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Unlocking Large Scale Access to Combined Mobility Through MaaS Applications in Europe: the IMOVE Approach

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Abstract

This paper describes the developments on MaaS concept and operation currently ongoing in the context of the IMOVE initiative, part-funded by EU under the H2020 program. IMOVE is looking at scaling up Mobility as a Service and combined mobility solutions by investigating (1) sets of measures, organisational frameworks, operational and business models enhancing the framework conditions for MaaS development and operation, and (2) advancing current MaaS supporting technologies by enhancing interoperability and integration of MaaS schemes in the landscape of ITS and other mobility services. Leveraging on recent experiences with MaaS piloting, such as the UbiGo/Go:Smart scheme operated in Göteborg, IMOVE is currently implemented in four European areas including Göteborg and the Västra Götaland region, Berlin Brandenburg region, Greater Manchester and Turin metropolitan areas, all strongly engaged in MaaS adoption and development. The paper describes the approach to organisational and technological enablers for MaaS and the main objectives and elements in the participating pilot sites.

Keywords: Mobility as a Service; combined mobility; service roaming; business models, behaviour change; enabling technologies; piloting; validation; Living Labs

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1. Introduction

Following recent mega-trends in the mobile and sharing economy and thanks to the latest ITS developments, Mobility as a Service (MaaS) is becoming a way people will move themselves and their goods in the near future (Holmberg et al., 2015; Kamargianni et al. 2015; Datson, 2017; Goodall et al., 2017; Kamargianni and Maytas, 2017). The “as a service” paradigm can be a real revolution when it is able to ensure higher continuity among the different means of transport, and enable offering combined mobility packages as a viable alternative to fragmented mobility and car ownership. This paper reports on the approach and activities of the H2020 IMOVE project, starting in June 2017 and addressing the rapidly evolving MaaS scenario. Leveraging on significant experiences conducted in recent years or currently ongoing in Europe – such as UbiGo in Gothenburg or the integrated mobility services operated in the Greater Manchester area – IMOVE will step forward the current MaaS landscape, contributing to radically change mobility paradigms by bringing in disruptive elements of mobility services.

Innovative business and technology enablers are currently being investigated able to concretely put into action, accelerate and scale up the MaaS market deployment in Europe, ultimately paving the way for a roaming capability for MaaS users at the European level. A suite of ITS elements empowering MaaS schemes – the IMOVE Software Enablers – are developed by IMOVE, including technology components for real-time collection of fine-grained data on mobility user needs, habits and preferences as well as components enabling the exchange of information and enhancing seamless interoperability among different MaaS subsystems and multiple MaaS schemes. Complementary to this, a set of Scalability Unlockers, including measures, organisational frameworks, operational and business models enhancing the framework conditions for MaaS development and operation are defined and validated in the project.

IMOVE solutions are investigated and validated in current mobility conditions in 5 European Living Labs already engaged in or having plans for MaaS development, involving a number of public and private mobility stakeholders in each site. The sites engaged in IMOVE include Gothenburg and the Västra Götaland region, the Greater Manchester area, Berlin Brandenburg region and Turin metropolitan area. A fifth Living Lab will be experimenting with service interoperability across two or more IMOVE sites.

2. Background

Even if some MaaS initiatives have been piloted across Europe, so far most of them had problems reaching a significant scale and stable business operation, and there is still a lack of a solid MaaS experience replicable at the EU level. Experiences such as UbiGo/Go:Smart, implemented in Gothenburg during 2013-2014, and HANNOVERmobil, launched already a decade ago in Hannover, have shown the potentials of the MaaS concept as well as the difficulties and barriers MaaS schemes are facing. Other recent experiences such as SMILE, running in Vienna, the recently launched MaaS Global with their Whim App and a number of “mobility aggregators” such as Moovel, Quixxit, URBI and Fre2Move providing integrated access mainly to vehicle-sharing services, highlight the dynamism characterising the current context of combined mobility and MaaS concept development.

Taking into account and investigating the current combined mobility scenario, IMOVE is building upon recent experiences carried out by the involved transport and mobility operators and combined mobility service providers such as UbiGo and URBI.

