

ECIM: European Cloud Marketplace for Intelligent Mobility

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Abstract. ECIM - European Cloud Marketplace for Intelligent Mobility brings to cities a platform that integrates a variety of mobility-related services, such as parking, shared bicycles and public transport, and allows developers to create multi-modal apps with seamless login, payment, discovery and use of different means of transport in the city. ECIM goes even further. It provides a base for development of new business models, such as Mobility-as-a-Service (MaaS).

Keywords: cloud platform; mobility; marketplace; parking; MaaS

1 Introduction

ECIM (European Cloud Marketplace for Intelligent Mobility) is a flexible, cloud-based solution for public and private sector actors who seek or provide web services to address mobility related needs of their cities. The Marketplace is a unique environment where service providers, data providers and developers come together and engage in co-design and co-creation of Mobility applications for citizens. To providers the solution offers an effective distribution channel as well as opportunities to enter new markets and expand their user base. Developers, for their part, benefit from easy access to standardised APIs of different mobility services, some of which are available exclusively through the ECIM platform. The solution is indeed unique and as such has potential to revolutionise the way Mobility services are designed and delivered to citizens. The aims of this paper are to (1) provide an overview of the ECIM project (2) discuss the encountered barriers and challenges during the project deployment and resulting lessons learned and (3) to describe the identified avenues that can help ECIM remain sustainable in the long run while staying at the vanguard of the ongoing transport revolution.

2 Project overview

ECIM (www.ecim-cities.eu) is an FP7 project, running between January 2014 and June 2016, with an overall budget of 4,384,000.00 EUR, with 50% of funding provided by the European Commission. The 14 partners from come from 6 countries, and different backgrounds: academic, industry, public authorities and SMEs:

iMinds	Belgium	ESADE	Spain
IS-Practice	Belgium	ISSY MEDIA	France
Intrasoft	Luxembourg	21C Consultancy	UK
Relational	Greece	CEN Group	UK
Mobile-for	Belgium	EJ Consultants	UK
BePark	Belgium	CIRB	Belgium
PayByPhone	France	ENoLL	Belgium

The work has been divided between 7 inter-related work packages (WP), with Living Lab as the overarching approach that engages all relevant stakeholders in each stage of the solution design, development, deployment, testing and evaluation. ECIM is currently in its final phase, and after successful piloting there is a proof-of-concept being run in Birmingham. Project partners are now focusing on dissemination of results and working on a plan to make ECIM sustainable after the end of EC funding.

2.1 Objectives of the project

ECIM has three main objectives: allow cities and businesses to easily migrate services to the cloud, open cloud-based services to innovators for use as a basis for new services and facilitate easy access and cross-border adoption of cloud-based services across Europe. ECIM completes the value-chain for cloud-based public services by deploying a Marketplace wherein public authorities and the private sector, especially SMEs, can migrate their services, create new ones and find a market to sell them. To validate ECIM we selected mobility/parking, consistently cited as high priorities for citizens and public service providers alike. Commercial off-street and public sector on-street parking solutions are easy to locate online. However, these offerings function in near total isolation from each other let alone with related areas such as public transport alternatives such as city bike stations. For example, merging real-time availability of on-street and off-street parking with transport options would enable cities to advance ‘softer’ urban mobility priorities e.g. encouraging environmentally friendly modes of transport. To address these issues, ECIM delivers a cloud-based platform with functionalities that facilitate migration of existing data and services (APIs) of various mobility service providers and public entities (e.g. parking, public transport) and innovative creation of new ones. Moreover, we want to show that by enabling open and innovative management of mobility within cities, ECIM has the potential to significantly improve citizens’ lives by reducing congestion, lowering pollution and

saving time. It also has the capacity to help cities save time and money by using cloud computing to stimulate development, aggregation and use of interoperable services that can be reused across borders.

