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Insights on traffic management in the MaaS value chain

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Abstract

This paper documents the evolution of traditional Traffic management (focusing on road infrastructure) in multi-stakeholders' MaaS ("Mobility as a Service") value chain based on the implementation of the TM2.0 ("cooperation between traffic managers and service providers") concept; the specific use cases described are coming from MyCorridor project.

Although, MaaS offers added value through a single application to provide access to mobility, with a sole payment channel instead of multiple ticketing and payment operations, the optimisation and more efficient use of the city transport system is also pursued, which can be reached through the deployment of seamless multimodal interactive traffic management measures. Moreover, a successful MaaS service brings new business opportunities. Around the world, there are currently various MaaS pilots, trials and business cases developed and launched. This paper investigates also the evolution of the interactive Traffic management in the MaaS world from the business point of view.

Keywords:

TM2.0, MaaS, Interactive traffic management.

Introduction

Some critical factors that have resulted from the recent growth of cities, greatly affect daily urban mobility: the car density with respect to the surface of the city; the urban structure that prevents radical viability transformation; the tourism flow (although usually concentrated in specific periods of the year); the inefficient use of the vehicles, and the daily people flows from the suburbs to downtown and vice versa, are such factors that contribute to the rise of environmental, mobility and social costs which are becoming difficult to sustain for today's cities. Cities, in their attempt to address these issues, are beginning to outline clear targets across the three pillars of sustainability: environment, quality of life and social welfare.

Insights on traffic management in the MaaS value chain

Within this context, a new concept as *Mobility as a Service (MaaS)* can be defined as the integration of various forms of transport services into a single mobility service accessible on demand [1]. For the user, MaaS offers added value through a single application to provide access to mobility, with a sole payment channel instead of multiple ticketing and payment operations. MaaS aims at providing an alternative to dependency on car ownership that may be seen as convenient, flexible, reliable and cheaper. The main building blocks of Mobility as a Service are: access to multimodal mobility services, single journey planning and ticketing options for the user, as well the provision of reliable and advanced travel information from the planning phase until the end of journey. Although the main motivation behind MaaS is to provide better, digitally-enabled mobility services for the end-user, it has also many important wider benefits. A successful MaaS service brings new business opportunities and ways to organise and operate the various transport options as a seamless multimodal service.

MaaS aims at optimisation and more efficient use of the city transport system and this builds an important link to traffic management and *TM2.0 (traffic Management 2.0)*. [2]

TM2.0 stands for a new proven collaborative concept for Traffic Management and Control, in which the travellers and goods, through the use of new technologies and sensors, become entirely part of the data supply chain (www.tm2.0.org). It offers great new opportunities for Traffic Management and Control making it, on one side, cheaper and more efficient for the road operators, and, on the other side, more custom, friendly and acceptable for the users. This is done combining effectively data collected by the infrastructure and from the mobility services in the vehicles and smartphones. Current navigation systems in the vehicle use traffic information to provide individual route advice to drivers, missing however the information related to traffic circulation strategies, traffic regulations or prioritized routes put in place by the TMCs. TM2.0 aims to close this loop and facilitate interactive traffic management. The Road Operator sends its Traffic Management Plans as these are decided by the Public Authorities to the Service providers operating in the area, who then send tailor-made information to their customers with regards to routing provided via the in-car navigation device.

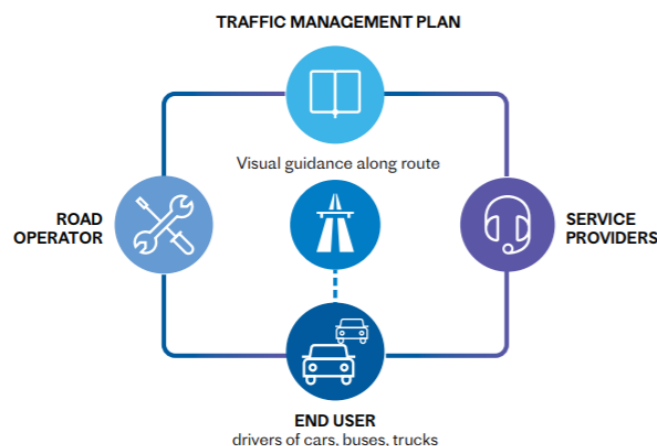


Figure 1- The TM2.0 concept.

Therefore, according to the vision of TM2.0, the future of traffic management is to combine

intelligently the individual driver objectives (individual users' optimization) together with network wide management strategies (system optimization and equilibrium) in a win-win scenario.

MyCorridor [3], a 3-year project, funded by the Horizon 2020 programme has the overall objective to achieve sustainable travel by creating a MaaS environment that would lead travellers in replacing private vehicle ownership by vehicle use. The work in MyCorridor is based on the concept of Traffic Management 2.0 (TM2.0) [2] to be extended beyond the Traffic Management world by providing a solution that incorporates multi-modal, seamless, flexible, reliable, user-friendly, all inclusive, price-worthy and environmentally sustainable travel at cities and regions and most importantly across all Europe.

