increase the risk and therefore need for trust increases, the behaviour typologies can be seen as cumulative. For trust to be reached in a level 3 collaboration, the requirements for level 1 and 2 also have to be met.

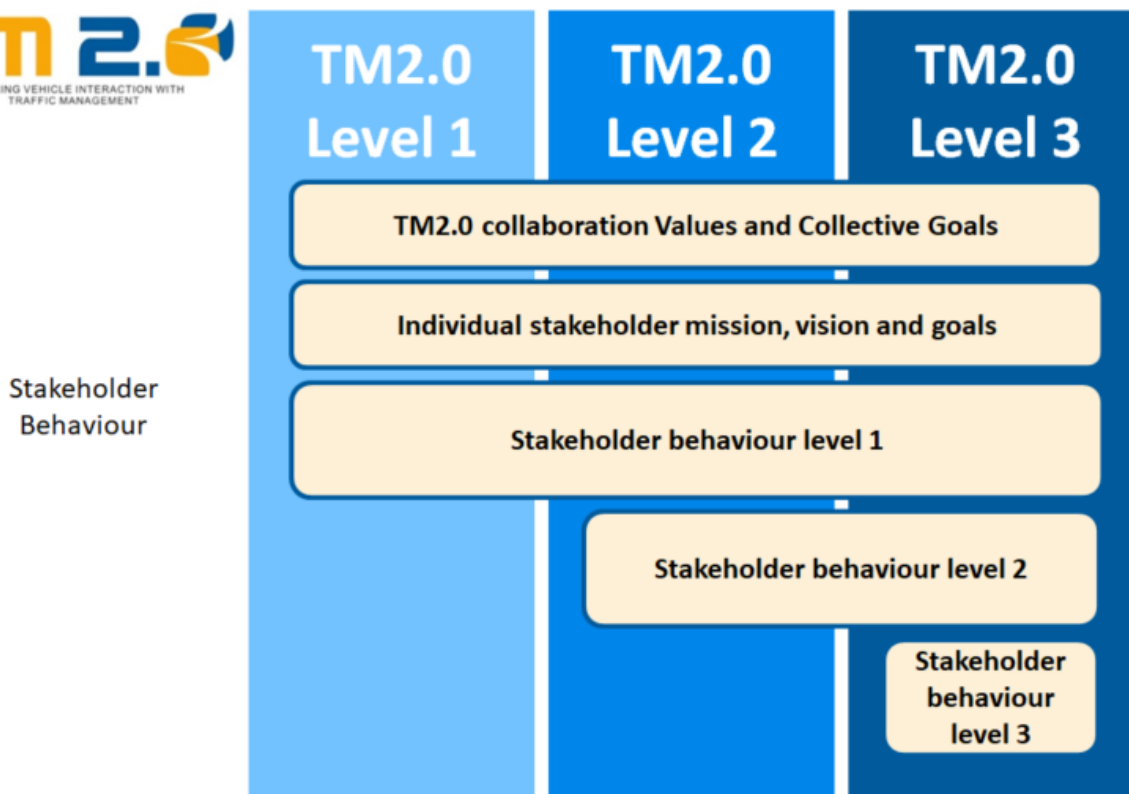


Figure 4. TM2.0 trust model, stakeholder behaviour segment

### TM2.0 collaboration Values and Collective Goals

Before engaging in TM2.0 collaborations on whichever level, it is important to establish what the common values and goals are that are strived for. These goals, in combination to the individual goals of stakeholders should lead to a win-win equilibrium between Road Authorities and Service Providers, and of course a Win-Win-Win where the win for the roadusers is involved as well. The TM2.0 innovation platform strives for this win-win-win collaboration, where through sharing of information and services between public and private stakeholders in European Traffic Management, effectiveness of services can be improved in a cost-effective manner, and will lead to smoother journeys for road users. Individual stakeholders in such a scheme will be able to uphold and improve reaching their individual goals, while sharing this benefit by helping other collaboration partners achieve theirs.

The members of the ERTICO TM2.0 innovation platform believe in cooperation among European traffic stakeholders in order to work towards:

1. Better insights in the infrastructure status for road authorities
2. More effective tools to influence this status where needed
3. Improved services that service providers can offer to their users

The TM2.0 concept focuses on enabling vehicle interaction with traffic management plans and procedures, keeping in mind the heterogeneous character that traffic management operations in Europe can have in terms of availability and quality.



## Stakeholder categories and individual goals

On the tactical level of traffic management (with strategic level being the policy development, and operational level being the actual execution of individual identified traffic measures), the situation in the network will be described and compared with the traffic policy to determine and analyse the bottlenecks, incidents and emergencies. For the services and measures to be triggered into action under TM 2.0, the vision and mission of the two main groups of road stakeholders have to be clarified: road authorities and service providers differ to a great extent in this respect given their different background, interests, operations and dependencies.

