Overview of the potential of Mobility as a Service

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Abstract: Mobility as a Service (MaaS) is a solution, which unites travel services by integrating multimodal route planning, reservation, payment, and ticketing options. MaaS development mainly focuses on the provision of a user-centered, intelligent, and personalized urban solution with the cooperation of public and private transportation service providers. The main point of the concept is that a new actor, the MaaS operator, is being established between the transportation service and the user. The establishment of the MaaS concept might happen on different integration levels. Examining the international market, the applications in the comparison do not differ to a great extent. The basis of the realization when developing MaaS is the provision of a high level of service with real time route planning and electronic payment for public transport services. There is a huge interest of providing a suitable MaaS solution by overcoming the technological challenges, by setting of business models, and by examining its applicability in a real-world environment.

Introduction

In urban mobility management several already existing and upcoming questions, which make an impact on the travelers’ life and the development of cities, have to be answered. The rapid development of digitalization provides an opportunity to create new mobility services, such as multimodal route planning, setting of travel preferences, appearance of on-demand transportation modes, or the use of modern travel media. In today’s transportation system from the travelers’ point of view, it is an advantage that several services and possibilities are offered to organize trips. Mobility as a Service (MaaS) is a solution, which unites travel services by integrating multimodal route planning, reservation, payment, and ticketing options. Thus, making the services to appear on the same platform possible.

Demonstration of the concept

In the focus of MaaS development, primarily the provision of a user-centered, intelligent, and personalized urban solution with the cooperation of public and private transportation service providers can be found. Due to the novelty of the concept, several definitions of MaaS can be found in the literature. In 2014, the father of MaaS, Hietanen provided a basis for the MaaS concept with the following definition: “Mobility as a Service (MaaS) is a mobility distribution model in which a customer’s major transportation needs are met over one interface and are offered by a service provider” [1]. In a white paper from 2016, the European MaaS Alliance set some guidelines and recommendations for MaaS: “Mobility as a Service (MaaS) is the integration of various forms of transport services into a single mobility service accessible on demand” [2]. The British Department for Transport and the Transport System Catapult Intelligent Mobility Technology and Innovation Center states that MaaS should include: “navigation, journey information, cashless payment as well as managed access to transport services including taxi, bus, rail and shared transport journeys” [3]. While MaaSLab defines the new paradigm as a “new mobility model that aims to bridge the gap between public and private transport operators on a city, intercity and national level, and envisages the integration of the currently fragmented tools and services a traveler needs to conduct a trip” [4]. The main point of the concept is that a new actor, the MaaS operator, is being established between the transportation service and the user (Figure 1). By integrating the supply and the demand, the task of the MaaS operator is to offer service to the users, to create pricing models, and to reach agreements between the transport service providers, the users, and the transportation authorities.

In 2016 MaaS Global started the testing of the Whim application in Helsinki, and after a year, the application, which offers mobility packages to the users, appeared on the market. Recently, Whim has been spreading to other European cities (e.g., Amsterdam, Antwerp, West Midlands). However, the first MaaS pilot has been introduced in Sweden, where the concept was tested as part of the GOSMART project [5]. In this project, the UbiGo application, which had been tested for 6 months among a chosen group of travelers, was developed. Based on the evaluation, it can be concluded that the users gave positive feedback, but some problems appeared (i.e., regulations, policies, barriers) concerning the
cooperation of the service providers and the organizations, which restricted the further development of MaaS. As a result of the project, studies were written about the demand of service providers and users, the integration of all aspects of mobility (i.e., user, commercial, social) and about the challenges of integrating the mobility services into one service [6].

**Definition of integration levels**

The establishment of the MaaS concept might happen on different integration levels, which based on the analysis of the literature and the various definitions, are the followings (Figure 2).

