Paper id 282

The TOMP-API - from idea to reality

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Abstract

The TOMP-API is the result of a collaborative effort to create a standardized language for the technical communication between Transport Operators and MaaS Providers within any MaaS ecosystem. This paper shows the road from the beginning of the journey into the future by taking you through the progress of the TOMP working group. The success of standards can be measured by its implementations, therefore two real-life use cases are used to describe the power of the developments. By bringing forward two real-world use cases the power of the standardized API becomes clear. The first project is the Amaze Mobility project, within the 7 Dutch MaaS pilots, secondly we present the Interreg North-West region project eHUBS spanning six countries.

Keywords

Standards, Mobility as a Service

Technical standardization in the MaaS ecosystem

Mobility as a Service and technical interoperability

A transition in mobility is needed to move towards a more sustainable way of travelling, but also to keep urban areas accessible and guarantee a minimum level of mobility in more rural areas. The mobility domain faces great challenges in the coming decade and Mobility as a Service (MaaS) is of positioned as one of the solutions and as a driver for the upcoming transitions in mobility (Giesecke, 2016).

For the purpose of this paper, MaaS is defined as the provision of multimodal, demand-driven mobility services, offering customized travel options to customers via a digital platform (e.g. Mobile app) with real-time information, including payment and transaction processing (MuConsult, 2017). The MaaS Provider is a new entity that provides mobility to the customer and is therefore positioned between the end user and the transport operators. Interoperability between services is needed to provide the customer with an integral and multimodal platform (Aapaoja, 2017), (Schweiger, 2021). Customers should be able to choose different kinds of transport through a single platform. This can only be done when MaaS Providers are able to connect to different Transport Operators. Standardization in these connections results in an efficient ecosystem.

As the number of MaaS pilots increases, the need for in the MaaS ecosystem becomes more clear. A good example is the 7 national pilots that were launched in a public-private cooperation in the Netherlands (Ministry of Infrastructure and Water Management, 2021). The partners that joined the 7 MaaS pilots agreed on using the same standards.

APIs (Application programming interfaces) are used for the data exchange between MaaS Providers and Transport Operators. In the public domain, a few examples of MaaS APIs exist (Haveman, 2019). However, none of those APIs is able to describe in full MaaS journey, including the planning, booking and payment of a trip. Moreover, standards are often focused on specific modes of transport, whereas for MaaS, all modes need to be described.

Need for standardization

In 2019 the Dutch Ministry of Infrastructure and Water Management, together with several other stakeholders in the MaaS domain, initiated the TOMP working group, to develop a generic technical interface between Maas Providers and Transport Operators. The TOMP working group is a collaborative initiative to create a standardized language for the technical communication between Transport Operators and MaaS Providers within the MaaS ecosystem by means of an API.

This was done with mobility providers of all kinds (shared bikes, taxis, shared cars, scooters, busses, trains). Their scenarios and user stories have been discussed and it seemed to be possible to implement the API to provide general information, do the actual planning, booking and trip execution, give support and provide payment information. The first blueprint of the API was published at the 13th ITS European Congress in June 2019 (Haveman, 2019).

In the past two years, the API has been developed in an open working group. The TOMP-API is based on different modules or building blocks, see also Figure 1. Every module contains a specific part of the MaaS journey (Garcia, 2020).

- Operator Information: Gives static information on the operator according to the GBFS(+) [24] standard (which is in turn based on the GBFS standard [25])
- Registration: Allows various registration processes of users and sharing of information
- Planning: Gives information about availability, estimated travel time and costs.
- Booking: Allows booking of a specific asset or service for a specific place, time and date.
- Trip Execution: Allows access to asset and travel during booked period.

- Payment: Allows payment of the service. Supports different business models (i.e. pay-as-you-go or subscription-based).
- Support: Allows a structured process to resolve issues and support users where needed.
- Asset Information: Provides static information used by other modules to supplement API calls with asset information if needed. Assets can be vehicles or infrastructure (e.g. charge points).

