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Cooperation Models for Public-Private Partnerships in Traffic Management

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Abstract

In the European project SOCRATES^{2.0}, a consortium consisting of eleven public and private organisations has been challenged to try different ways of working together to realise smart traffic and navigation services. The partners have selected and developed 3 types of services, which will be tested by at least 9,000 users in the regions of Amsterdam, Antwerp, Copenhagen and Munich. These services include smart route advice (for example in case of events), actual speed and lane advice and local warnings, for example on environmental zones and road works. The pilots will take place in 2019 and 2020 and include motorways, regional roads, urban-interurban interfaces and urban roads. It is expected to lead to more business opportunities for the private partners, a more cost-effective traffic management for the public authorities and better service for the road users.

Keywords: Cooperation models, public-private partnerships, intermediary

The SOCRATES^{2.0} project

The SOCRATES^{2.0} project consists of 9 activities and follows a V-model approach (figure 1). First, a common framework was defined (Activity 2), which was then specified for the four pilots (Activity 3). The designs will be validated in the pilots (Activity 4-7), evaluated (Activity 8) and the results will be used to update the framework (Activity 9).

SOCRATES^{2.0} works as much as possible with existing techniques to realise smart traffic services and traffic management. So, what's new? To create these new and better services for road users, international service providers, car manufacturers, ITS companies and road authorities should cooperate and share information. The partners in SOCRATES^{2.0} are defining and experiencing sustainable public-private cooperation and business cases in traffic management. This is an important step in the direction of implementation of smart mobility services. The collaboration makes SOCRATES^{2.0} a unique and valuable project, from which lessons can be drawn for all stakeholders in the traffic management chain.

It is expected that SOCRATES^{2.0} will learn from different approaches.

