MOVEUS Project: "ICT Cloud-based platform and mobility services available, universal and safe for all users"

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Abstract

The main goal of MoveUs project http://www.moveus-project.eu is to design, implement, pilot, evaluate, disseminate and exploit a number of ICT tools for smart mobility in smart cities, with the aim of radically change the European users' mobility habits by offering intelligent and personalized travel information services, helping people to decide the best transport choice and providing meaningful feedback on the energy efficiency savings obtained as a result. The paper focus on the services developed for the Madrid use case:

-   A smart crossing service: allows pedestrians to activate a request for green light, but also takes into account the real-time status of the intersection, and directly interacts with the traffic control center and extends the green phase if needed.
-   A bus priority service: prioritizes delayed buses at selected crossings in order to optimize travel time and frequency, improving also the efficiency of this mode of transport.
-   A trip planning and info mobility service: calculates the best multimodal journey option, taking into account different parameters such as time, energy efficiency, incentives, etc.

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1

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1. Introduction

70% of the EU's energy is consumed in cities. In such environments, 40% of petrol is used for finding somewhere to park and 80% of urban trips involve just one person travelling alone. Cities – and citizens – are key partners when it comes to reaching the EU's objectives of 20% energy saving by 2020 and when it comes to developing a low carbon economy by 2050. Cities therefore have a huge potential for energy saving through smarter use of transport resources and intelligent technology integration for improved mobility services.

However, there are relatively few ITS systems and services that specifically address environmental objectives. But ITS can indeed help to reduce emissions and save energy through a better demand management including the use of road charging and access management. Better multi-modal information and feedback to drivers (eco-driving) are also valuable instruments.

This can happen in a cross-city or cross-border manner, but naturally also in an urban framework. A change of mobility habits in the average European citizen is needed. This should be proposed and reinforced by new and better mobility services at hand and a clear conception of the benefits for such citizen, the city and the entire society.

Reducing congestion through better management of demand and capacity can be achieved through dynamic traffic management based on real-time data from roads/streets, vehicles and even mobile phones, and the use of simulations and historic data can also improve the strategies to mitigate congestion. In this regard ICT can provide a lot of information that can help optimize the management of such a complex system, but this information can come from very diverse systems. Managing these data and delivering a satisfactory service on a need-basis is challenging.

The ever-increasing quantity of information that can be captured, stored, processed, aggregated and communicated among users and providers of mobility services calls for a transformation of our current idea of cooperative communication around the Future Internet concept; this transformation has to be driven from the cloud-computing concept.

Technology-wise, this whole idea should be built on top of a thorough analysis of the city's mobility requirements, sources, sinks and current infrastructures, and be based on a number of components able to securely process heterogeneous data and deliver multi-platform access to real-time information and services.

More specifically, this platform must be able to guide the operation and control of the transportation companies, to know where the user is and where he wants to go and to deliver him incentive-based and complete services on the fly. Multi-modal travel information services provided before and during the journey (including advice on environmental conditions) can assist the traveler to make responsible mode and route choices, and to be aware of how and up to which point these choices are beneficial in terms of energy efficiency.

Summing up, the three main motivators for carrying out the MoveUs project are:

1. The need for availability and take-up of European new multimodal, personalized, sustainable, safe and reliable smart mobility services

2. The need for user-engagement, through incentives, for allowing the citizen to act as a data source and to know how a habit change can reflect on real energy savings

3. The need for solutions capable of capture, store, process, aggregate and communicate large amounts of mobility data, that can be used by a number of stakeholders, thus representing viable business cases.

Therefore, it has been identified that cities have a huge potential for energy savings by improving mobility services with smarter use of transport resources and intelligent technology. In addition, ITS systems can help to reduce emissions and save energy through a better demand management and providing the right information to people for taking more energy efficient decisions when choosing from different transportation modes.

2.   MOVEUS project

MoveUs aims to radically change the European users' mobility habits by offering intelligent and personalized travel information services, helping people to decide the best transport choice and providing meaningful feedback on the energy efficiency savings obtained as a result.

The main objectives of the project are:

- To integrate mobility data from heterogeneous sources and deliver it in a coherent and useful way

- To provide green, multimodal, personalized, sustainable, safe and private, reliable and extensible services

- Provide business cases and incentives recommendations for smart mobility services in urban environments.