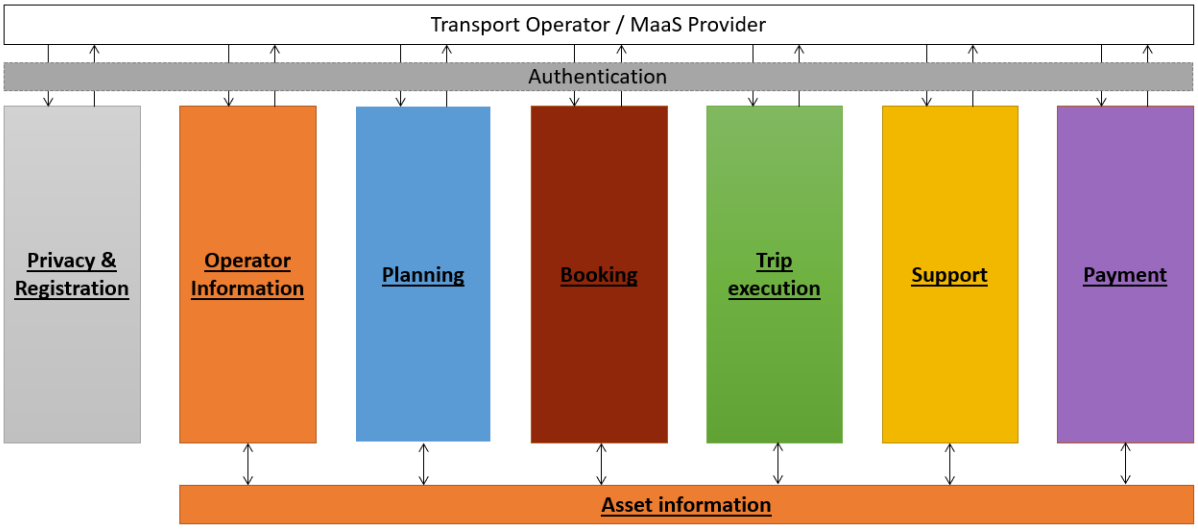

Figure 1- Functional blocks of the TOMP-API (Haveman, 2019)

Most of these blocks are covered by the TOMP-API, except for the 'Privacy & Registration' part. Later insights showed that this is a separate functionality, that should be covered by another API.

Current development

Version 1.0 of the TOMP-API was launched in the summer of 2020 (Garcia, 2020). Several parties have implemented the API in their business and are using the interface for data exchange between MaaS provider and Transport Operator.

Feedback of the parties that implement TOMP is used to update the API. The TOMP-API is open source and is developed in an open working group. The TOMP working group noticed that a lot of early adopters ('The first wave') have contributed to improving the API. The second wave of adopters is coming in, using the standard, sometimes creating issues with relatively small extensions. Within this second wave, we have observed that not only Transport Operators are using the API. Due to the generic description of TOMP, the interface can also be used to provide other things, like parking spots or meeting rooms.

The MaaS ecosystem will change over time and new use cases and requirements will pop up. With that in mind, the TOMP-API cannot be viewed as a finished product, it will be an ongoing process of adaptation and innovation. Semantic versioning is used to maintain and develop the API.

The current adoption is not limited to the Netherlands; there are implementors in e.g. Belgium, Switzerland, Australia, France and incidental requests are coming in from mainly West-Europe. Even organizations in the Nordics are looking at the TOMP-API, for instance, cities demanding implementation to the operators in their boundaries. The amount of organizations involved in the TOMP-API is at this current date (February 2021) close to seventy.

A Proof of Concept in the crossborder MaaS pilot in Germany, Belgium and the Netherlands showed that the TOMP-API can also be used for a multimodal and crossborder MaaS journey (Accept Institute, 2021).

Nowadays the TOMP-API is recognized as the most integrated API to facilitate the interaction between MaaS Providers and Transport Operators (U.S. Department of Transportation, 2020).