UbiGo provide a fully integrated mobility service combining public transportation, car sharing, rental car service, taxi service, and a bicycle system; all in one app, all on one invoice, with 24/7 support and bonuses for sustainable choices. The service originates from the Go:Smart pilot project developed and tested in Gothenburg during 2013 and 2014 by partners such as Volvo, Chalmers university, City of Gothenburg, Viktoria institute, Västrafik and Lindholmen Science Park. The mission was to make everyday life easier for urban households and foster sustainable transport by offering a simple, flexible, reliable and priceworthy service as an alternative to car ownership. It was conceived similar to a flexible mobile phone subscription plan, with units for public transport, car, taxi, etc. are accessible to all members of a household through digital punch-cards hosted in the cloud. By taking care of household’s budgets, UbiGo can procure everyday travel in volume, repackage and deliver in a unified way.

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Overall, 70 paying households have been subscribing to the UbiGo fully integrated mobility service with very positive results. It was one of the most ambitious and promising efforts to create a fully integrated service for the Combined mobility and Mobility as a Service model. During the pilot, over 12.000 transactions (day tickets, car

or taxi reservations, etc.) where made. Results from a thorough evaluation based on surveys, interviews, travel diaries, focus groups and usage were very positive. Indeed, none of the households withdrew from using UbiGo service and a vast majority wanted to stay as customers also after the conclusion of the pilot. Overall, the households' expectations of convenience, price worthiness and correspondence to own mobility needs were fulfilled. The business model that was tested on households in the pilot can be also applied to a B2B market, where business can be either employers (e.g. business trips), events, shops and restaurants, just to mention a few business market segments.

3. The IMOVE approach

IMOVE aims to boost the MaaS concept and initiatives through two main strands of activities and corresponding achievements:

- 1) investigating and developing a set of MaaS Scalability Unlockers, as sets of measures, organisational frameworks, operational and business models enhancing the framework conditions for MaaS development and operation and
- 2) designing and implementing a set of novel Software Enablers that will significantly advance current MaaS supporting technologies by enhancing interoperability and integration of MaaS schemes in the landscape of ITS and other mobility services.

Both areas and sets of results are developed and implemented during the project and their transferability will be ensured to support other existing as well as future MaaS initiatives beyond IMOVE. Both sets of results are regarded as complementary and interconnected: the IMOVE Software Enablers are developed to facilitate MaaS operations, enable monitoring the performance and improving the relationships among the three main stakeholders involved in a MaaS scheme: the users, the MaaS Operators and the Transport Operators. They provide relevant enabling technologies to be exploited by the Scalability Unlockers to support the deployment and development of MaaS schemes.