MoveUs services and functionalities are mainly targeted to:

- Citizens and Tourists

- Public and private transit organizations and transport/ fleet operators

- City authorities

- Local business

- Energy operators

- ICT solutions providers

- Non-profit organizations

MoveUs means ICT cloud-based platform and mobility services available, universal and safe for all users. As a result of the research activity along the project, MoveUs has delivered:

- A cloud-based mobility management platform, which will collect input data from distributed heterogeneous sources and process these data to infer valuable information of the traffic status and users' mobility patterns, ensuring data privacy and security all along the handling process.

- An API toolkit offered as a platform extension, in the form of light full services (REST) which provides developers and third parties access to these data and use them to develop new services.

- A set of innovative user-centric services supported by an effective incentive-based model, aimed at assisting users' mobility and fostering behavioral changes towards sustainable transport modes.

- A fully integrated smart mobility application (MoveUs App), running either on users' smartphones or control centers owned by Local Authorities or Transport Operators.

- Energy efficiency assessment tools to measure users' carbon footprint and the energy gains vs. consumption for the ICT solutions applied to each pilot.

MoveUs will therefore integrate, in a cloud-computing environment, different transport and traffic management components and future internet technologies which are able to capture, store and elaborate a relevant and heterogeneous quantity of mobility and energy assessment data.

These data will draw from asynchronous user-generated information (e.g. mobility patterns, preferences), synchronous user-generated data (e.g. position in real time), historic databases (e.g. weather reports and trends, public transportation schedules) and data from mobility companies and vehicles in real-time. Such vast amount of

information will then be used for developing an API toolkit for third parties plus a wide range of innovative, personalized and incentive-based mobility services.

For each of the three piloting cities in the MoveUs project: Genoa, Tampere and Madrid, a thorough study was carried out in the beginning stages of the work. This study analyzed the current infrastructures, the main development trends and programmes already in place, and what the citizens wanted. With our "green, multimodal, personalized, sustainable, safe and private, reliable and extensible" idea in mind and the aforementioned results with regards to city and citizens' requirements, the MoveUs services were deployed and localized in each piloting city for all relevant stakeholders to use.

A preliminary study of different piloting cities, their particularities and their infrastructures was carried out, and the selected ones are Madrid – a big capital city starting to position itself in the smart cities landscape, Genoa – a medium-sized Mediterranean smart city and the largest seaport in Italy, and Tampere – a small Nordic inland city with a contrasted career in the smart city world.

With regards to the users, in each of our cities, the project established a Living Labs approach for the MoveUs pilots, which emphasized the participation of representative samples of the urban population in the phases of requirements collection, co-creation, use and evaluation of the mobility services.

These users were not only end-users but also other relevant stakeholders such as SMEs, associations and public bodies. They are the ones to propose, by eliciting their everyday requirements, sustainable business cases for the MoveUs technology. The selection of the respective samples (with different demographic characteristics) was performed by the cities themselves and their supporting technical partners. The involvement of representative samples of the population allowed the project to study the acceptance and penetration of the services within specific segments of the population.