The two case studies described in the remainder of this paper show the benefits and practical challenges of implementing TOMP.

Case study: Amaze Mobility – MaaS Amsterdam

The Amaze Mobility project

In 2019 the Dutch Ministry of Infrastructure and Water management launched 7 national MaaS Pilot initiatives in cooperation with regional authorities to develop and learn from MaaS in different perspectives. Some key requirements included the application of a to be defined standard for interoperability between Maas Providers and Transport Operators – now known as the TOMP-API. Another key requirement was to provide anonymous data about the behavior of the user for research purposes.

Amaze Mobility was awarded the MaaS Pilot known as the Amsterdam Zuidas project. Amsterdam's most important business area is coping with huge infrastructural challenges in public transport and road traffic and was looking for an innovative solution that could reduce the daily commuting cars and growing parking challenges in a timeframe spanning several years to allow for a larger train station and creating new underground motorways.

The City of Amsterdam was at the same time reviewing its policy for shared bikes, shared cars and developed the eHub guidelines. New licenses would become available in 2020/2021 allowing Transport Operators to pilot new concepts in different parts of Amsterdam. More than 10 different Transport Operators were going to emerge as winners of these licenses.

COVID-19 reality changed travel behavior and may result in new guidelines for employers with respect to home working and obligations on office hours.

Amaze committed to implementing several core functions in one single app – plan, book, travel, payment and services. No need to exit the app for these functions.

The only way to efficiently integrate a large number of new transport operators was to agree on a standard way of interconnecting – the TOMP-API. Amaze Mobility actively joined the working group sessions and joined 2 other initiatives to understand the CDS-M City Data Specifications and the Open Bike II – a standard framework for bilateral agreements. The Open Bike II initiative has recently been used as the basis for Open Wheels. In Open Wheels a Model Partner Agreement is developed to formalize cooperation between transport operators and MaaS platforms. This standard contract is the result of an inspiring cooperation between bike- and scooter operators, MaaS platforms.

Challenges

One of the key challenges proved to be the integration of a Lock/Unlock solution for Bluetooth locks (mostly used on bikes). Every bike operator or lock vendor has its own way of protecting and operating the lock. The 2 options available – integrating an SDK or installing a companion app – are far from optimal and definitely need further development. Amaze Mobility decided to implement both options – using a companion app to integrate Urbee and 4 other parties that use the same app – and using the SDK of GoAbout.

Another challenge proves to be the commercial conditions some Transport Operators have before a MaaS Provider is given access to the assets. Municipalities must consider this prior to awarding exclusive licenses to parties. Some kind of obligation to connect under acceptable conditions must be negotiated or evaluated. Parties that require connection fees or minimum volume commitment or who are not prepared to share part of the margin should not be awarded a license.

Parties participating in one of the 7 national MaaS pilots all faced the challenge of a lack of countrywide established Transport Operators like OV-Fiets, Greenwheels, MyWheels and some large city based Transport Operators willing to support the TOMP-API as the standard interface to open the 5 key functions.

Funding was offered to the MaaS Providers and there we no incentives to help TOs to migrate or to support the TOMP-API.

Mainly the smaller new players and some new international parties realized there was an opportunity to operate in 7 Pilots in 2020 and 2021 by implementing the TOMP-API.

Amaze Mobility felt the obligation to support deep linking from a Near Me option in the app.

Results

Amaze Mobility is on track to commercially launch the first app that supports any Transport Operator that is TOMP-API ready by September 2021.

eTickets for all public transport in the whole of the Netherlands – will allow commuters, business people, tourists and occasional users to travel nationwide – in some cases taking advantage of off peak discounts.

More than 10 different Transport Operators will be offering bikes, e-bikes, scooters, cars, taxis to support both national and city requirements.

Business users will have the option to formally registered their expense claims for all Amaze Mobility planned, booked and paid trips on a regular basis with their employers in line with the corporate guidelines of the employer.