The vision on behalf of the road authorities is:

- Safe, efficient and sustainable management of road infrastructure
- Use available means for traffic management in the most (cost-)effective way
- Responsibility for road infrastructure
- *In the case where the road authority is a private organisation: competitive advantage*

The vision on behalf of the service providers is:

- Fast, efficient and safe driving experience for its users
- Make routing and navigation a tool for reliable journey planning and better driving
- Competitive advantage

The mission on behalf of the road authorities is:

- Cooperation with service providers so that a better overview of road infrastructure is gained, and more effective and individualised measures are available
- Gain better insight in what is happening on the roads by collecting data
- Improve ways of taking measures to adapt road infrastructure use

The mission on behalf of the service providers is:

- Cooperation with the road authorities to contribute to their tasks on traffic management
- Acquire knowledge of the TMPs so that the user/driver has the best information and service

The differing interests and viewpoints of the two groups of stakeholders in traffic management, have to be aligned according to the TM 2.0 concept. For TM 2.0 to work, stakeholders will have to understand and respect each other's interests and effectively translate the traffic management strategy towards measures taken by both. Win-Win-Win

## Level 1 behaviour

When aiming for a level 1 collaboration, stakeholders involved exchange traffic management information in order to improve the mutual understanding of the current infrastructure status, however this does not lead to operations from a common viewpoint (e.g. common operational picture) or coordinated activation of traffic measures. The information is exchanged between two or more stakeholders, under the assumption that this will benefit the collective goals, but without concrete agreements on how or for what purposes the data is used. An example of this is sharing real-time occupancy data of carparks by municipalities to service providers as open data, under the assumption that sharing this information will improve efficient use of parking capacities. There are no agreements on how this information is used by third parties. The fact that this collaboration

level involves little concrete expectation on what other parties will do with this information other than the general goal of better infrastructure insights for taking better TM decisions, means that risks for stakeholders are relatively limited and therefore the need for trust is not that extensive then other levels. Generally, in order to avoid stakeholders acting against the win-win equilibrium, and be actively counterproductive to individual stakeholder missions, stakeholders should be aware of the goals of parties involved and there should be a high-level agreement on for which purposes the information exchanged will be used.

### Required Behaviour

- Stakeholders should take notice of the joint win-win goal(s) of the collaboration (e.g. improve traffic safety, reduce congestion, improve air quality, etc.).
  - There does not need to be agreements on how stakeholders will enforce these goals using the exchanged information, but stakeholders should have the general intention to align with these goals.
- Stakeholders should share the information that is proposed in the data exchange, and make the context of this information known (what do the numbers exactly mean, in which format are they communicated, and what the reliability of this data is)
- There needs to be mutual data exchange between stakeholders ('give some, take some') in order to grow past just one-sided data-purchasing or sharing (e.g. based on commercial contracts), which would not be a TM2.0 collaboration.

### Optional Behaviour

- If the collaboration is also aimed at strategic collaboration, stakeholders could set up a joint set of goals the collaboration aims for. This does not require tactical level detailing of these plans, but the agreement on strategic level gives extra understanding of which collective goals stakeholders are aiming for.
- The character of data could be categorised in different priority levels and build up in a stepwise approach (e.g. safety related data as priority 1, traffic state information priority 2, traffic prediction information priority 3, incident context information as priority 4.).
- The fact that data is exchanged mutually does not mean that there are no exchange of financing, however this is to be decided between stakeholders and no requirement for TM2.0 collaboration as such.

### Forbidden Behaviour

- Use the information received to undermine the collective goals and individual goals from data-sender for individual gain. This would mean that sharing data would bring stakeholders in a disadvantage (either in traffic management measures or commercial position) and will bring the collaboration to a full stop.
- Provide misleading information or actively misrepresent TM reality. Data should represent the traffic management situation described in the data exchange context description.

### **Ambition level 1 implementation example: NAP sharing real-time traffic state data as open data**

In some European countries, the National Access Points (NAP) share real-time traffic state data (such as congestion levels and incident information) through open data with third parties. This is done under the assumption that sharing data on congestion will help drivers avoiding these stretches, thereby reducing the traffic inflow and reducing congestion buildup. In some cases this is done as open data, and in others these are two-way interfaces with specific third parties. They all have in common that there are no hard agreements on how this data is then used, apart from the alignment of TM goals (Public side improving their TM impact, and private side improving the reliability of the service.). The buildup of trust is therefore not needed on a high level, but is still important for involved parties to understand that the sharing of data increases their impact and achieving these goals. This is also important for the continuation of the collaboration.

### **Ambition level 1 implementation example: EVIS project**

The Austrian EVIS project is a cooperation project of the national motorway operator, the operators of federal roads, police, selected cities and service providers. It aims at implementing harmonized interfaces and a common format for exchanging and disseminating traffic information of different infrastructure operators as well as sourcing and creating this data in order to provide a comprehensive data basis for traffic information and traffic management. Basically, this represents a Level 1 cooperation.