2.2 Approach

To design a solution according to real end-user needs, ECIM relies on the proven Living Lab approach ensuring end-user involvement in all stages of development. The approach taken in analysing possible business models and developing a sustainability plan also relied on Living Lab-supported validation exercise. To validate the solution, we ran pilots in Barcelona, Issy-les-Moulineaux and Brussels, and a proof of concept in Birmingham. The platform was built based on collected requirements from project partners, and various APIs were integrated. A mobile app was developed for the pilots, which were able to share services among themselves to demonstrate cross-border interoperability of the solution. Tests were conducted in several iterations, to feed developers with feedback and test the app with incremental improvements. As its basic idea, ECIM is a platform that plays the intermediary role in a two-sided market. In order to create a realistic sustainability plan, various tasks were performed, from market to business model analysis and validation. Following the market analysis, business model analysis was performed and validated with project partners.

3 Main project outcomes

ECIM had specific goals in what concerns development of the technical solutions. Based on extensive user requirements collection and iterative development, the platform Marketplace is considered as a core project outcome. Piloting the test app, as a Marketplace service consumer, helped us to validate the integrated multi-modal services concept, and finally, the solution was complemented with a sustainability plan.

3.1 Platform Marketplace

The platform Marketplace, developed in WP3 [2], allows publishing a variety of data formats (CSV, JSON, XML), web services (REST), and complements the offering with a single-sign-on and a single-payment mechanism. To publish its offerings, the service providers are presented with an interface that allows them to create an attractive presentation of his offering and provide full data / service details (e.g. endpoint URL, methods, parameters), useful to a developer, who will subscribe to their offering. On the other hand, to consume a service a registered developer follows a procedure, where he needs first to subscribe to the desired service, and only when a data/service provider approves his request, he is able to access it. The Marketplace is analogous to common app stores, playing an intermediary role in terms of data/service discovery, subscription, technical interfaces (APIs), contractual, financial and legal agreements.

3.2 Common API recommendations

While integrating various data and services from private and public providers, we encountered the need for more homogeneous interfaces. The idea of harmonising API formats, e.g. for a specific mobility domain (e.g. parking), stemmed from the efforts required to integrate a variety of different service provider APIs, which enable interaction with similar services. As a solution, we proposed common API recommendations initially for parking services (on-street and off-street) [2], and later we complemented these with a single-sign-on and a payment service. The initiative is promoted via www.smartmobility.io. The recommendations would first of all benefit developers, who will need to get acquainted with only one format, and secondly the service providers, who would simply follow the existing implementations and would benefit from a large number of developers able to integrate their service with minimal effort.

3.3 Piloting

Tests demonstrated that the ECIM app was perceived as potentially useful for citizens and visitors [10]. This measure was evaluated the most positive, together with the concept underpinning ECIM. As such, ECIM app responds to the need to find relevant mobility information fast while on the move, and to interact with these services (start/end parking, pay tickets, etc.). Nonetheless, despite these positive points, the ECIM app did not manage to convince testers for further use. The reasons for this relate to the aspects of ease of use, content quality and accessibility of the app, which for some testers interfered with getting the relevant information fast and without problems. Besides addressing strictly usability and design issues of the app, it became clear that integration is more than just adding services together and make them technically fit. It involves also elaboration of a customer service around the fact of having the services combined both at the physical parking spot as well as on the app regarding crucial information. This cannot be done by the pilot test team alone, but requires the active involvement of all service providers. Nevertheless, the ECIM concept was positively evaluated, and the testers confirmed the need for such integrated apps, thus showing the platform idea is a valid one. In its final phase the piloting was complemented with hackathons and app challenges, which gave us the opportunity to validate the Marketplace and to use developers' feedback to further improve the platform.

3.4 Advances beyond the state of the art

ECIM complements existing OpenData initiatives by providing not only data (e.g. points-of-interest), but also (web)services, which allow a developer not only to read, but to also interact with mobility service providers. As such, it goes beyond the concept of OpenData and provides the ground for OpenServices, where an authenticated and authorised developer is able to consume and monetize public and private services, up to now available only to providers themselves. ECIM creates a set of API format recommendations to increase service interoperability, help developers easily integrate new services in an app, and enable both sides exploit ECIM cross-border

capabilities. With its central role, taking care of interaction between different parties, the Marketplace brings as one of the first the concept of the 'app store' to the Mobility domain, paving way to development of Mobility-as-a-Service (MaaS) offerings.