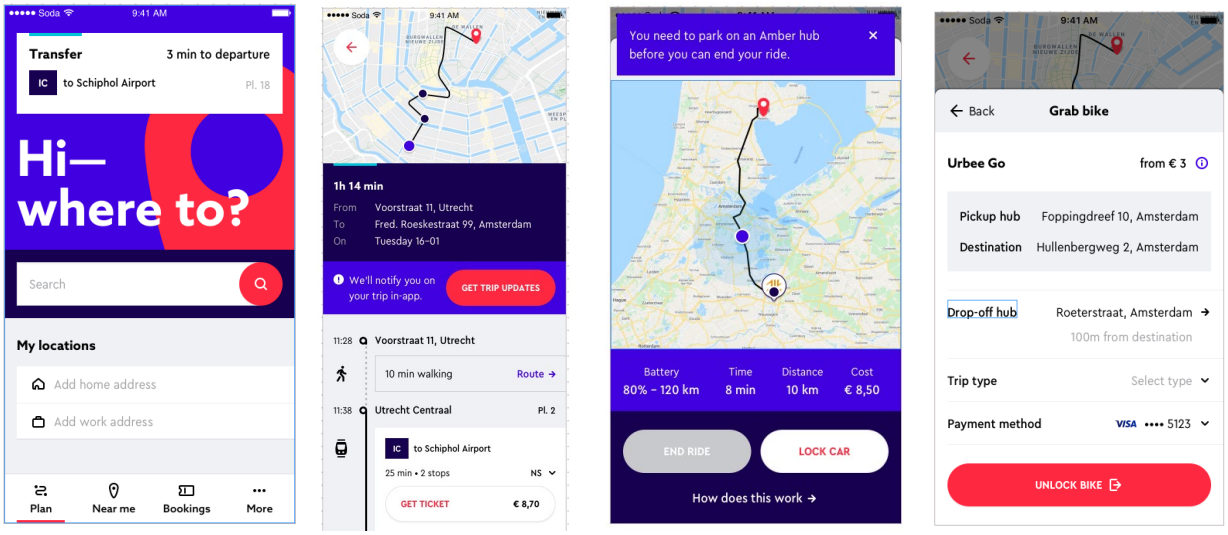

Figure 2 – Screenshots of the MaaS application (Amaze Mobility)

More info on Amaze Mobility can be found on the company website: https://www.amazemobility.nl/ The app is available free of charge in both the Apple and Google apps store.

Case study: eHUBS

The eHUBS project

As of today, it is crucial for both the health and the quality of life of our citizens to simultaneously promote sustainability and accessibility in transport within cities. In the face of this difficult and challenging task, electric mobility sources like eHUBS might be the best future solutions (Interreg, 2021).

Indeed, e-Mobility hubs, shortly eHUBS, represent a crucial step towards the adaption of shared and electric mobility services. These dedicated on-street locations, where citizens can choose from different sustainable electric transport options for shared use, will represent a real alternative to the use of a private car, by providing opportunities to increase shared and electric mobility in a truly innovative way.

eHUBS are on-street locations that bring together e-bikes, e-cargo bikes, e-scooters and/or e-cars, offering users a wide range of options to experiment and use in various situations. The idea is to give a high-quality and diverse offer of shared electric mobility services to dissuade citizens from owning private cars, resulting in a cleaner, more liveable and pleasant cities.

The eHUBS project is part of the Interreg North-West Europe program, a European regional development fund. The consortium consists of organizations, cities & companies from five countries in the north-west of Europe (Belgium, France, Germany, the Netherlands and the United Kingdom).

The connection with the TOMP-API

One of the goals for the project is to create an API-standard to facilitate the communication and interaction between Transport Operators and MaaS providers in general and a specific API to facilitate this communication process for eHUBS themselves.

Since there is no need to reinvent the wheel multiple times the first reflex was to investigate efforts around us trying to achieve similar goals. The TOMP working group was just starting up by then and we decided to join and focus our efforts for this goal towards the TOMP-API for creating a technical standard interface for communication within the MaaS ecosystem while keeping the needs of the public authorities and cities in close consideration.