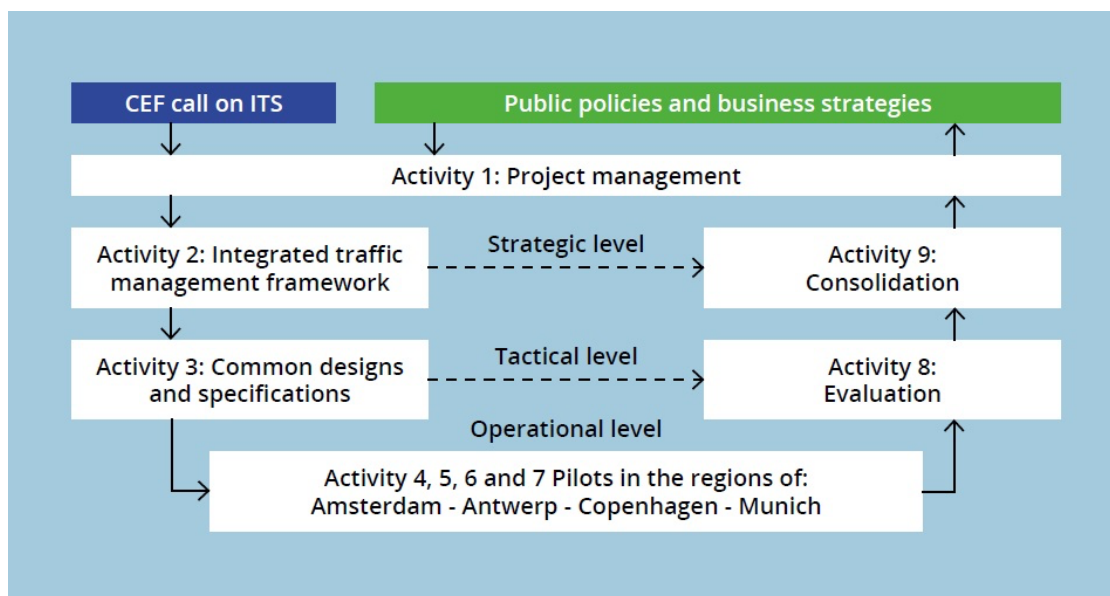


Figure 1 – The SOCRATES^{2.0} activities model

The needs and interests, both for the commercial parties (e.g. revenues, customer satisfaction) as well as authorities (fast, safe and green traffic), are evident. They are in some extent overlapping but are different on other aspects, and it may be a challenge to find a cooperation model that is attractive for all. Although there is research on cooperation within the Traffic Management domain (Heygi et al, 2001; Hoogendoorn et al, 2003; Kammouna, 2014), it predominantly handles joint control strategies, e.g. by means of scenario deployment. Models suitable for cooperation between several public and private organisations with the goal to come to one common strategic, tactical and operational framework are scarce or not well described. That is why the SOCRATES^{2.0} partners started with defining a common ground for cooperation on a strategic level, the so-called SOCRATES^{2.0} framework on public-private traffic management. This framework builds upon the TM2.0 concept (Rehrl et al, 2016; Vlemmings et al, 2017) The preliminary elaboration of different models for cooperation was mainly covered in SOCRATES^{2.0} Activity 2.

The SOCRATES^{2.0} vision

The vision of the SOCRATES^{2.0} partners is that cooperation will lead to a win-win-win situation for all actors in the traffic management eco-system: the road user, the road operator (Traffic Management Centres) and service providers. To reach the win-win-win situation, some basic concepts and common agreements were elaborated among the partners.

The partners in SOCRATES^{2.0} wanted to establish something new and not just improve an existing concept of cooperation. To do so, they recognised that a paradigm shift should be made from ‘managing

and influencing traffic’ to ‘supporting people on their journey from A to B’. To bring the vision to the pilots in the ongoing deployment work, two statements are adopted as the agreed base:

- Active involvement of the customer (road user) and the communities (pre-trip, on-trip and post-trip);
- Move from managing traffic to supporting individuals.

As a result, the vision does not just focus on technology or the traffic management process but is elaborated along four elements: customer, community, technology and cooperation. The essence of each element is captured into four ‘slogans’, especially summarizing what is new behind this concept, compared to contemporary traffic management (figure 2).