Summing up, the MoveUs platform, API toolkit and services has been designed to flexibly enough address different urban contexts in Europe, considering the different maturity stages of cities in the process of becoming smart cities. The piloted cities constitute a small but well representative sample of European cities in terms of size, socio-cultural and technology/mobility infrastructures and this will yield interesting impacts.
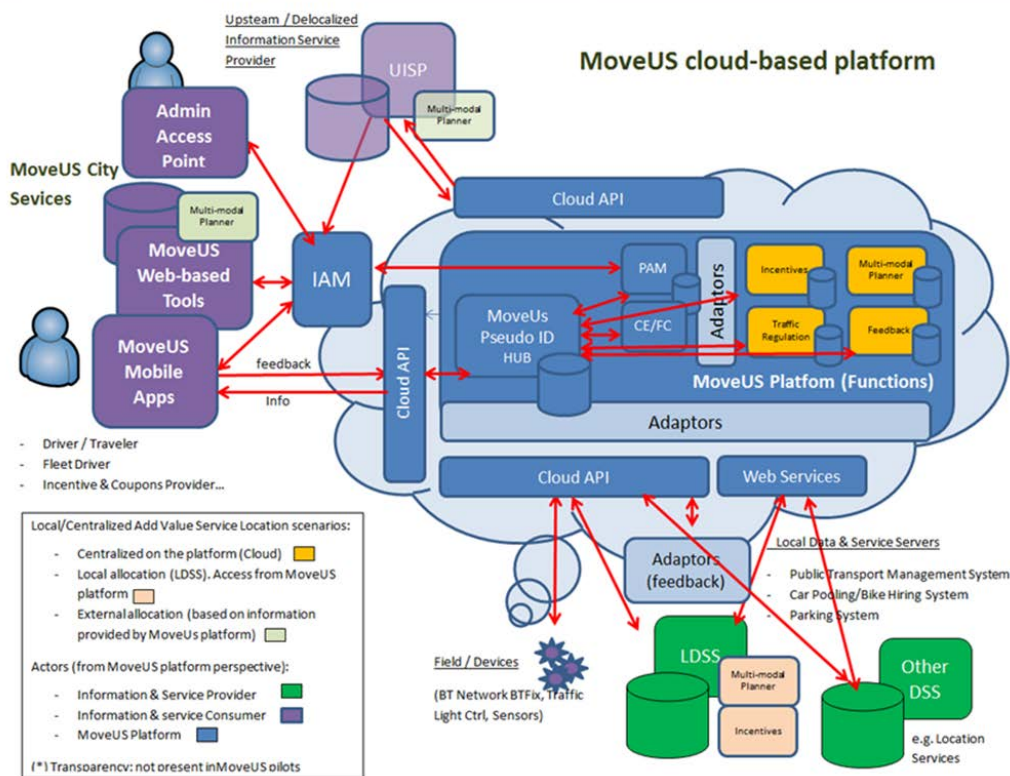

Fig. 1 MoveUs cloud based platform. Source: MoveUs Project

MoveUs has developed innovative user-centric city services supported by an effective incentive-based model and energy efficiency tools, aimed at assisting users' mobility and fostering behavioral changes towards sustainable transport modes.

Those services are integrated in a user interface targeted to citizens to make the functionalities and the information processed by the mobility platform easily accessible in a friendly and personalized way, and also through various console services targeted to authorities.

Today many of the initiatives that aims at triggering eco-friendly mobility choices are restrictive actions but it is likely that in the near future, a mix between prices, financial and positive social incentives could represent an effective measure to make drivers reduce of a significant percentage of the mileage in urban environment or to shift to other modes of mobility.

MoveUs project has designed and developed a complete system where positive incentives can be gained by using "soft" mobility modes such as shared vehicles, bicycle and public transportation. The three Living Labs in Madrid, Genoa and Tampere have developed custom incentive schemas and initiatives to fit the local needs and situation with the aim to achieve less energy consumption and smaller carbon footprint in urban mobility.

Based on the journey option emissions, green points are assigned to users to promote the more environmentally friendly options like walking or biking. These points can be exchanged for incentives such as discounts in local stores, by using the MoveUs app.
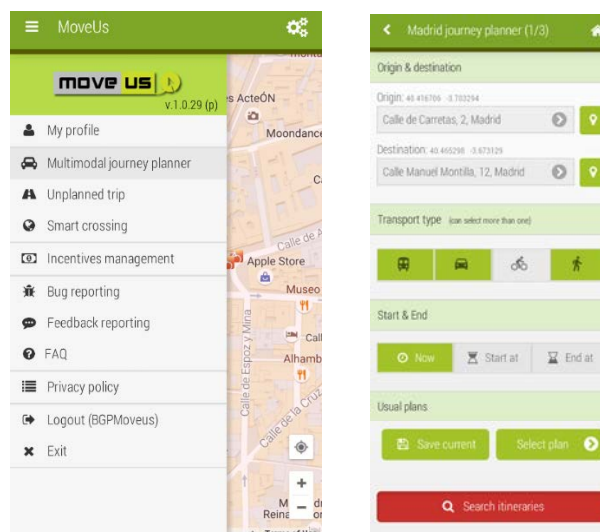

Fig. 2 MoveUs App interface. Source: MoveUs Project

3. Madrid City use case

The city of Madrid has implemented MoveUs platform and has tested three specific services by the Living Lab community of the city, composed of, among others, representatives of the city council, the urban public bus operator, local technology experts in ICT and transport solutions, user associations and citizens.

These are the functionalities which have been developed:

- Multimodal Journey Planner: (this is common for the three pilot cities) User plans a trip according to a mode of transport and gets itineraries, travel times, CO2 savings, calories consumption, green points and incentives. It allows the user to search route options and to choose the most suitable mobility option amongst the suggested modes of transport (public transport, cycling, walking, and car).