This TOMP-API environment ensures growth in opportunities for interoperability between multiple parties.

The practical use of the TOMP-API for eHUBS

Within the eHUBS project, we have created a kiosk application that presents travellers with a clear and understandable overview of (real-time) travel options & information within the direct vicinity of the eHUB, even when they don’t have access to a smartphone.

This is achieved by collecting and interpreting data of the Transport Operators providing their services nearby the eHUB point, of course in close cooperation with the local authorities. Because of the local character, the data-sources and quality differ immensely. Some hubs are in densely connection urban areas, but they can also be situated in more rural surroundings.

If we consider the model for the levels of MaaS integration by Steven Sarasini as depicted below. The TOMP-API aims to fulfil all levels of integration, for the KIOSK application as it is planned today we do not need to go beyond integration **Level 1: Integration of information**

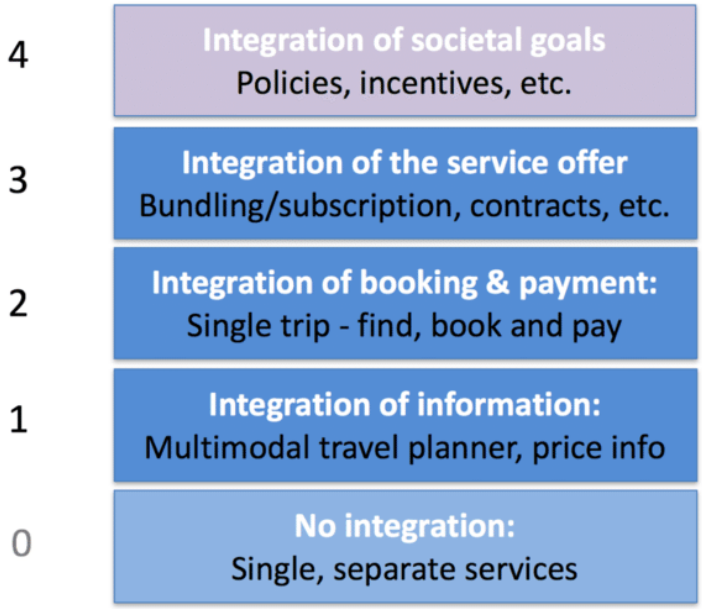

Figure 3 - 4 levels of MaaS (Sochor, 2017)

The KIOSK application focused on providing information to users. There is no booking or route-planning foreseen within the KIOSK.

This is why we focus on the building blocks required to make this possible taking advantage of the modularity of the TOMP-API. Where the definition of what is implemented and how this can be used is to be described in the operator/meta endpoint.

The required blocks for the eHUBS KIOSK are:

- Operation-Information: Static information on the API-owner.
- Planning: Up to date (realtime when possible) information on availability, estimated travel time and costs of assets.

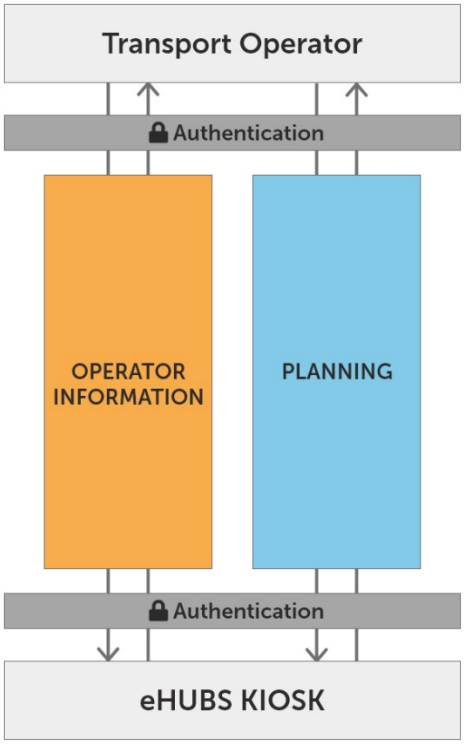

Figure 4 - an overview of pillars required for eHUBS integration (Groen, 2020)

This application illustrates the strength of the TOMP-API, it shows how easy and fast it can be to implement new transport options and make them available directly. Especially when compared to the tedious process of combing to endless API descriptions and data-formats trying to find some unity and ways to reliably incorporate this.