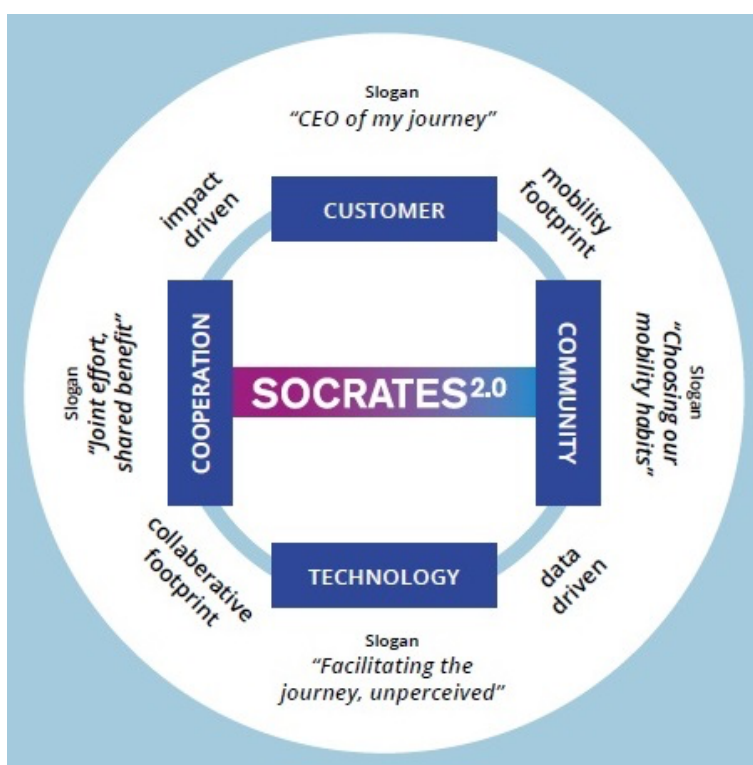


Figure 2 – The 4 elements of the SOCRATES^{2.0} vision and their slogans

The SOCRATES^{2.0} cooperation models

One of the main objectives of SOCRATES^{2.0} is to design, operate and evaluate a cooperation framework for interactive traffic management by road authorities, service providers and car industries. Therefore, the project introduced and discussed different cooperation models and intermediary roles. A first selection of options for cooperation models and intermediary roles was defined in Activity 2 (Koller-Matschke, 2018). The next steps were to define and elaborate different cooperation models and intermediary roles and to determine what cooperation and intermediary models are applied and tested in the use cases (services) in the respective pilot sites. As planned, the SOCRATES^{2.0} pilots will experiment with different cooperation models and intermediary roles, to learn the effects of different options.

The cooperation models were defined in the form of a matrix, looking at two dimensions regarding the exchange of Traffic Management strategies: level of commonality: is there a commonly agreed plan for coordinated actions or common insights, a so called ‘common truth’? and level of detail: at what level of detail do we want/need a commonly agreed ‘truth’? The matrix was expanded on the level of commonality-axis, talking about the level of commitment of the individual stakeholders: are stakeholders free to use the agreed plan/basis or do they commit their selves to a set of needed actions to achieve the common goals (figure 3a)?

	No joint approach – exchange info	Exchange info - common insights	Joint approach – common insights – coordinated approach
Situational – status sensors, actuators	Monitoring with own instruments	Share data, jointly set up CSP and optional improve own monitoring	Joint development CSP and all agree to use it
Operational – actions, measures	Independent choice and deployment of measures	Share actions and measures and optional improve own measures and actions	Joint development, choose and deploy coordinated measures and actions
Tactical – approach, TM services, motivation	Independent development and choice of tactical approach	Share approach and motivation and possibly improve own approach and motivation	Joint development, choice and deployment of coordinated approach
Strategical – policy, priorities, objectives	Independent development and deploy of policy framework	Share policies and priors and possibly improve own policy and priors	Joint development and deployment of policies

Figure 3a – The SOCRATES^{2.0} cooperation model matrix

As a part of defining the pilot designs the partners had a (‘bottom up’) discussion on the role of stakeholders and how they could cooperate. These options were further elaborated with theoretical (‘top down’) options and finally resulted in recommendations for the respective use cases.

Discussing the cooperation options more in detail resulted into 6 elaborated cooperation model options (figure 3b).

	No joint approach – exchange info	Exchange info - common insights	Joint approach – common insights – coordinated services
Situational	CM 1	CM 3	CM 5
Operational			
Tactical	CM 2	CM 4	CM 6
Strategical			

Figure 3b – The SOCRATES^{2.0} cooperation model matrix, clustered

CM1 & CM2: 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 gain additional information and they can use that to optimise their service. The difference between CM1 and CM2 is the kind of information that is exchanged: situational & operational (traffic conditions, VMS messages active, etc.) versus tactical & strategic ('reduce inflow' tactic is deployed, strategic goals of the government, etc.).

CM3 & CM4: in both models, information is shared, and from that information a common picture of the current or expected situation is developed. Partners have the same 'picture' in front of them, however what they do with this information is still up to them. The difference between CM3 and CM4 again is the kind of information that is exchanged: situational & operational versus tactical & strategic. An example of CM4 could entail that partners share and review each other's goals and KPIs and individually assess their potential to contribute (impact) to this, based on the common picture. This cooperation can also be the basis for an impact driven business model, driven by exchange of added value between public and private parties.

CM5 & CM6: 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 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.

Intermediary design

The various use cases and coordination models each ask for certain roles to be fulfilled by stakeholders. The project therefore explored the options for an 'intermediary': a facilitating actor or function for the interaction between public and private service providers in delivering traffic management services. This enables truly interactive traffic management, the overarching goal of SOCRATES2.0. In short, the framework presented the following options for an intermediary:

- No intermediary: Each public or private service provider arranges its own interactions;
- Multiple public or private intermediaries: Each public or private service provider can decide which intermediary service to subscribe to;
- 1 intermediary for public service providers: public TMC's align on traffic management measures, while private service providers operate independently;
- 1 intermediary 'trusted party': Each service provider acts as an integrated part of the intermediary;
- 1 intermediary 'orchestrator': Each service provider is connected to the intermediary which provides instructions to all services/systems/users.