  The multimodal journey planner compares the given options according to, for instance, the duration of the journey and energy consumption. One of the objectives is to encourage people to choose sustainable mobility modes by offering information about energy efficiency of different journey options.

There is also the option of making an unplanned trip, so user registers a trip without initially specifying the start and end locations. Corresponding green points are assigned after the user ends the trip.

The planner includes an energy efficiency calculation module which provides information on the energy consumption of the different journey options.

- Smart crossing for pedestrians: Improves road safety and mobility. It allows the user to activate the green light at pedestrian crossings using the mobile App. It also detects slow pedestrians to provide them more time to cross the road.

  This service also integrates pedestrians into traffic cooperative services. A controlled traffic light crossing is equipped with cameras to detect crossing pedestrians; LED lamps to reinforce the lighting at the crosswalk, Bluetooth and 3G communications beacons for pedestrian interaction (via Smartphones) and a PCBox which supplies real time information of the crossing status.

  The system allows the traffic light regulator to extend green pedestrian time, to provide lighting and to activate a green-light request via cellphones Bluetooth. This system is integrated with the MoveUs app being capable to activate a vibrating alert as a signal that the green phase is active. It has been deployed in Madrid (Av. Valladolid, 11) within a controlled traffic light crossing with the support of the City Council.
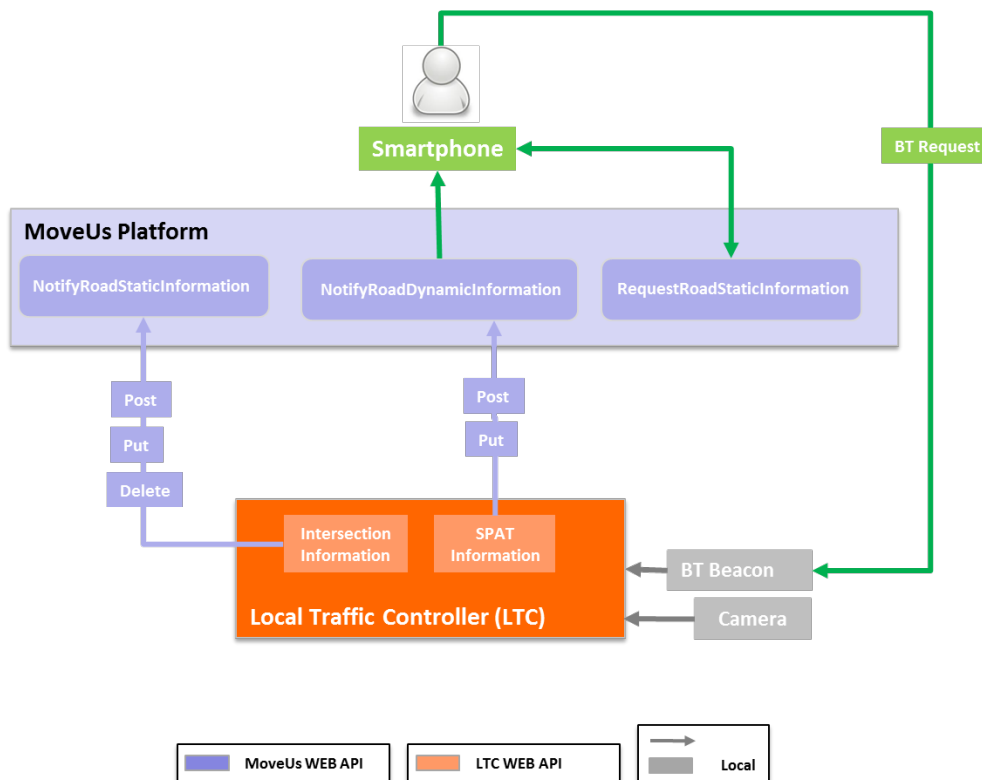

Fig. 3 Architecture of the Smart Crossing service developed in Madrid

- Bus priority: This service allows to provide priority to buses to catch up with their schedule's delay by provoking changes in the normal operation of the specific traffic light controller. This service is intended to improve the quality of public transport and thus improve mobility in the city.

  The aim is to give traffic light priority to buses who have promptly been considerably delayed on their schedule for gradually recovering this delay without affecting the rest of traffic.

