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The potential of interconnected service marketplaces for future mobility ☆,☆☆

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ABSTRACT

Mobility currently evolves far beyond owning a car or using public transit services. Passenger transport can be managed by mobility providers by combining and extending various mobility services either directly or by using available mobility service platforms. This paper evaluates the capabilities and technical features of existing mobility service platforms with a special focus on electric mobility. Based upon this evaluation, criteria are presented which future platforms should address. As part of this work, a marketplace approach is developed which addresses the identified criteria. Potential marketplace architectures are presented which are deemed to establish marketplace interconnectivity. The developed marketplace approach and the proposed architectures contribute to the vision of an interconnected service ecosystem for mobility services.

1. Introduction

The number of world-wide mega cities with around ten million inhabitants or more is currently more than thirty [1] and continues to grow. The citizens and the commuters demand a satisfying level of mobility, provided by the public transport system, transport companies or by themselves in any way. Electric mobility (eMobility) is still a niche, even though it has been a major topic for many years and is considered to be a tremendous market in the future [2]. A closer look unveils its sustainable potential: eMobility affects various domains which would have been undetected at first glance. The production domain for electric engines and batteries are directly involved as well as the energy domain which is in charge for providing electric power in an intelligent manner. eMobility also affects domains like the public and private transport, logistics, parking, vehicle sharing, and urban design.

A lot of research has been conducted on electric vehicles and eMobility in general. The research's achievements help to promote eMobility in our society. A good example is the North Sea region with about 70 eMobility projects [3]. To support the progress of eMobility, Value Added Services (VAS) are designed, developed and publicly provided via service platforms. This is done in various publicly founded projects[1] but also by companies.[2] To the current date, these service platforms are specialized in a particular eMobility domain like charging, car-sharing, parking or others.

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[1] Green eMotion (GeM) (www.greenemotion-project.eu/. Accessed: 02.06.2014), CROME (crome-project.eu/, Accessed: 27.06.2014), Olympus (www.proeftuin-olympus.be/en/home-1.htm, Accessed: 05.01.2015), Streetlife (http://www.streetlife-project.eu/index.html, Accessed: 05.01.2015).

[2] Hubject (www.hubject.com/pages/en/index.html#1-1-home.html, Accessed: 23.06.2014), Parku (www.parku.ch/?lang=en, Accessed: 23.06.2014), Multicity (www.multicity-carsharing.de/en/, Date Accessed 10.06.2014).

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The next section provides an insight into existing eMobility platforms and presents criteria for future service marketplaces. The criteria have been elaborated based upon the identified strengths and weaknesses of current platforms during the State of the Art (SotA) analysis. Section 3 introduces an eMobility marketplace approach and demonstrates how current limitations can be solved. Section 4 discusses current limitations of eMobility platforms and addresses the lack of interconnectivity. In this section architectural approaches are proposed which are considered to overcome the gap of interconnectivity between eMobility platforms. A conclusion is provided in Section 5 and an outlook can be found in Section 6.

2. Existing eMobility platforms

The platforms introduced in this section operate in the mobility domain. Parking, vehicle sharing and charging are part of this domain. Some presented platforms offer services for eMobility whereby some of these services are also useful for combustion vehicles. Services designed for combustion and electric vehicles might require a different treatment. A combustion vehicle for instance can use every suitable parking lot. In contrast, an electric vehicle with low battery capacity probably needs a parking lot with a charging station. If such a parking lot is occupied, the electric vehicle driver has to find another suitable parking lot with a charging station and within the vehicle's remaining range. Thus, within the parking domain, it is feasible to differentiate the kind of vehicle which occupies a parking lot. The term platform is used in this section but will be replaced by eMobility MarketPlace (eMMP) later. The authors of this work consider a trading platform which enables only one supplier to sell capabilities to multiple end-customers not as a marketplace. That complies with Petersson and Lind [4] who conclude that a *1:n* relationship violates the marketplace paradigm. That paradigm constitutes that the marketplace is a multi-party trading environment. It consists of multiple suppliers and consumers [5–8]. Therefore the marketplace is an environment of *n:m* business relationships.

Table 1 provides an extract of globally available eMobility platforms for major mobility domains. This extract does not claim to be complete but shows that eMobility is of great interest around the globe and affects various eMobility domains. The platforms have been identified using web searches, project disseminations and publications as well as internal reports.

2.1. Identified criteria for future eMobility marketplaces (eMMP)

A future eMMP should address certain criteria to develop from a basic service platform to a strong marketplace for eMobility services. The criteria has been elaborated based upon the platform capabilities identified during the SotA analysis. This analysis consists of (i) platform publications and disseminations (ii) official platform web pages and (iii) discussions with domain experts and project leaders.[3] One of the used methods during the SotA analysis has been Zwicky's morphological box [9]. The morphological box unveiled (i) current platform capabilities and (ii) feasible new platform capabilities which can improve the overall platform operation but are not yet implemented. The criteria has been defined while analyzing the current and the possible future capabilities. The identified criteria narrow down the list of existing platforms which will be analyzed and referenced later.

Future eMMPs should address following criteria:

- Span over multiple systems to access service infrastructure.
- Allow remote access on infrastructure.
- Associated service buyers must have real end-customers in the field.
- Process infrastructure information and internal data.
- Participation and contribution need to be manageable.
- Transaction data must be available and accessible.
- Host at least two different eMobility domains.
- Host multiple service buyers and service suppliers.
- Open for various mobility domains and participants.
- Use open and/or standardized protocols.
- Implement contracting approach for automated service processing.
- Support interconnectivity between eMobility marketplaces.

The strengths and weaknesses identified during the SotA analysis of current eMobility platforms are listed below. These findings among others have been used to define the criteria for future eMMPs. Ideally, future eMMPs should not only overcome the current platform weaknesses but also implement their current strengths and improve them. An improvement of a strength should not be on the expense of a weakness.

- General platform strengths:
  - Contribute to protocol standardization.

[3] Representatives of the German showcase region program. Project members of Green eMotion, CROME, Open Mobility Berlin (VeMB) and EMD (www.emo-berlin.de/en/showcase/projects/, Accessed: 27.07.2014), Stuttgart Services (www.livinglab-bwe.de/projekt/stuttgart-services/, Accessed: 10.07.2014) and Hubject.