**Figure 2** MaaS integration levels

<table>
<thead>
<tr>
<th>Name of the application</th>
<th>NorthwestMobil</th>
<th>WienMobil</th>
<th>Mobility Shop</th>
<th>Compte Mobilité</th>
<th>Whim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>Basel</td>
<td>Wien</td>
<td>Hanover</td>
<td>Mulhouse</td>
<td>Helsinki</td>
</tr>
<tr>
<td>Transportation service</td>
<td>public bike-sharing, car-sharing, ride-sharing taxi parking, railway, long-distance bus</td>
<td>public bike-sharing, car-sharing taxi parking</td>
<td>public suburban railway, car-sharing taxi</td>
<td>public bike-sharing, car-sharing parking</td>
<td>public bike-sharing, car-sharing, car rental taxi</td>
</tr>
<tr>
<td>Payment</td>
<td>one-time travel and payment</td>
<td>one-time travel and payment</td>
<td>fix monthly membership payment, one-time travel and payment</td>
<td>monthly accounting</td>
<td>bimonthly package, one-time travel and payment</td>
</tr>
<tr>
<td>Available functions</td>
<td>real time information, route-planning ticketing, payment, accounting</td>
<td>real time information, route-planning reservation payment, accounting</td>
<td>real time information, route-planning reservation ticketing, payment, accounting, emergency hotline</td>
<td>real time information, route-planning reservation ticketing, payment, accounting, emergency hotline</td>
<td>real time information, route-planning reservation ticketing, payment, emergency hotline</td>
</tr>
<tr>
<td>Mobility provider</td>
<td>public transportation service provider</td>
<td>public transportation service provider</td>
<td>public transportation service provider</td>
<td>public transportation service provider</td>
<td>company</td>
</tr>
<tr>
<td>Technology</td>
<td>GPS/ePay</td>
<td>GPS/ePay</td>
<td>GPS/ePay/smart card</td>
<td>GPS/ePay/smart card</td>
<td>GPS/ePay</td>
</tr>
<tr>
<td>Personalization</td>
<td>saving favorite routes</td>
<td>individual transport profile saving</td>
<td>saving favorite routes and recall previous ones</td>
<td>setting monthly max. consumption</td>
<td>implementing calendar, sharing personal</td>
</tr>
</tbody>
</table>

At the base level, there is no integration, which means that separated applications help the travelers to conduct their trips. Today’s traveler information systems are primarily on this level. On the 1st level, the integration of the information appears, which basically provides centralized travel information and multimodal route planning including several services. On the next level, the route planning is connected to payment and ticketing services. Unlike the previous level, services of this level provide an easier access to the overall travel process. On the 3rd level, agreements are made by various service providers, which results in mobility packages, subscriptions, and other discounts. On the 4th level, through rules and incentives, the regulators, the local authorities, and the government are involved, as well. The main aim here is to maximize the social benefits, to provide an accessible transportation system and a livable environment.

**Comparison of applications**

Examining the international market, those applications that can be found on higher levels are gathered (Table 1). The area describes the special coverage of the application, while the year demonstrates the appearance of the application on the market. The transportation service lists those modes and services which appear in the application. The payment indicates the possibilities to pay, while the available functions present those service elements, which are included in the application but not necessarily apply to all transportation modes. For example, in WienMobil, the available tickets to buy is exclusively to public transportation (i.e., other services cannot be paid via WienMobil). The mobility provider shows the type of MaaS operator, which might be the public transport service provider, a private transport service provider, or another company, too. Regarding the technology, the GPS is required for the localization process, the ePay symbolizes the payment possibilities, the smart card is suitable for payment and vehicle access. The personalization includes those functions that the user of the application can generally set, where the settings are mainly connected to the demands for a given trip.
The applications in the comparison do not differ to a great extent. The Swiss application is an exemption, as it provides a service not only in an urban area and agglomeration but at a country level. Furthermore, NordwestMobil integrates the highest number of transportation modes and services. WienMobil is distinct in its wide range of criteria which can be set for route planning. The applications of Hanover and Mulhouse integrate a small number of transportation modes and services, but regarding the functions, these applications present the biggest variety. Moreover, both Mobility Shop and Compte Mobilité provide a smart card option to the travelers. Compte Mobilité is the only application, which is available to the users via a web-based platform besides the application. Solely, Whim is the application which is provided by a non-public transport service provider. All the applications have in common that a registration is needed to reach every mode, and both public and private transportation modes are available. The Swiss application and WienMobil integrate the greatest number of transportation modes besides providing reservation, payment, and ticketing functions. Thus, these applications reach Level 2. By buying a monthly membership, Mobility Shop provides discounts in car-sharing, taxi, and railway services. Compte Mobilité gathers the monthly expenses and gives the account at the end of each month. The applications of Hanover and Mulhouse can be found between Level 2 and Level 3. Out of the applications, Whim is the one which offers a preset mobility package for the users thus reaching Level 3.