The document is organized as follows: a first part describes the convergence of the MaaS and TM2.0 concept highlighting the interactions and synergies among these initiatives, MyCorridor Use Cases description are also reported, while a second part is dedicated to evolution of the business model vision. Last but not least, the concluding part underlines the evolution of the interactive Traffic Management plans in the MaaS environmental.

TM2.0 and MaaS: Bringing together the two concepts

Today, traffic management plans (TMP) are not part of the dynamic traffic information delivered to the vehicles. At the same time, the individual vehicle behaviour (intended, in relation to the route guidance system plans) is not made available to the traffic management system. Still, an efficient TMC integration into multimodal MaaS has not been even attempted.

To attempt the implementation of the TM2.0 concept in the MaaS world aims to extend the Traffic Management 2.0 at its borders by providing a solution that incorporates multi-modal, seamless, flexible, reliable, user-friendly, all inclusive, price-worthy and environmentally sustainable travelling [5]. The MaaS concept can institute a new sphere in traffic management, where traffic optimization measures and advanced services for the end-user can also be enabled by mobility service. TM2.0 acts here as a foundation, enabling key services in each operational field, that are namely:

- Parking availability information.
- Route planning.
- Real time traffic state and forecast.
- Event management.
- Advanced traffic forecast provision.
- Zone access information control provision.
- Traffic light forecast.
- Traffic events.

The concept of TM2.0 builds upon the deployment of connected vehicles and travellers in order to achieve convergence of mobility services and traffic management, combining actions of the individual travellers with the collective mobility objectives. This way, TM2.0 connects the innovative developments in the vehicle and on the road while improving the value to the legacy systems and, at

the same time, creating new business opportunities; a new business paradigm shall be deployed in which TM becomes part of the multi modal service offering of a MaaS product.

In the future MaaS world, Road Operators will have access to more dynamic traffic data (e.g. travel time, speed, traffic flow etc.) from a range of vehicles and transport modes not just road traffic data from traffic information service providers. Through the access to information about scheduled events by network operators and municipalities, traffic data services related to forecasted travel time estimation, forecasted level of services can be realised.

The roadmap towards multi modal management - TM2.1

The TM2.0 – MaaS convergence can enable Road Operators to implement interactive multimodal traffic management and implement traffic management measures to optimize the speed and direction of all vehicles and transport modes. ***This vision is labelled as TM2.1, and depicts the advancement of TM2.0 into a multi-modal environment.*** TM2.1 will include the following elements:

- Target end user group: drivers either planning their trip or while in drivers mode.
- There is a recommendation event published by the Traffic Management system to MaaS platform, when triggered by a scenario specified by the Traffic Management system.
- MaaS will then activate a method to influence the user behavior in order to adopt the recommendation and avoid car mode or specific path/route.

In MyCorridor project the *On trip TM2.1 use case* has been identified concerning the possibility to have recommendations to use alternative modes instead of car when the driver is *en route*.

The main scenario envisaged is the event that the road capacity levels drop or rise within the transport network and as such cannot be solved by traffic management measures alone, MaaS operators could be used to channel travel demand into a different travel mode or modes to optimize the flows in the network. In that case, the Traffic manager should provide a “recommendation event” to MaaS platform; the recommendation event is triggered by a scenario based on real time or forecasted conditions/incidents, on a specific path, corridor or area, and should have a clear objective: Less cars on the network or no cars through this path. MaaS platform will associate the event to the trip of the individual user, and use method(s) to influence user behaviour. Prime method will be push information (for example with pop up message). There are two scenarios:

A) Virtual VMS: when the user’s car enters a pre-defined geo-fence then an in vehicle, pre-defined message is presented to the driver proposing re-routing if such an action has been proposed by the Traffic Management System.

B) Park and ride message: when the user’s car enters a pre-defined geo-fence, AND if there is parking availability based on real time occupancy data then an in vehicle, pre-defined message is presented to the driver proposing nearby parking and public transport information from a designated park & ride lot spot.

MaaS may use also additional methods to enforce the desirable end user behaviours such as: loyalty and/or financial incentives (such as discounts) if the user adopts the proposed alternatives.

