eCo-FEV Mobility2.0 Mobincity

Clustering Activities

Common Deliverable

Version number	**Version <2.3>**
Dissemination level	**PU**
Due date	**Release 2** 7th Mar 2014, **Release 3** January/February 2015 (tentative) **Release 1** 21st Dec 2012

Authors

Aguado, Irene (ITE)

Budroni, Angela (Fraunhofer)

Heidrich, Wolf (Fraunhofer)

Inhuelsen, Henrike (EICT)

Klaudel, Witold (Renault)

Kovacs, Andras (BroadBit)

Lenardi, Massimiliano (Hitachi Europe Ltd)

Lin, Lan (Hitachi Europe Ltd)

Maslekar, Nitin (NEC Europe Ltd)

Santonja Hernández, Sixto (ITE)

Soriano Borrull, Raúl (ITE)

Winzer, Anja (EICT)

Legal disclaimer

Revision and history chart

Version	Date	Comment
0.0	22-07-2013	**Mobincity**: Draft proposal
0.1	30-07-2013	**Mobincity** / **All**: Review of v0.0 in webconf. Tentative agreement on its contents. Proposal of modifications.
0.2	11-09-2013	**Mobincity**: Tentative arrangement of sections based on contributors' proposals.
0.3	12-09-2013	**Mobincity**: Format cleaning up for easier collaborative editing.
0.4	03/10/2013	**Mobincity**: Clean version for webconf discussion. Inclusion of tentative editing assignment
0.5	04/10/2013	**Mobincity** / **All**: Review of version by all on webconf. Agreement on final deliverable's structure. Agreement on work editing assignment.
0.6	18/11/2013	**Mobincity** / **All**: Review by all on webconf. Fine tuning of assignments.
0.7	29/11/2013	**All**: Contributions (respect release 1): • Executive summary content updated • §1 Use cases and architecture: New section • §2.2 List of standards: Lists reviewed and updated. • §4 content updated. Modified and new subsections: §4.1, §4.2, §4.2.1, §4.2.2, §4.6 and §4.6.1.
0.9	16/12/2013	**eCo-FEV**: Contributions on sections 1.1, 2.1, 2.2.1 and 3
1.0	17/12/2013	**eCo-FEV:** Figure update on §1.1.4
1.1	18/12/2013	**Mobincity**: Added contributions from: • Andras on §2.1 and §2.2.3 • Angela on §3
1.2	19/12/2013	**Mobincity**: Status review in web conference. Minor corrections on provided contributions. Updating of comments.
1.3	30/12/2013	**Mobincity**, **eCo-FEV:** eCo-FEV contribution for §4.6.1 included.

1.4	04/02/2014	**Mobility 2.0**: Contribution on architecture, common interfaces, use cases and requirements (Chapter 3)
1.5	07/02/2014	**Mobincity**: Contribution to section "4.3 Meetings"
1.6	07/02/2014	**Mobility 2.0**: Contribution to sections 1 and 3
1.7	24/02/2014	**All**: section 3 **Mobility 2.0**: section 6 **Mobincity**: Minor changes in sections 1, 4 and 6.
2.0	28/02/2014	**Mobincity**: consolidated version
2.3	06/03/2014	**All:** final version

The 3 EC FP7 projects eCo-FEV, Mobility2.0, and Mobincity aim at satisfying the objective GC-ICT-2011.6.8 "ICT for fully electric vehicles".

The EC requested common actions among the 3 projects, in particular on possible synergies and clustering strategies.

eCo-FEV

AT A GLANCE

Specific Targeted Research Project (STREP)

Project coordinator:
Hitachi Europe Limited, Massimiliano LENARDI

Partners:
Hitachi Europe, CEA, Centro Ricerche Fiat, EICT, Politecnico di Torino, Renault, TU Berlin, SITAF, Facit Research, Département de l'Isère, ENERGRID, Institute for Economic Research and Consulting, BlueThink

Duration:
September 2012 – May 2015 (33 months)

Total cost:
4,265,317 €

Programme:
7th EU Framework Programme

Further information:

www.eco-fev.eu

Mobility2.0

AT A GLANCE

Specific Targeted Research Project (STREP)

Project coordinator:
BroadBit
Andras KOVACS

Partners:
BroadBit, EXTRA, Barcelona Digital, ICCS, Municipality of Reggio-Emilia, ARMINES, University of Twente, Privé, NEC Europe

Duration:
September 2012 – February 2015 (30 months)

Total cost:
2,691,580 €

Programme:
7th EU Framework Programme

Further information:
www.mobility2.eu

Mobincity

AT A GLANCE

Specific Targeted Research Project (STREP)

Project coordinator:
ITE
Sixto SANTONJA

Partners:
ITE, Fraunhofer ESK, ETRA, EIHP, ENEL Distribuzione S.P.A., CIT Development S.L., Elektro Ljubljana Podjetje Zadistribucijo Elektricne Energije DD, Hrvatski Telekom, Technomar Gmbh, SZ-Oprema Ravne D.O.O., ETREL Svetovanje in Druge Storitve D.O.O., CRAT, Zabala Innovation consulting S.A.