3.5 Overall innovation potential

The innovation potential of ECIM lies in its open common APIs, which enables service providers, such as park operators, to easily publish their API to the ECIM Marketplace, where it immediately becomes available to registered developers. Since the developers need to visit only one Marketplace and choose from a variety of services, his development path is much smoother and quicker. The platform takes the role of an intermediary and lowers the discovery and negotiation cost because it takes over all technical, financial and contractual negotiations. A developer or a service provider is also able to combine different APIs and create new ones, and finally publish them on the ECIM Marketplace. By providing this flexibility, ECIM gives developers and service providers the tools to innovate not only in technical terms, but also on finding new ways to monetize their products and innovate in the business model.

3.6 References to related work and related projects

ECIM was built on the lessons learned in European Platform for Intelligent Cities (EPIC) project (2010-2013). ECIM also made use of lessons learned in other projects and initiatives: MOBI.Europe, SuperHub, POLITE, smartCEM, SATIE. As part of the requirements collection and technical design phase we explored several mobility-related initiatives, API services, Mobility apps, IoT and Mobile payments. During the project several commercial initiatives have emerged, and the ECIM team made sure the most important and relevant were studied and considered in the solution or concept design. Just to highlight one, MaaS, a concept emerged in 2015 in Finland, identified as a paradigm shift, changing the way citizens, employees or travellers use Mobility services. ECIM is seen as a technical enabler for MaaS offerings, putting MaaS brokers on the map of potential customers.

4 Sustainability

4.1 Exploitation approach and expected impact

ECIM Marketplace enables SMEs to monetize their data and web services. With strong value proposition for various groups of potential users, and a positive outcome of the market analysis, the project partners engaged in studying a feasible business model that would enable the project to become commercially viable and sustainable also after the funding from the EC has been concluded. Sustainability planning started with a market analysis [8], using desk research and tools such as SWOT analysis. We concluded that in an increasingly crowded market, ECIM needs to establish itself

soon: manifold solutions exist or are being established that in one way or another mirror ECIM's. MaaS plays a role in this regard, as more and more projects are focusing on it, rearranging boundaries of existing services. The competitive advantage of ECIM was identified as following. First, no other solution offers an online space for collaboration and co-creation of mobility services. Second, ECIM caters for service/data providers and developers – a box ticked only by one of the analyzed competitors, OneStopTransport. And third, the wide range of APIs ECIM offers to developers. This leads to the realization that ECIM's most promising potential lies in enabling MaaS initiatives by integrating various mobility services and offering them in an integrated and open fashion.

<p>Strengths</p> <ul style="list-style-type: none"> • Enabling cooperation between service and data providers and developers • Technological means to do so (APIs) • Active interest and involvement of the public sector 	<p>Opportunities</p> <ul style="list-style-type: none"> • Popularity of MaaS concept and paradigm shifts in transport market entailing diverse business opportunities • Involvement and investment from local, national and EU governments could secure leadership buy-in
<p>Weaknesses</p> <ul style="list-style-type: none"> • Limited Marketplace participants • As an EU project disincentives established mobility actors to invest 	<p>Threats</p> <ul style="list-style-type: none"> • Other actors (e.g. UbiGo) expanding into ECIM pilot cities • Several competitors with similar offers

Table 1. SWOT Analysis

We continued exploring which business model could help ECIM enter this market and provide added value to its customers and become sustainable. ECIM business model relies on the platform theory, which is characterized by interdependencies of the participating groups of providers and consumers, and is conceptualized as a multi-sided market where the utility that user A derives from participating in the market is correlated to the number of users B (and conversely): externalities between stakeholders internalized by the market [4]. We initially studied the business model frameworks proposed in the literature, and started with business model canvas, proposed by Osterwalder [9], which serves well to evaluate a single company. It is a chart that helps to visualize and clarify the essential parameters of a service or product: key partners, activities, resources; value proposition, customer segments, customer relationships, channels; cost structure and revenue streams. However, to provide a coherent treatment of the most relevant business model parameters, while at the same time emphasising relationships between actors in an ecosystem setting, we decided to use another approach [1][5][7] to enrich the classic value chain approach in changing environments such as online services where value is no longer created in a linear fashion. To