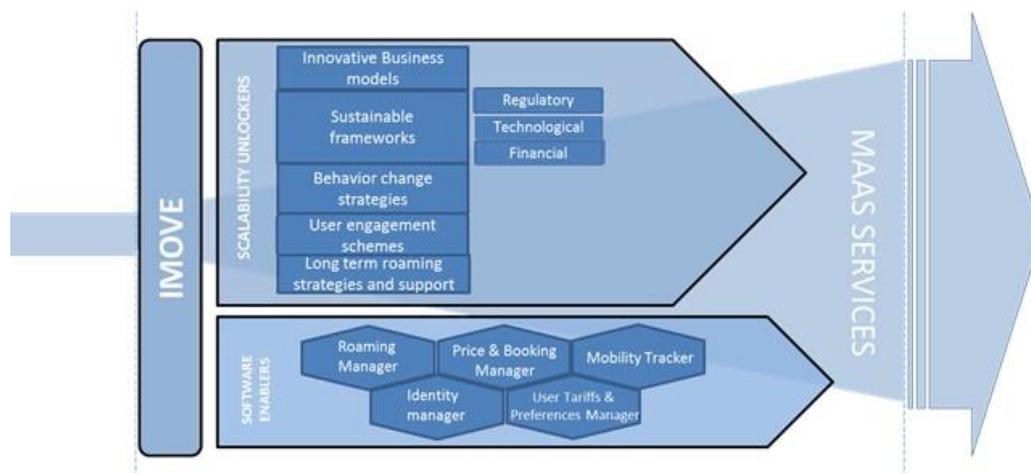


Fig. 1 The IMOVE Scalability Unlockers and Software Enablers

3.1. The IMOVE Scalability Unlockers

A MaaS scheme is a mobility distribution model in which customer's major transportation needs are met through "mobility packages" made available thanks to one single integrated service provider combining public and private transportation infrastructures, travel information, payment services and more (Finger, 2015). A MaaS scheme, however, implies a number of issues and complex organisational and commercial matters to solve. Achieving the appropriate balance between public and private components in the combined mobility scheme is a major issue, with the need of compromising between different business roles, objectives and attitudes within the same ecosystem. The adoption of viable policies for information and service sharing is also a barrier to overcome, with the handling of business-sensitive data, commercially exploitable user-related information and privacy aspects presenting, at the same time, opportunities and threats for the MaaS success.

In order to boost the MaaS approach, IMOVE investigates the current MaaS framework conditions with the aim of delivering a set of tested measures able to enhance MaaS operations and ensure long term scalability of MaaS solutions.

3.1.1. Viable MaaS Business models

Starting from the assessment of the early experience of MaaS pioneers and the investigation of XaaS[†] models adopted in various domains other than mobility, IMOVE is designing a MaaS value proposition meeting the current and emerging market conditions. Cost structure, customer segments, recruiting channels, marketing strategies and pricing models will be identified and data-driven assessments will be elaborated. Expected market penetration will be assessed for both conventional and disruptive approaches, considering for the latter the rapid creation of a critical mass of new users, leveraging complete intermodality and the modal shift from private cars usage. In order to validate the sustainability of proposed business models, complementary services are also studied in order to provide additional revenue streams, such as parcel delivery, long-distance trip booking, mobility management and/or loyalty programs and other services linked to urban travels.

3.1.2. Sustainable MaaS frameworks

Requirements on frameworks necessary for ensuring the take-up and long-term sustainability of MaaS schemes are investigated and defined in the following areas:

- **Regulatory MaaS framework:** disruptive mobility services such as Uber are facing problems to fit within the existing European regulatory frameworks. Leveraging the stakeholders' panels supporting the project, IMOVE is investigating and will produce guidelines for a regulatory framework that best meets the needs and requirements of MaaS schemes, taking into account the different conditions, specificities and maturity levels in EU member states.
- **Financial MaaS framework:** ensuring the necessary engagement of financing-bodies and investors is and will be a relevant issue for to the take-up of any MaaS scheme, especially in its start-up phase. IMOVE is assisting the MaaS stakeholders in the involved pilot sites in identifying and setting up a suitable financial framework meeting the local requirements and objectives. In doing this, IMOVE takes advantage of the existing momentum – the very active debate on MaaS in place at the EU level and the increasing attention the MaaS concept is receiving, with a significant demand at a number of places across Europe – as this could be the right time to push investment plans able to attract potential financiers.
- **Technological MaaS framework:** starting from an analysis of current MaaS enabling technologies, IMOVE is investigating the main gaps in the technological support of MaaS operations. Based on that, IMOVE is assessing the needs for further technology development, including tools to support MaaS scalability and interoperability in the ITS and mobility service landscape, and developing specifications for the required new technology components. A set of novel enabling components are preliminarily identified and outlined in the next section, and will be implemented and validated in the Living Labs at the participating pilot sites.

3.1.3. Behaviour change strategies

By offering combined mobility packages, a MaaS scheme provides the opportunity to influence and change users' behaviour in their modal choice. This research area of IMOVE includes various behaviour change strategies validated and assessed in the MaaS Living Labs. The strategies are defined starting from the conditions and objectives of the current MaaS schemes and will be based on carefully designed incentives models, rewarding schemes and gamification, coupled with (embedded in) suitable product offering/pricing packages. Leveraging the IMOVE Software Enablers and tools available from the IMOVE partners and stakeholders cooperating at the local level these strategies are implemented and their impacts will be analysed throughout the entire project duration. Recommendations regarding behaviour change strategies for further MaaS deployment will be delivered based on assessed results in the IMOVE Living Labs.