  The bus, through its on-board system, knows its status and location and when it detects its proximity to traffic regulators with the priority system implemented sends the request to the MoveUs platform which in turn connects to the control systems to assess and respond to the bus accepting or rejecting the request.

If the application is accepted, it is communicated to the driver via the on-board console so driver can act accordingly.
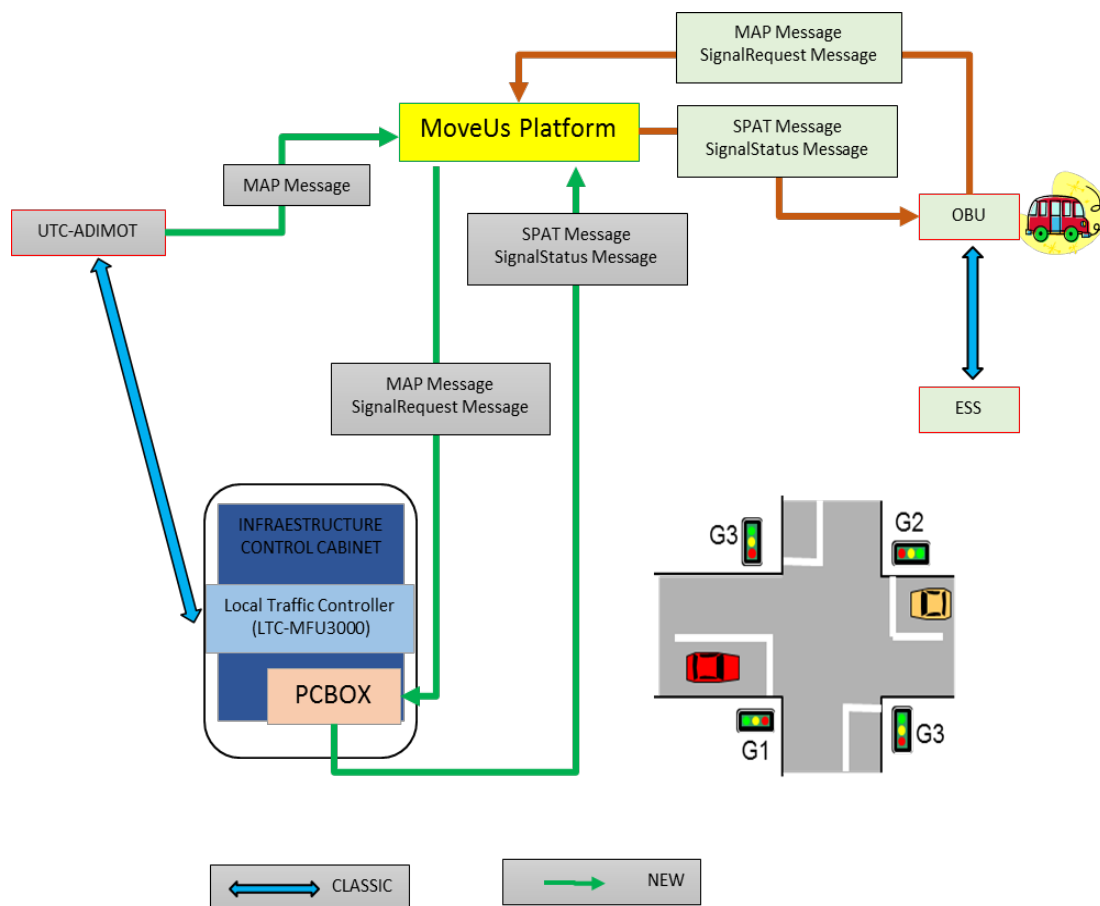

Fig. 4 General overview of the architecture for the Bus priority service developed in Madrid

4.   Conclusions

MoveUS project has proven to be a very positive experience in the development of functionalities and services taking into account different approaches.

In the specific case of the bus traffic priority service, the experience has been very positive, since the services developed thanks to the MoveUs platform are based on software as opposed to the traditional systems based on hardware, which has repercussions in its lower cost and complexity.

The city of Madrid, for example, thanks to the positive results of the tests carried out within the framework of the project, will undertake shortly the installation of this priority service in a certain number of crosses of the city.

Madrid received the "Thinking Cities Award" last December 1st at the 2016 Polis network Annual Conference in Rotterdam.

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