For more info, see: For more info, see: <http://www.EVIS.gv.at>

### **Ambition level 1 implementation example: Traffic Light Forecast 2.0**

Traffic Light Forecast (TLF 2.0) is an ongoing project focusing on the non-discriminative access to traffic light data of the Free and Hanseatic City of Hamburg via the Urban Data Platform Hamburg. The open data approach and the use of standardized API allow diverse stakeholders using the data for implementing applications for different purposes. One example would be the implementation of so called GLOSA applications which aims at a smoother traffic flow. TLF 2.0 represents a typical level 1 cooperation as the overall goal of smoother traffic flow respecting speed limits is followed without specific agreements on how to achieve this overall goal.

### **Ambition level 1 implementation example: aVME - Automated Traffic Volume Detection**

The “Automated Traffic Volume Detection” (aVME) project aims at establishing vehicle counting throughout the Free and Hanseatic City of Hamburg. For this purpose, traffic lights are equipped with infrared cameras generating real-time data. This data will be accessible as open data via the Urban Data Platform Hamburg. Traffic management systems and operations will profit from the use of this data. Similarly to the TLF 2.0 project, aVME is considered as a level 1 cooperation as the data provided for an overall goal for different stakeholder without specific agreements.

## **Level 2 behaviour**

In a level 2 collaboration, not only information is exchanged, but this is brought together in a joint framework of common insights in the infrastructure status (e.g. common operational picture or ‘Network Monitor’ role), and sharing information within this framework on which measures are activated by which partners. There does not need to be agreement on which measures are taken when and on which grounds, however the fact that some are active will improve the reasoning behind the current infrastructure status and is therefore valuable information to know. In comparison to a level 1 collaboration, this level brings the need for a more detailed agreement on common goals and the win-win equilibrium, and some sort of data integration, and exchange of

data on active (or planned) traffic measures. This improves the relative risk of for example unintended data exposure, active traffic measure conflicts and sharing of (possible previously secret) TM strategies, and therefore a more elaborate level of trust is required for smooth collaboration in TM2.0 context. Given the fact that in this level data from different stakeholders are consolidated in one place, one approach for this level is to instantiate an intermediary party or 'trusted third party' where this task is performed on behalf of the other stakeholders.

### Required Behaviour

- Agree clear common goals on strategic and tactical level so that these can clearly be represented in the common insights (e.g. traffic state, incidents, air quality data, modalities, etc.). Just getting information together will possibly not serve specific goals aimed for in the collaboration, therefore the common insights must represent these goals, and therefore the data-input should be adapted to them.
- Agree on one party to integrate data (either one stakeholder that is trusted by other involved stakeholders or an intermediary party). Dependant on the activities of National Access Points (NAPs) the NAP could take such a role.
- Collaborate on data integration (common geographical mapping, align data formats, using agreed interfaces and/or standards etc.)
- Share active traffic measures and their impact

### Optional Behaviour

- Share predicted TM measures or measures to be activated in near future.
- Instantiate a trusted third party or intermediary to perform integration tasks in behalf of multiple stakeholders.

### Forbidden Behaviour

- Use data shared by others for purposes outside of the agreed common goals and strategies

#### **Ambition level 2 implementation example: Amsterdam Arena Eventmanagement Common Operational Picture**

On the southside of Amsterdam, the Dutch largest football stadium, and two of the largest concert halls are located within 500m radius. On nights where all three locations host events, the Operational Mobility Center is operational where multiple organisations related to the event organization (e.g. Representatives from the event locations, parking facilities, emergency services, public transport, service providers and road authorities) are looking at one Common Operational Picture, where real time data is visualized on traffic states, traffic predictions, crowd control, public transport capacity, ticket registration data etc. The COP is developed within the mobility program Amsterdam Practical Trials. The hierarchy is relatively untouched (emergency services still have full control in cases of incidents, event managers and parking providers are responsible for their own locations, and the road authorities still focus on their roads. However by actively sharing this data, looking at the same status and prediction and communication in one room, all parties are capable and willing to cooperate and align actions. Nevertheless, no hard agreements are made upfront on which partner will perform which actions based on which triggers. As the COP is used more often all parties experience the improved understanding and impact, and smoother events, and build upon this bases in collaborations to come.

For more info, see: <https://www.praktijkproefamsterdam.nl/en/cop>

### **Ambition level 2 implementation example: EVIS project**

Within the Austrian EVIS project also Level 2 cooperation is implemented. One example is the collection and management of incident messages. For the management of planned or unplanned incidents the roles and responsibilities of the different bodies have been discussed and defined in a common responsibility matrix. In future, all bodies will know their responsibilities and roles for the collection and dissemination of incidents and will share the information accordingly. Moreover, several of the partners are implementing a software tool to create and manage the incident data together and aligned their needs and processes accordingly.

For more info, see: <http://www.EVIS.gv.at>

### **Ambition level 2 implementation example: virtual operations room**

The project “virtual operations room” is currently in the preparation phase within different stakeholders in the Free and Hanseatic City of Hamburg. The project aims at an optimised and integrated traffic management for networking the control centres of the City of Hamburg (e.g. traffic control center, public transportation control center, tunnel control center). The focus is on the integration of diverse data sources, data processing modules and a visualization of all information for all different control centers. In the current framework the project is considered as a level 2 cooperation, as there is need for detailed agreements and data integration is taking place.