3.1.4. User engagement schemes

Appropriate user engagement schemes are a fundamental enabler to unlock the potentials of MaaS and boost their deployment and operation. Leveraging specialised marketing companies and the know-how in the XaaS economy provided by external experts, this investigation area of IMOVE is elaborating a set of assessed users engagement

[†] XaaS: “X as a Service”, or “Anything as a Service”

strategies and operational schemes resulting from experimentation and validation in the IMOVE Living Labs. Cultural barriers in the participating countries are taken into account when designing the strategies and leading commercial methodologies will be included and recommended as part of the schemes. Guidelines for user engagement and recruitment strategies for further MaaS deployment are also provided. In this part of the investigation IMOVE takes advantage of previous and current accessible combined mobility experiences such as Go:smart/UbiGo, Hannovermobil, Commute Greener and the CO2 Journey (Torino) providing further evidence supporting the recommendations included in this Unlocker.

3.1.5. Long-term roaming strategies and support

In order to pave the way for the MaaS integration at European level, IMOVE will produce guidelines with a short, medium and long term outlook for a cross-border MaaS roaming at EU level. This package will include recommendations regarding non-technical aspects (reference regulations, market/business enablers, operational frameworks) as well as technical standards of relevance to enable cross-MaaS roaming through European cities and regions.

3.2. The IMOVE Software Enablers

Efficient operation of any MaaS scheme requires ICT and supporting technologies to enable the enactment of the workflows and interactions among the various actors involved in the scheme. With the increasing interest around Mobility-as-a-Service, MaaS enabling IT platforms and solutions are gradually appearing on the market, including those offered by major ITS players such as Siemens, Ericsson, Kapsch and others. The approach taken by IMOVE is not to investigate and develop yet another MaaS supporting ICT platform. Rather it is to investigate, provide and validate a number of MaaS Software Enablers (SWEs) as core ICT components aimed at enhancing current MaaS operation – particularly, looking at “small” MaaS operators and providers, offering tools to help lowering market entry barriers – and, ultimately, supporting interoperability and roaming across different MaaS schemes.

The IMOVE SWEs thus provide the technical counterpart of the operational and business enablers previously described, allowing the implementation and enactment of the relevant Scalability Unlocks. Overall, the SWEs include a number of enablers addressing key functional areas of MaaS operations – e.g. user identification and profiling, tariff and pricing management, mobility tracking, etc. – and two major horizontal components providing a standardised B2B MaaS Application Interface (API) to enable application development and a MaaS Orchestrator offering core interoperability elements to support information exchange and roaming among MaaS applications.

3.2.1. The Identity Manager SWE

This functional component is to enhance user identification & authorization capabilities allowing shared user access to services among MaaS operators and other external tools /services involved in the combined mobility value chain, managing the critical security & privacy factors (i.e. managing and merging users’ identities, leveraging external identity providers to enhance the usability of the solution, etc.). The identity Manager will enable both the user and third party providers (e.g. HERE.com, URBI and others using the IMOVE B2B API) to manage himself/herself all personal information needed to interact for example with all the mobility service providers connected to the MaaS service provider.

3.2.2. The User Tariffs & Preferences Manager, Price & Booking Manager SWEs

These IMOVE enablers provide general services to support the core task of MaaS operation related to linking users’ profiles and preferences with mobility offerings and service booking and access. The components provide tools to handle rich user’s profile and preferences structures (evolving over time, based on actual transport choices), tariffs and pricing strategies (e.g. auctioning), service booking and access to external travel management services (e.g. external trip planners and Apps) in order to ensure always the best personalised integrated mobility offering is proposed to the user. Adapting to different stages of maturity of current MaaS schemes, the Price & Booking Manager SWE will also be responsible to interact with existing single-ticket providers where available, building up the integrated single ticket solution for the chosen travel option.

3.2.3. The Mobility Tracker SWE

The data exchanged among the three types of combined mobility stakeholders (users, MaaS and transport operators) provide a large and relevant set of information about users’ mobility choices and behaviour and a fundamental asset to understand demand and improve MaaS transport offering. The Mobility Tracker SWE records

the most relevant mobility data, requests and transaction among MaaS actors to support the monitoring of MaaS scheme performance and enabling big data analytics. This data enables to adapt and improve services, offerings and operation, as well as to support user engagement strategies (e.g. gamification), user choices/operations tracking and rewarding/incentive schemes management to support travel behaviour changes towards sustainable transport modes.