Supporting local Transport Operators in adopting this standard will be an important step forward for the digitalization of the infrastructure effectively and sustainably.

More info on eHUBS can be found on the project website:

https://www.nweurope.eu/projects/project-search/ehubs-smart-shared-green-mobility-hubs/

A detailed description of how the get eHUBS ready is explained in the deliverable for WP6.3 :

https://www.nweurope.eu/media/12785/d63_api_standard_for_information.pdf

Discussion

The two implementation examples covered in this paper showed that the TOMP-API can be successfully used to exchange data between Transport Operator and MaaS Provider. The early adopters encountered some issues, but the flexible and open structure of the TOMP working group proved to be helpful in fixing the issues. It can be concluded that cooperation is key in the developing MaaS ecosystem.

To really reap the benefits of the TOMP-API and standardization more implementations are needed. In this way, it becomes easier to establish technical interfaces between stakeholders in MaaS. The TOMP working group is growing and a lot of implementations are ongoing.

In the future, the TOMP-API will still be extended to cope with more scenarios, but always with a generic perspective. On the current roadmap, there are extensions for e.g. seat reservation (planes and (international) railways) and integration with current or future ecosystem components or concepts (digital contracting, self-sovereign identity, etc.).

The authors think that real MaaS travelling throughout Europe or the world needs an open ecosystem. This ecosystem needs to be designed and consolidated, using standardization where possible. In this ecosystem, the roles of End Users, Transport Operator and MaaS Providers are defined, but other roles like Discovery Service, Clearinghouse and Personal Data Store need to be established or at least standardized, just like it happened to the TOMP-API. This is only the beginning!

References

1. Aapaoja, A. J. (2017). Business models for MaaS. *1st International Conference on Mobility as a Service*, (pp. 28-29).
2. Garcia, J. R. (2020). *Blueprint for an Application Programming Interface from Transport Operator to MaaS Provider (TOMP-API)–Version Dragonfly.*
3. Giesecke, R. S. (2016). Conceptualising mobility as a service. *2016 Eleventh International Conference on Ecological Vehicles and Renewable Energies (EVER)*, 1-11.
4. Haveman, S. R. (2019). Creating effective MaaS systems - Using a systems engineering approach to design an open (e)MaaS architecture. *ITS Europe.*
5. Interreg. (2021). *eHUBS - Smart Shared Green Mobility*. Retrieved from Interreg - North-West Europe: https://www.nweurope.eu/projects/project-search/ehubs-smart-shared-green-mobility-hubs/
6. Ministry of Infrastructure and Water Management. (2021). *Mobility as a Service: personal and multimodal travel advice (only in Dutch)*. Retrieved from https://www.rijksoverheid.nl/onderwerpen/mobiliteit-nu-en-in-de-toekomst/mobility-as-a-service-maas
7. MuConsult. (2017). *Mobility as a Service (only in Dutch).* Amersfoort.
8. Schweiger, C. (2021, January 26). *Five mobility trends to watch out for in 2021*. Retrieved from Intelligent Transport: https://www.intelligenttransport.com/transport-articles/116047/mobility-trends-2021/
9. Sochor, J. A. (2017). A topological approach to Mobility as a Service: A proposed tool for understanding requirements and effects, and for aiding the integration of societal goals. *Conference: 1st International Conference on Mobility as a Service (ICOMaaS)*, (pp. 28-29). Tampere, Finland.
10. U.S. Department of Transportation. (2020). *Comparison of Existing Efforts to Standardize Mobility Platform APIs.*