As a part of defining the pilot designs, the partners specified this concept further into tasks and functions, how these could be grouped and how data/information flows should be designed. This enabled the partners to organise more detailed discussion on distribution of roles between types of stakeholders (public authorities, private service providers and others) and how roles can be allocated to the consortium partners.

Value chain model

A public private cooperation was sketched by means of a value chain model, in which both current public and private services for a specific use case were depicted. Several intermediary functions were identified and described and added to the value chain model. Based on needed expertise, different intermediary functions were clustered, resulting in the following 4 different clusters of intermediary roles:

- Strategy Table;
- Network Monitor;
- Network Manager;
- Assessor.

Each of these intermediary roles is described in general terms and is used as a reference for detailed description when applied to specific use cases and cooperation models.

Strategy Table

The Strategy Table is the meeting place <counsel/assembly> to establish and monitor strategic cooperation between public and private parties. It focuses on joint or coordinated approaches for the implementation of use cases and services. Public and private strategic goals and roadmaps are brought to the Strategy Table and through a joint process promising Win-Win-Win business cases are described.

Both individual and common goals are identified and translated into measurable KPIs. Public and private services with potential impact on the KPI's are identified and generally described. The impact of the services to the KPIs is reported regularly to the Strategy Table, allowing an agreed period of time to revise performance and achievement of the individual and collective goals or KPI's. When necessary and agreed, the Strategy Table will also define guidelines and principles for ranking and/or rewarding the level of impact delivered by public and private parties.

The Strategy table is facilitated by a facilitating partner and will have participants with a mandate from the public and private parties they represent.

Network monitor

The Network Monitor collects data from road authorities and private data providers and determines the common current (and if possible predicted) state for a pre-defined use case related network and

indicators. In this process the Network Monitor can perform data handling services, such as quality assessment, data completion and fusion of different public and/or private sources according to use case and business requirements. The Network Monitor distributes the network common state (current and – if possible – predicted) to other intermediary roles and other agreed parties.

Network manager

The Network Manager combines KPIs (desired state of network) with the current (or predicted) network state and defines the problem state. Furthermore, he identifies potential effective measures to solve the problem based on available public and private services. The Network Manager distributes service requests and receives feedback on the performance of the deployed services and uses it to improve the corresponding scenario.

Assessor

The Assessor collects, validates and reports the impacts (value) of public and private services to the defined KPIs. If defined the Assessor can also be responsible for implementation and management of a reward system based on the reported impact of services to specific KPIs. The Assessor is most necessary in impact driven cooperation models.

The SOCRATES^{2.0} pilots and planning

SOCRATES^{2.0} will pilot several Use Cases at four separate pilot sites: Amsterdam, Copenhagen, Munich and Antwerp. Ultimately, five Use Cases were selected from an original list of 14 after pilot site inspection by the consortium (Table 1). Currently, pilot sites are designed, (sub)systems are build, tested and implemented and the Use Cases will be executed during almost a year starting the second half of 2019. The Amsterdam site will employ at least 6.000 end-users, while the other pilot sites will evaluate the Use Cases and accompanying Cooperation Models by deploying at least 1.000 end-users each. After execution of the Use Cases at the pilot sites the evaluation will be finalised, followed by consolidation activities.

Table 1 – Use Cases and accompanying Cooperation Models that will be evaluated per Pilot Site

		PS Amsterdam	PS Copenhagen	PS Munich	PS Antwerp
SR_01	Optimising network traffic flow	CM6	CM3		CM4 and CM1
SR_02	Smart Destination	CM3 and/or CM5	CM3	CM2	
SLA_06	Lane information				CM1
LIHW_01	Road works	CM3		CM3	CM3
LIHW_04	Environmental / areal info	CM1	CM3		

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