3.2.4. The MaaS Connector & Orchestrator, Roaming Manager SWEs

These IMOVE SWEs provide a set of fundamental tools to facilitate interoperability between MaaS schemes enabling the interaction and cooperation between different MaaS platforms. They provide the fundamental services to support roaming scenarios and allowing users to benefit from the MaaS offering while travelling across different MaaS sites. Leveraging other IMOVE SWEs (e.g. Identity Manager, User Tariffs & Preferences Manager, Mobility Tracker) these SWEs ensure data is exchanged between cooperating MaaS platforms including both operational level data (e.g. information about available mobility services, tariffs, bookings) and higher level user related information (e.g. users’ profiles and preferences, travel choices) providing a core enabler to facilitate the development of a MaaS network.

3.2.5. The IMOVE B2B API

The IMOVE B2B API provides a unified access to IMOVE Software Enablers and to MaaS services using or built on top of IMOVE SWEs, enabling the interaction with external applications and services of interest for MaaS operation. For instance, the interface ensures interoperability with external Journey and Travel Planners (e.g. HERE.com, MyWay, etc.) and mobility aggregators Apps (e.g. URBI, Moovel, etc.) allowing such external applications to access all information managed by IMOVE SW enablers. Thanks to this, customers will be able to access MaaS services using their own preferred applications and services. The API supports widely adopted data and service interface standards as well as security by-design principles to ensure the required openness and quality level in accessing IMOVE services.

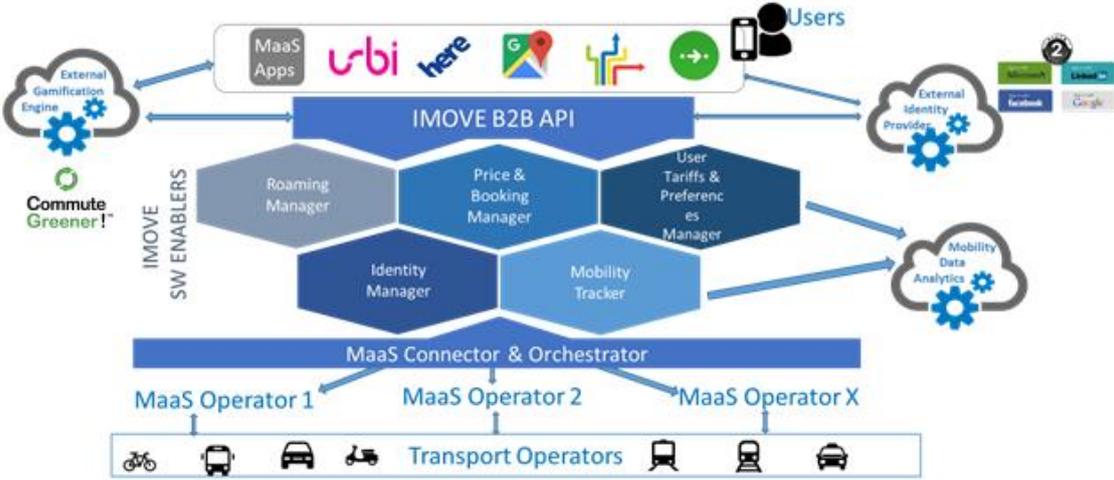


Fig. 2 The IMOVE Software Enablers architecture

4. The IMOVE pilots

The IMOVE approach to MaaS development and the enabling technologies investigated and developed in the project are validated in four select pilot sites. Both Scalability Unlockers and Software Enablers are to be deployed at the four participating sites and will be validated and assessed in real-life conditions involving users and stakeholders through the set-up and operation of local Living Labs.

IMOVE sites have been selected due to the variety and complementarity of local conditions, transport environment and engagement in the domain of combined mobility services.