## **Level 3 behaviour**

In a level 3 collaboration, coordinated services are activated based on a joint approach in traffic management and starting from a common viewpoint on the infrastructure status. In order to shape this joint approach, collaboration on strategic level is required. For shaping this policy in to a joint approach, tactical level collaboration is required. And for maintaining a coordinated manner of measure activation, operation level collaboration is required. Generally speaking, this level of collaboration requires extensive understanding and agreement of what stakeholders will do with the information that is shared, and how stakeholders will act on this. This could be done by defining all actions and action triggers beforehand (e.g. a traffic scenario approach) or defining a set of triggers in current or predicted traffic state data when to act, and a limited set of possible measures taken by stakeholders to be taken at their own discretion (e.g. a more dynamic approach). Given that multiple tasks need to be performed on one place, based on input from multiple stakeholders, a collaboration scheme approach could be to outsource these tasks to an intermediary party or ‘trusted third party’

### **Required Behaviour**

- Collaboration agreements have to be agreed in detail with regard to expectations, ways of working, data processing, trigger values, TM goals and strategies to be implemented, etc. This should allow that it can be predicted within a certain bandwidth how other parties will activate their traffic measures and services given certain traffic situations in the network.
- Agree on a collaboration scheme where multiple mutual activities are performed by stakeholders or intermediaries (e.g. data integration, traffic measure activation, evaluation and assessment, etc.)

- Construct strategies to valorise exchanged services for both public and private actors. This is essential for constructing a sustainable businesscase around the collaboration to enable longer term implementation of the TM2.0 scheme.

### Optional Behaviour

- Willingness for audits by trusted third party or trusted external evaluator in order to evaluate impact figures related to valorisation strategies.

### Forbidden Behaviour

- Use received data for any other purpose outside of the purposes that are strictly defined by the consortium.
- Discriminate between roadoperators and/or service providers, as this might lead to unwanted competition and market competition. All service providers and all road operators should be treated equally with regard to subjects such as data sharing, service requests, impact analysis, etc.

#### **Ambition level 3 implementation example: Socrates 2.0 Amsterdam Pilot site, Network Optimisation.**

In the Socrates 2.0 Amsterdam Network Optimisation use-case, a multitude of public and private traffic management parties active in the region are constructing an integrated public-private traffic management approach. Sharing real-time data, agreeing on traffic management plans and related triggers, measuring impacts and working towards monetizing these impacts. This includes three intermediary Public or Public/private roles that perform tasks on behalf of the wider consortium, such as merging traffic data, harmonizing the TM service requests, and evaluating the service impacts. The deliverable on these structures, agreements, goals and processes is made public and is available on the link below.

For more info, see: <https://socrates2.org/news-agenda/news/project-implements-new-intermediary-role>

#### **Ambition level 3 implementation example: EVIS project**

A Level 3 cooperation is implemented within the Austrian EVIS project, where motorway operators and operators of federal roads have jointly defined detour routes and are jointly operating the detour management in cooperation with the police. Within this cooperation also hardware is shared, as for example traffic cameras, belonging to the motorway operator, are installed on federal roads and operators of federal roads get access to and control permission for the motorway operator's cameras.

For more info, see: <http://www.EVIS.gv.at>

#### **Ambition level 3 implementation example: Demonstrator TM 2.0- Hamburg**

The "Demonstrator TM 2.0- Hamburg" was implemented as a showcase between the Free and Hanseatic City of Hamburg and Here technologies. This demonstrator showcased a traffic management - compliant routing. This was conducted by integrating detour recommendations generated by the traffic control center of the City of Hamburg into the Here routing service. This showcase is considered as a level 3 cooperation as information is exchanged with defined scenarios and collaboration actions.

## Data Character and Communication

Now that goals, expectations and responsibilities are defined and discussed, the level commences where these collaboration guidelines are brought to a collaboration structure, data architecture, and evaluation processes are defined. This level, and chapter, is structured in the following way:

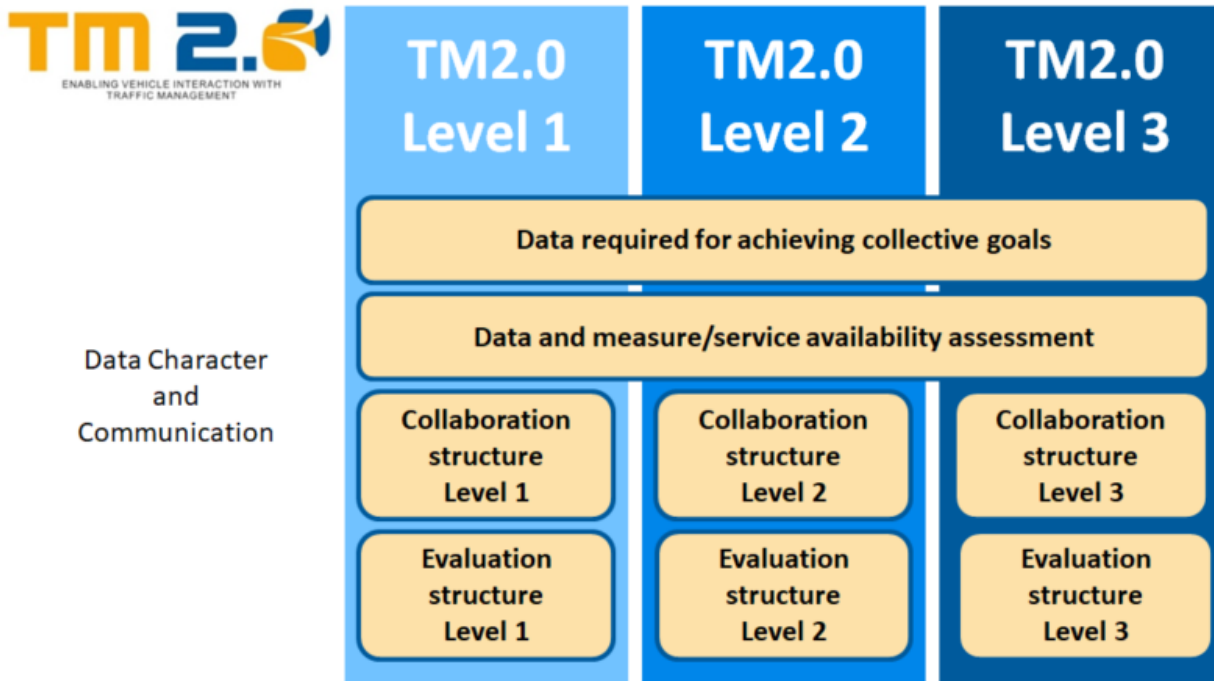


Figure 5. TM2.0 trust model, Data Character and Communication segment

### Data required for achieving collective goals

Given the set of goals and ambitions from the collaboration between TM stakeholders, an inventory should be made on what collaboration, communication between stakeholders and data-exchange is required for achieving these goals. For example, for TM collaboration aiming to reduce congestion or improve traffic flow, one should think about traffic intensities, active traffic measures, road closures, whilst for improving air quality one should additionally think about air quality measures, weather data, etc. On which scale is this data required, and in which detail? Initially the focus should be on the minimal viable product: what is minimally required to set up the functions the collaboration aim for?

### Data and measure/service availability assessment

Then given this set of requirements in data, in collaboration between partners, possibly in sharing of responsibilities, one should make an inventory of the current availability of this data or information. Do partners around the table have the required data either within their organisation or have the ability to acquire this information? If not, part of the efforts should be on either reshaping the collaboration goals, or making this data available (one or more) of the collaboration partners. This availability is not limited to a data inventory only, also availability of required TM measures and impacts, and responsibilities for the TM collaboration functions should be inquired: Do we have the needed TM capabilities within the group of stakeholders, and can we operate



within our own fields of responsibility, or are additional external stakeholders required to agree on TM operations within their responsibility fields?

## Collaboration Structure

Structuring the collaboration refers to a functional architecture of which stakeholders are performing which tasks, and which stakeholders are dependent on others for performing these tasks (for data-input/output, for measure activation, for TM policy definition, etc.). Due to the difference in complexity for the different collaboration levels, the character of the structure might differentiate between the levels, and therefore are described separately below.

End goal for this element is to:

1. Structure which stakeholders perform which tasks, what these tasks are, how the interdependencies are and what information is communicated,
2. This element might go as far as agreeing on a first data architecture (who will send what to who)

### Level 1

On a level 1 the collaboration structure might very well be clear from the start, as well as the data requirements and availability. Most often the goals are close to current practice and/or based on existing data, and represents incremental innovation. Also, the collaboration structure might not be different than previous daily practice, with the exception of addition data communication not previously operated. As responsibilities are not shared and measures are not jointly taken, there is no need for data integration and gatekeeping by an intermediary party.

### Level 2

In a level 2 collaboration, the collaboration structure might require more effort as this could entail sharing of responsibilities, exchanging fit-for-purpose data, integration of various data from different stakeholders (possibly requiring gatekeeping), etc. As there is one location where the 'joint insights' (be it an Common Operational Picture for a specific purpose, or a common interpreter of road infrastructure status and required actions, an agreement should be reached in which organisation (possibly an NAP, one of the stakeholders, or an intermediary party on behalf of the other stakeholders) should perform these tasks. Also, the ways of working should be (to a certain extent) made transparent so that every stakeholder understands how the common insights are delivered, constructed and interpreted. This will require a joint approach where these issues are (possibly regularly) discussed before and during implementation and operation.