A new Business Model vision

The mobility and transport domain is a domain that is typically heavily biased towards thinking primarily in terms of solutions and corresponding infrastructures, and only later in terms of values for specific customer segments. To try and reverse this way of thinking, i.e., start from the customer value perspective, we have chosen to explicitly include a business modelling effort. We use BASE/X as a practical framework, given its demonstrated potential in the domain. BASE/X is a business engineering framework for service-dominant business, i.e., service-oriented business that puts value-based service management at the forefront [4]. BASE/X covers the entire spectrum from high-level business strategy definition to business information system architecture design, including elements like business model design, business service specification and business process modelling. In this paper, we concentrate on business model design using the BASE/X business model radar (BMR) technique, which has proven useful for interactively creating collaborative business models in the mobility and transport domain [6], [7], [8], [9], [10]. Below, we first briefly explain the BMR technique and then report on our findings from its application in MyCorridor's project 2nd Pan-European Workshop: Mobility as Service across borders.

Any MaaS activity is by default operating in a user centric, multi modal and multi vendor business environment. A MaaS business activity, as such, would involve multiple stakeholders coming from Public and Private sectors and from many mobility related businesses, such as public transportation, para transit, vehicle sharing, parking, City transport Authorities, traffic management (especially in the case of MyCorridor project), content providers, application service providers, navigation service providers etc. Those stakeholders are having different perceptions in terms of Governance, Business and Customer Care in the Mobility. The main mobility related stakeholders can be grouped as follows:

- City Authorities/Road Operators.
- Mobility Operators.
- Content/Application providers.

On top there are MaaS specific stakeholders:

- MaaS issuer (MaaS operating specifically in a single locality, City or Region).
- Payment providers.

Each the various stakeholders' groups have different sets of objectives. Each one of the stakeholders when operating autonomously may use also various incentives and methods to influence the behaviour of the end users in favour of their objectives.

The real business model challenge is to put all above mentioned to work together under any MaaS business framework; there are quite a few such framework alternatives: the MaaS could be lead by the City/Regional Authority/Road Operators or by a local or global private mobility operator or an application service provider, and each case could be deployed at local or global levels.

The BASE/X business model radar (BMR)

The BMR technique uses a circular diagram to represent multi-party, service-dominant business models, which is shown in Figure 2. The BMR is centred on the co-produced *value-in-use*, i.e., the

added value that the collaboration produces for a customer [7]. Each *actor* (participating organization) in the collaboration is represented by a pie slice in the radar. One actor is always the *focal organization* (the party that is in the lead of executing the business model). One actor is always the *customer*. There can be an arbitrary number of other actors. The three rings around the *value-in-use* contain the three other main elements of a service-dominant business model on a per-actor basis. In the innermost ring, we place the *actor value propositions*, which state *what value* an actor contributes to the central value-in-use. The actor value proposition defines *why* an actor is part of the business model from the customer point of view. In the middle ring, we find the *actor coproduction activities*, which state *what high-level activities* an actor has to perform to generate its actor value proposition. The outermost ring lists the *actor costs and benefits*, which state what an actor pays and receives, both in financial (like profit) and non-financial respects (like reduced CO₂ footprint). The costs and benefits explain why an actor wants to be part of a business model from its own perspective. In modern business models, the value of data plays an important role here.

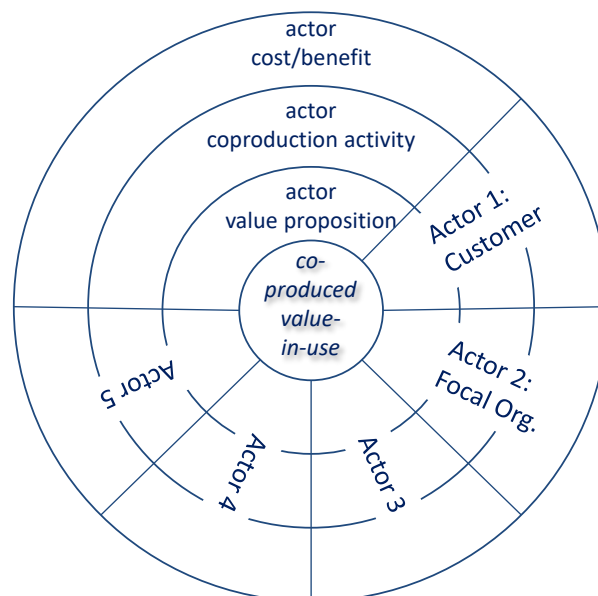


Figure 2 – BASE/X business model radar (BMR).

Application in MyCorridor 2nd Pan-European Workshop: Mobility as Service across borders

We have applied the BMR technique in an interactive business modeling session, in which a number of stakeholders from the MyCorridor project participated. In this session, two drafts of practical business models were created with input from all workshop participants, moderated by two experienced BASE/X architects. The design process started with identifying the *value-in-use* and the *customer*. After that, the *focal organization* was determined, followed by the other *actors*. Based on this, the rings of the BMR were filled incrementally from the inside to the outside. Figure 3a illustrates the use of the BMR ‘poster’ and ‘post-it’s during the workshop, while the figure on the left (3b) shows the business model blueprint refined after the workshop.