6.1. Göteborg and Västra Region

Västtrafik, the Public Transport authority in the region of Västra Götaland, was an active part in the GoSmart/UbiGo trials in Göteborg. Since the finalisation of that project, Västtrafik has been working with designing the process in which MaaS (or combined mobility services) will be introduced in the region. Their decision to stimulate commercial actors to participate in this introduction through a procurement process, will result in the start-up of a publicly supported, commercial MaaS operator which will be launching the service at the end of 2017 or early 2018, according to current planning. The service is expected to combine public transport, car-pool, bike-pool and taxi, but the full coverage of the awarded service will be decided by the tendering parties. The approach taken by Västtrafik, is combining two of the approaches for MaaS currently discussed in the MaaS community, and is of a great interest as one of the four sites of IMOVE.

6.2. Greater Manchester

Transport for Greater Manchester (TfGM) is the regional transport authority responsible for coordinating and facilitating transport services in Greater Manchester (GM) area, the fastest growing UK region with population of 2.7 million residents. Urban, national (intercity) and international (cross-border) trips that start or end in this area are currently investigated in order to assess how a MaaS service could work on different geographical levels and a common payment account system. This will bring together different public and private mobility service providers including bus, tram, metro, taxi, car-sharing, rail, coaches, electric vehicle charging infrastructure, and parking operators using the TfGM smart card platform “Get me there” already in operation. The “Get me there” (<http://www.getmethere.co.uk/>) smart card on Metrolink (light rail - tram) is operational since autumn 2014 and in November 2015 a Metrolink mobile ticketing App was launched – followed by the introduction of “Get me there” for bus passengers. The intention is now to deliver a one-ticket smart solution for buses and trams across Greater Manchester in 2017. This means that the Get Me The smart card for Metrolink will be extended from concessionary travel holders to all passengers and multimodal smart travel for joint bus and tram travel will also be introduced. The solution will include multiple methods of paying/topping up a smart card and will also allow contactless enabled travel where passengers use their bank card to touch in and touch out instead of a smart card (this is initially being rolled out on Metrolink). Smart Capping will also be included where the system works out the best value are tariff for passengers who make multiple journeys.

6.3. Berlin Brandenburg

The fourth IMOVE MaaS Living Lab is implemented in Berlin Brandenburg metropolitan and regional area. Berlin has an outstanding local public transportation network. The network of regional trains, S-Bahn (city train), U-Bahn (subway), trams and buses has a total length of around 1,900 km – roughly equivalent to the distance between Berlin and Moscow. Passengers can get on or off at over 3,100 stations and stops. In addition, several other mobility services are available for the citizens including vehicle-sharing, both free-floating (Car2Go, DriveNow, Multicity) and stationary (Cambio, Flinkster), scooter-sharing (e-Mio, Coup Berlin), bike-sharing (Call A Bike, Next Bike), taxis (Public Taxi, MyTaxi) and Uber. The URBI mobility aggregator is currently providing access to most of these mobility services in a single App, and plans to extend the offering public transport (busses, U-Bahn, S-Bahn) towards a full-fledged MaaS concept, which is introduced in the framework of the IMOVE project.

6.4. Torino

The municipality of Turin, through their Public Transport company and mobility service company 5T, are running a MaaS service integrating Public Transport, Bike Sharing, Traditional Car Sharing, Free Floating car sharing (Car2go), Electric car sharing (One Way), Carpooling (with 3 different operators to be integrated). The service was introduced in 2012, with the initial step of integrating PT and car sharing services, leveraging the integrated ticketing scheme BIP (Biglietto Integrato Piemonte) that covers a greater area around the city. In addition, the municipality is going to implement a CO2 certificate in order to reward with credits the sustainable travel choices and behaviour of citizens. This environmental accountability scheme will be included in MaaS as well.

5. Conclusions

IMOVE has started on 1st June 2017 and will run for 30 months. It is investigating and validating in the real-life contexts provided by four challenging European metropolitan and regional areas, the framework conditions and enabling technologies to allow the MaaS concept developing and MaaS schemes expanding on the European level. The testing and validation of organisational and technical facilities favouring interoperability among MaaS

schemes and enabling service roaming across different locations is regarded in IMOVE as a major objective and will be subject to a cross-site pilot service tested and evaluated in the final part of the project.

In order to test the transferability of IMOVE solutions – both the Scalability Unlocks and the supporting Software Enablers – an additional pilot site will be included starting from June 2018 and selected via a public open call launched at the end 2017 to look for any interested city or region engaged in MaaS development and interested in cooperating with IMOVE:

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