### Level 3

In a level 3 collaboration, where the aim is to jointly take traffic measures, and possibly even evaluate and monetise the impact reached by different stakeholders, this level requires not only data integration and interpretation, but also a joint approach in taking traffic measures, agreement on evaluation processes and on how stakeholders are incentivised to take appropriate actions. Additionally to the Data Integration by a certain party, and a discussion table for constructing these processes as transparent as possible, this also requires taking joint action of traffic measure harmonization and activation, on data-storing for evaluation purposes, for an independent evaluator, and for a joint approach in TM strategies and KPI's. So here we are looking at a multitude of functions, each of which need to be performed by one organisation (be it an NAP, a stakeholder or an intermediary), increasing the complexity of the collaboration.



## Evaluation Structure

TM2.0 collaboration is started to meet certain collective as well as individual TM goals, thereby establishing a win-win. During and after the collaboration is in operation, it therefore is important to see if these goals are actually met. In higher collaboration levels, one might also want to see in what way efforts of individual stakeholders contributed to meeting the collective goals, and possibly even monetise this impact. However, this requires more elaborate evaluation structures and agreements than a level 1 collaboration. Therefore these structure descriptions are differentiated per level. The goal of these structures is to establish:

1. What is to be evaluated
2. How the process of evaluation will work
3. What information/data is needed to be tracked and/or stored to operationalize the evaluation process.

### Level 1

Level 1 evaluation only needs to be very generic, as there is no strict agreement on what is done with exchanged information, and possibly relies merely on assumptions on how the exchange will contribute to the high-level goals. Therefore, stakeholders want to be able to measure or research the impact of the data exchange on the collective goal themselves to be able to judge if the collaboration indeed provides added value to the individual goals, and therefore provides ground for trust and continuation of the collaboration.

### Level 2

Aiming for a level 2 collaboration takes more effort and preparation than a level 1 collaboration, but also assumes a higher impact on collective goals. Therefore the need for evaluation on the collaboration impact is also higher, as the benefits have to outweigh the costs. On the other hand, since there is no strict agreement on who will take which actions based on the common insights, liability is relatively low and original responsibilities are only very limitedly shared. This level should entail the evaluation on how valuable and reliable to common viewpoint is to the individual insights from stakeholders, and in what way this strengthens the efforts to reach the common goals.

### Level 3

With the relatively high interdependency between stakeholders in a level 3 scheme, it is very important to, whilst in operation, keep track of how the collaboration is performing and how valuable and reliable data communication between stakeholders is. This is also the case for how well appointed tasks are performed by stakeholders or intermediaries. This requires a short-loop near-real-time evaluation of the collaboration operation, so that problems and hiccups that could potentially affect whole chains are identified and solved as soon as possible. Moreover, given the wider shattering of TM impacts between different stakeholders, it is more difficult to keep track of the collective TM impact of the whole collaboration, and therefore more important to design this into the collaboration up front.

## Service Quality and Availability

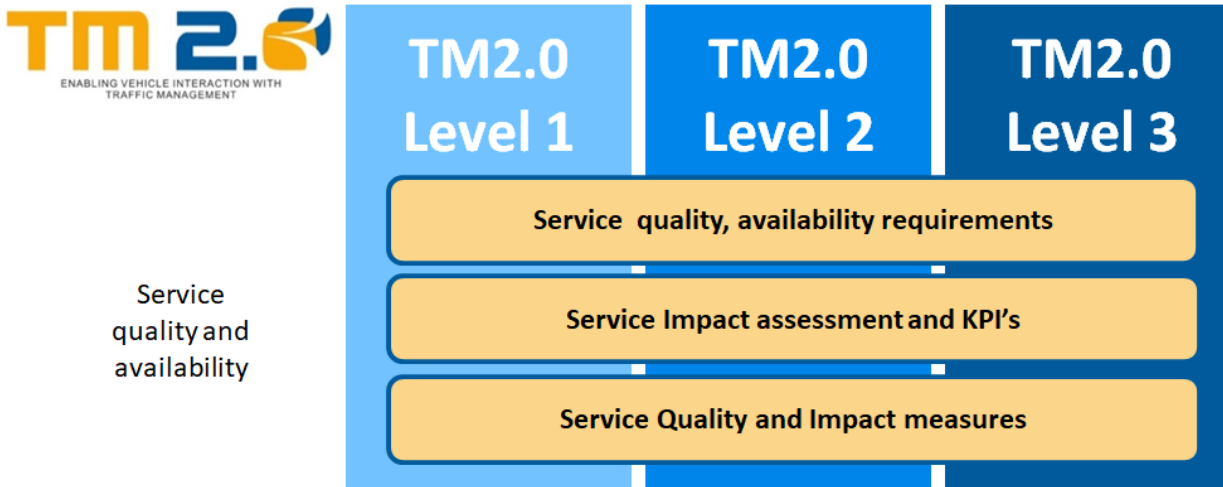


Figure 6. TM2.0 trust model, Service quality and availability segment

### Service Quality and Availability requirements

At this stage in the trust model the collaboration ambitions, structure, and available data and services are becoming clear. However now that services can start to be deployed based on these results, expectations should be discussed on what quality of services, availability and expected and/or required impacts are related to deploying these services. As for Service quality, a non-extensive list of aspects is:

- Service Quality
  - Service timeliness (available when needed)
  - Service Accuracy
  - Service data objectivity (Underlying data should be objective)
  - Service data completeness
- Service data collection
  - Traceability (documentation of data collection)
  - Reproducibly
  - Ease of understanding
  - Relevancy (Collected data should have relevance to the service or to end user)
  - Data manipulation/processing
  - Data harnessing for end user

### Service Impact Assessment and KPI's

Measuring the impact of individual TM measures can be very complex, or practically impossible in some cases. However, upon making agreements on impact expectations these possibilities should be researched, and where possible designed into the collaboration from the start. Moreover, data related to service impacts, especially for private stakeholders, is of vital commercial importance and therefore will require careful consideration in how to exchange and present impact results.

## Service Quality and Impact Measures

Once the service impact needs are clear, the consortium should agree on measures in the case that these impacts might not be sufficient or unreliable on how the either adapt the goals to the impact that can be generated, or try to adapt the impact of services. These measures might also be taken collectively, and might be required for the whole duration of the TM implementation, making this also an important step to agree on together.

## System Security and Confidentiality

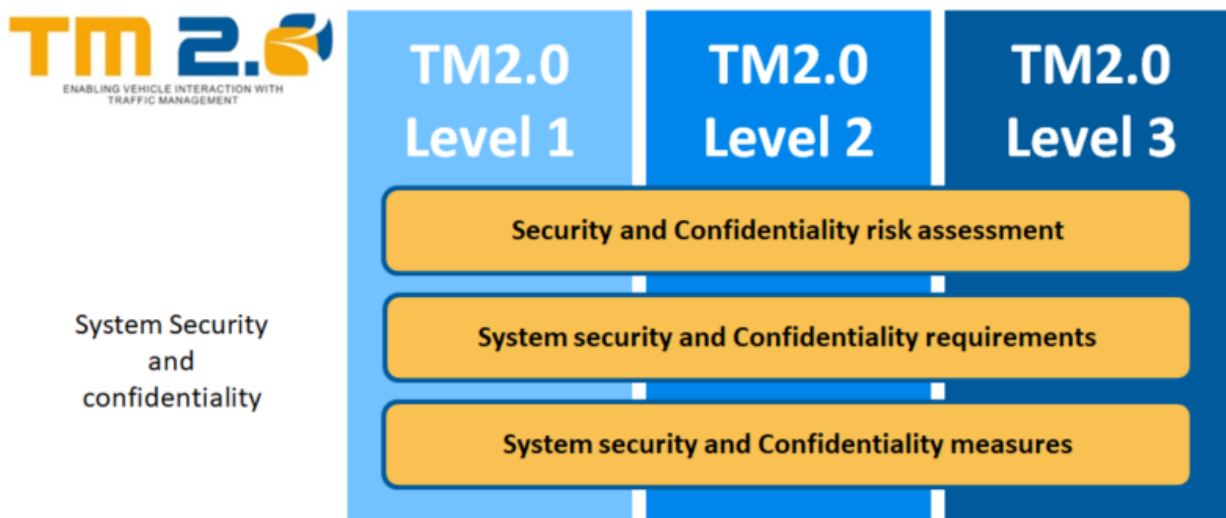


Figure 7. TM2.0 trust model System Security and confidentiality segment

Regarding Security and confidentiality, as with any digital collaboration, a stepwise approach should be starting at a risk assessment based on the proposed collaboration goals, structure and data-communication, these should then be related to a requirements assessment on which security measures are appropriate to address these risks, and resulting in a list of measures that jointly should be taken and upheld during the collaboration. In the case of sharing open data, these actions could be less strict but should still be taken nonetheless. As most TM2.0 collaborations will involve commercially sensitive information and/or private data from end-users, and the domain of Traffic Management can be seen as a mission critical system, this level of an intergraded system approach regarding security is key. The risk assessment, requirement analysis and measure definition should all be in line with the national policy implementations of the EU NIS directive, as it will involve Digital collaboration in EU territory and in some cases also cross-border collaboration.