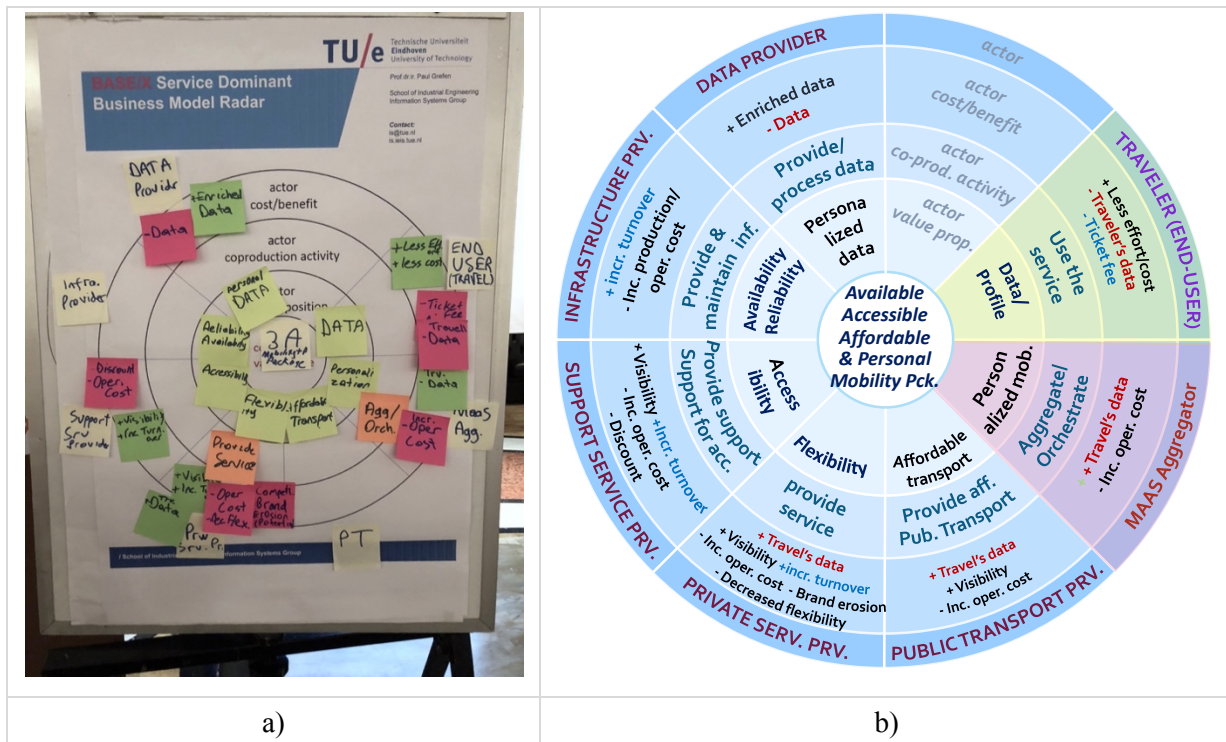


Figure 3 – The BMR poster and ‘post-it’s used during the workshop, and the business model blueprint refined after the workshop.

From this design session, a number of lessons can be learned. Firstly, it appeared that for many participants it was quite new to start thinking in terms of values and customers, placing solutions and infrastructures ‘on the second rank’ (these are implicitly included in the actor coproduction activities in the BMR). In other words, it was new to place the ‘why’ of a collaboration (or solution) before the ‘how’ – but this way of thinking was generally found worthwhile. Secondly, it became clear that the concept of *customer* was ill-perceived: very different kinds of solution users were treated as the same. As a very practical example, we learned in the workshop that the value-in-use for holiday travelers is completely different from that for daily commuters – thus thinking in terms of general traffic participants is too general. Hence, holiday travelers and commuters are in different customer segments that need different business models. Thirdly, having multiple business models implies thinking about how to represent infrastructure costs in the *costs and benefits* of a BMR: multiple business models may use the same infrastructure – depreciation models or pay-per-use models may help here. Fourthly, by explicitly modeling the actor value propositions, a much better view was generated on the required collaborators in a business model. Some ‘standard collaborators’ appeared superfluous in the design process, whereas ‘new ones’ needed to be brought in.

Conclusions and next steps

The TM2.0 – MaaS convergence can enable Road Operators to implement interactive multimodal traffic management and implement traffic management measures to optimize the multimodal network capacity thanks to the use of all vehicles and transport modes available by the deployment of network

wide multi-modal management strategies (system optimization and equilibrium) obtaining through a strictly Road and MaaS actors cooperation. MyCorridor project aims to prove this concept defining and implementing “ad hoc TM2.1 Use cases”. This advanced Traffic Management concept will bring to a new customer-oriented business model approach.

Acknowledgments

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