determine the right answers to the above-described challenges and to produce a solid business plan for ECIM, a so-called LLAVA (Living Lab Assumption and Validation matrix) tool developed by iMinds-SMIT was deployed. It enabled us to discuss different business model aspects in a common framework, allowing to create and agree on a common vision on the different business model aspects and to manage and execute the innovation tracks by listing critical assumptions and mapping out validation steps. Finally, it supported us to assess the strength of the envisioned business model by pinning down focus, differentiation and coherency. We identified different business models, from transaction-based revenue sharing, to city-paid subscription, eventually following a public-private partnership. In all cases, the concept relies on large scale deployment, integration of many mobility services, playing the role of a central platform on which local players rely on and at the same time allowing new entrants - application developers, festival organisers and tourist service providers to exploit these services and provide more value to their existing offerings, e.g. full ticket-less city mobility during a music festival, or simply providing parking when renting a car.

4.2 Barriers and obstacles, and expected market value

Platform businesses have proven to be most viable in today's Internet economy. Nonetheless, to establish such a business, various roadblocks have to be overcome in the go-to-market strategy. The conclusion of the workshops suggested the need of city authority's involvement in ECIM deployment in order to create impact. Establishing ECIM as a general service relying on revenue sharing would require a substantial business setup investment and more beneficial financial conditions to be attractive to service providers with existing payment processing contracts. Nevertheless, the main challenge is to start such two-sided market because the interdependencies on which such markets are founded pose substantial difficulties. Participating is only interesting for an actor if its counterparts also participate, and to launch such market is similar to the "chicken and egg" problem. This coordination problem ("hold up") refers to the lack of incentives to invest for independent firms planning to offer complementary goods/services. Such problems ('indirect network effects') are argued to be "endemic" to the ICT industry [6]. Coordination problems lead in turn to incentives to bundle and to cross-subsidize complementary products and services, e.g. by using a so-called razor-and-blade or loss-leader revenue model. In such model one good (e.g. an inkjet printer, a video game console, or a razor) is sold below cost or is even free, while this cost is offset by revenues from sale of complementary goods [6]. In ECIM, users on one side of the market will only be attracted by the offer if there is desired content. The other side supplies content, which will in turn only be attractive to join for providers if there are users. Several strategies theorize how to face this initial problem. Most importantly, pricing policies need to maximize the quantity of content providers on the one hand, and clients on the other. Cross-subsidization is necessary, as known from "freemium" offers [3]. The theoretical exercise, with the addition of the workshops with project partners and discussions with third party providers, resulted in several pricing models and income streams being identified as realistic and attractive.

5 Conclusion

The market analysis proved that there is room and demand for a solution such as ECIM, positive feedback on the concept was collected during the piloting, where testers (citizens) acknowledged the significant value of having several Mobility services integrated the one pilot app, which was developed using ECIM APIs. Furthermore, the business model workshop showed that the identified value proposition is realistic, and the overall business model is feasible. Revenue sharing gets increasingly complex with an increasing number of actors involved. As a technological and contractual intermediary ECIM establishes rules for these relationships and simplifies the revenue sharing. This is the case also because certain kinds of service re-users will also be able to provide their own services on ECIM Marketplace at some point, thus changing role to provider; or even being both at the same time. Nevertheless, based on the amount of the estimated initial investment, and the identified barriers in becoming an attractive platform for service providers to share their revenue, we identified that the most feasible initial model is to provide the platform as a public infrastructure that is not per se profitable, but instead relies on low running cost enabled by its cloud nature, while maintaining the opportunity to switch to a paid, revenue sharing model once it gains popularity. Project partners are already discussing the possibility to provide the platform to Brussels region as regional infrastructure service, provided by CIRB and commissioned by the Brussels parking agency, which aims to harmonise and streamline parking services in the region.

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