## Trust

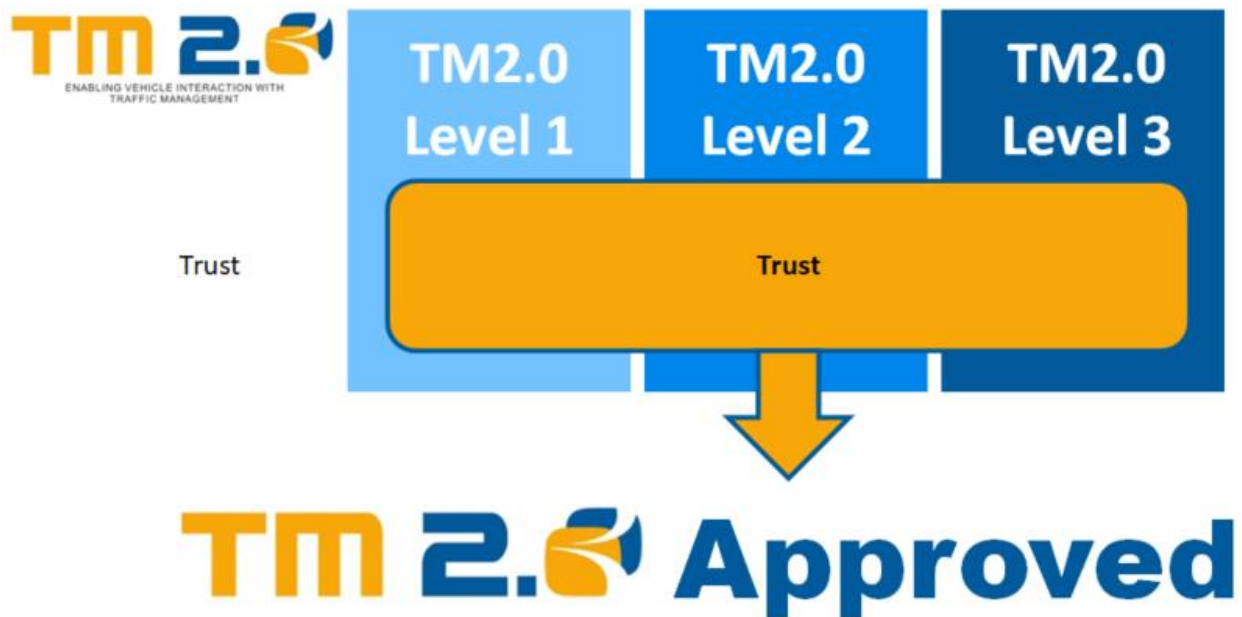


Figure 8. TM2.0 trust model, Trust segment

### Established Trust

The TM2.0 taskforce sees trust as the essential lubricant in effective and efficient TM2.0 collaboration, achieving the highest impact results. When all levels discussed in previous chapters have been addressed sufficiently in shaping and implementing an TM2.0 collaboration scheme and operation, the foundation has been made on which trust between stakeholders can grow over time. The speed and extent in which this occurs is dependent on many factors such as the value and tangibility of TM2.0 collaboration impact results and the speed in which these results can be experienced. Moreover, the building of trust is accelerated by the transparency and active collaboration of all stakeholders, and the level in which the working of the collaboration (goals, ways of working, decision schemes) can be understood for all stakeholders.

### TM2.0 trusted approval

Based on the elements identified in this document, one could perform a quick-scan audit on TM collaboration initiatives and projects to see if all elements for laying the trust foundation have sufficiently been addressed (Have the elements been considered, and appropriately addressed?). If this indeed is the case, the ERTICO TM2.0 Innovation Platform is aiming to provide these collaborations with a form of TM2.0 collaboration certificate, and facilitate dissemination across Europe on the collaboration experiences, facilitate scaling up and standardisation initiatives, and provide its network of the TM2.0 coalition of the willing to see how the impact could be improved even more. For this to happen the requirements for these different elements should first be defined in more detail, and a process for this approval should be agreed upon. These actions will be taken into the TM2.0 innovation platform in the upcoming months, and communicated within the European Traffic Management ecosystem.

#### Trust Certificate implementation example: AEOLIX trust label

The AEOLIX project aims at facilitating sharing information in the logistics domain between private logistics partners in the logistics chains, but also with related authorities such as customs. In the project an ecosystem is created for trusted data sharing connecting distributed applications and services. For the partners inserting and using data on the AEOLIX platform to be trusted, a low key process is put into place where AEOLIX, as a legal entity performing the certification itself, checks certain criteria with partners being added to the platform to make sure that partners can be trusted. Most of the elements to be checked have to do with the financial and legal position of partners, as a more reliable financial situation also produces bases for are more longer term fruitful collaboration. Moreover, certificates are checked and processes and use of standards are referenced. If these elements are checked and approved, the AEOLIX organization provides the 'approved by AEOLIX' trust label, allowing the partner to collaborate on the platform, and as a basis bases for building trust in the collaboration.

For more info, see: <http://aeolix.eu/>

## Acknowledgements

This report is written by the TM2.0 Innovation Platform taskforce on TM2.0 as a Trusted Network. This taskforce consisted of: Jop Spoelstra - Technolution (Chair), Samaneh Beheshti Kashi - City of Hamburg, Anna Damaris Gruber - Austriatech, Ian Cornwell - Mott Macdonald, Florian Krietsch - PTV Group, Per-Olof Svenk - Trafikverket, Magnus Andersson - RE Rise Viktoria, Matthias Mann - HERE Technologies, Stephanie Leonard - Tomtom, Olaf Vroom - NDW and Johanna Tzanidaki - ERTICO. For the purposes of benchmarking the model against actual projects and implementations we thank all liaisons for helping in understanding these projects and the issue of trust.