**Realization possibilities**

The basis of the realization when developing MaaS is the provision of a high level of service with real time route planning and electronic payment for public transport services. If the latter function is not available, even Level 2 cannot be achieved. A positive aspect is the extension of transportation modes (including public bike-sharing, public cars, public scooters), which in case of integration, might provide a wide range of mobility possibilities, once cooperation is reached. The most crucial question regarding the sustainability and the effectiveness of the concept is what kind of relationships can be set between the actors run by the government and by the private companies to cooperate successfully.

To start the realization process of MaaS concept, a framework was introduced with the goal to develop a traveler-based, intelligent mobility service with the promotion of sustainable transportation modes. The aim is to examine the demands of the transportation service providers and the possibilities of service integration, to analyze the travel characteristics of the users, to develop business plans, which bring benefits for all the actors in field of transportation. Furthermore, the technological questions have to be answered to be able to connect the services successfully. The service concept is planned to be realized on Level 4: the elaboration of business models, the consideration of the travelers’ demands, the overcoming of technological challenges, the setting of guidelines and policy (Figure 3). To reach the above goals, living labs have to be created, which aims to connect the stakeholders, the companies, the transportation services, the authorities, the research centers, and the users thus providing a possibility to take part in the pilot development. During the realization process, workshops and meetings for focus groups have to be organized to conduct a debate on the business models and technological demands of MaaS. This has to be followed by the testing phase with the possibility to try the integrated transport services, which help the development of a MaaS service based on real business observations. A potential solution to overcome the scattered mobility solutions is provided by Urban Mobility Operating System (UMOS), which aims to build a seamless, open, collaborative, and interoperable solution. The service will facilitate data exchange, widen transport options, and overcome barriers between the travelers and service providers. With the cooperative business model and a suitable technical background UMOS will be able to provide a high-level mobility service.

### Table 1 The comparison of some integrated application

<table>
<thead>
<tr>
<th>Settings</th>
<th>preferred modes</th>
<th>reservation and payment cancellation</th>
<th>information</th>
</tr>
</thead>
<tbody>
<tr>
<td>preferred modes,</td>
<td>time, money,</td>
<td></td>
<td>cancellation,</td>
</tr>
<tr>
<td></td>
<td>CO2 emission</td>
<td></td>
<td>subscription, upload</td>
</tr>
</tbody>
</table>

**Figure 3 Suggested MaaS framework [7]**

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Conclusion
In conclusion, MaaS concept is in its early phase, though it can be seen that there is a huge interest in the overcoming of the concept's technological challenges, the setting of business models, and the examination of its applicability in a real-world environment. The introduction to the market has to be well prepared with the support of a variety of agreements for a high-level integration, while the uncertainty of the economical use case and the real demand has to be considered. In addition, the user expectations are high, the service providers are interested to assess the new possibilities, and slowly the advantages of the new service are recognized on a strategical level. Thus, it can be concluded that it is expected that soon more and more MaaS services will be available in cities.

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References