Duration:
July 2012 – June 2015 (36 months)

Total cost:
3,927,530.00 €

Programme:
7th EU Framework Programme

Further information:
www.mobincity.eu

Table of contents

Index of figures

Index of tables

Executive summary

This Deliverable, common to all three projects eCo-FEV, Mobility2.0 and Mobincity, represents formally the Liaison among the three clustering projects and aims at synchronising key milestones and achieving overall synergy with each other. The three projects will also participate in any official concertation process.

Taking into account the specific project goals, the clustering objective is to actively work towards alignment in common work towards standardization, common awareness actions (e.g. joint demonstration events, workshops, webinars, joint final event), coordination and synergy in dissemination activities (e.g. presentation of the cluster achievement in conferences); possibly, the projects will try to align also in system concept and definitions, high level architecture and standard interfaces, interoperability.

This common Deliverable is a living document, with three releases planned. The 1st Release provided the clustering activities' initial contributions/ideas.

The 2nd Release has been updated with the use cases, architecture and requirements of each project. Furthermore, a common general functional architecture of the E-Mobility platform has been defined. The three projects have also identified the relevant stakeholders, a set of standardized communication interfaces and a list of messages being exchanged over them for the implementation and deployment of an E-mobility platform. The second release of the common Deliverable also includes the common activities carried out by the clustering projects, such as the "Use cases and requirements" Workshop that was held on September 20th 2013 in Brussels.

The 3rd/final Release will be updated with further plans and concluded activities and has been planned (tentatively) for January/February 2015.

1 Use cases and architecture

The three projects eCo-FEV, Mobility2.0 and Mobincity have included in the following sections a description of the architecture of the system, the actors and components involved and an explanation of the user and technical requirements.

1.1 eCo-FEV

The objective of the eCo-FEV system is to simplify the usage of the full electrical vehicles and to appease range anxiety related to the new full electrical powertrain concept. To achieve these objectives the eCo-FEV proposes to play the role of facilitator between travellers and all operators participating in planning and realization of trips involving FEVs.

The project proposes services for two classes of travellers: individual travellers and light urban delivery fleet drivers.

The main use cases for both classes are “trip planning” and “trip assistance”. For individual travellers trips can include supplementary option of multimodality (i.e. a trip mixing public transport and personal car usage). For urban delivery the trip planning is encompassed by the more general daily planning for the entire urban delivery fleet.

The principal novel characteristic of eCo-FEV is its employment of data-mining (i.e. cloud based “data collect” and “learning machine”) to optimize the trip planning and of what we term “trip monitoring” to reassure the trip realization. This new approach allows roadmaps generation based on knowledge coming from historical data concerning driver and car behaviour, traffic and weather forecasts and a complete information about the charging spot availability. The real time functionality introduced by the “trip monitoring” permanently verifies the trip progress and the accessibility of the charging points. Due to the trip monitoring the driver will always be proposed the best solution to achieve his trip objectives.

Another novelty concerns the eCo-FEV business model in which we separate the role of so called “identity provider” from that called “service provider”. The “identity providers” are in charge of the user subscriptions and “service providers” delivers the services (e.g. charging, parking) to the users recognized by eCo-FEV “identity providers”. Some operators can play the both roles. Thank to this approach we hope to limit the number of subscription the user have to accomplish and to simplify the payment processes when user is not in the vicinity of his home.

The proposed novel functionalities necessitated some technological novelties to be introduced to the eCo-FEV project scope. These novelties address the FEV charging technology and the ICT solutions. In the domain of charging technology the eCo-FEV project builds the field test for charge while driving installation. For the ICT domain the project introduces:

- The OpenID / OAuth (c.f. http://openid.net/specs/openid-authentication-2_0.html and http://datatracker.ietf.org/wg/oauth/) necessary for the identity provider” and “service provider” paradigm introduction. These technologies are today largely deployed by the

Internet actors like Google or Amazon. The project will propose its implementation rules adapted for the transport context.

- Mobile IP (c.f. http://tools.ietf.org/html/rfc2002) the IP routing technology ensuring the application session continuity and the car addressability in spite of telecommunication access changes. In the context of the project, the Mobile IP technology simplifies information exchange initiated by the cloud towards cars.
- M2M CoAP (c.f. http://tools.ietf.org/wg/core/draft-ietf-core-groupcomm/) optimized protocols for data collect functionalities

1.1.1 eCo-FEV ecosystem

The figure below represents the eCo-FEV ecosystem. As already underlined, the eCo-FEV plays the role of facilitator. It proposes services and interfaces to all ecosystem actors necessary to satisfy the list of eCo-FEV use cases.

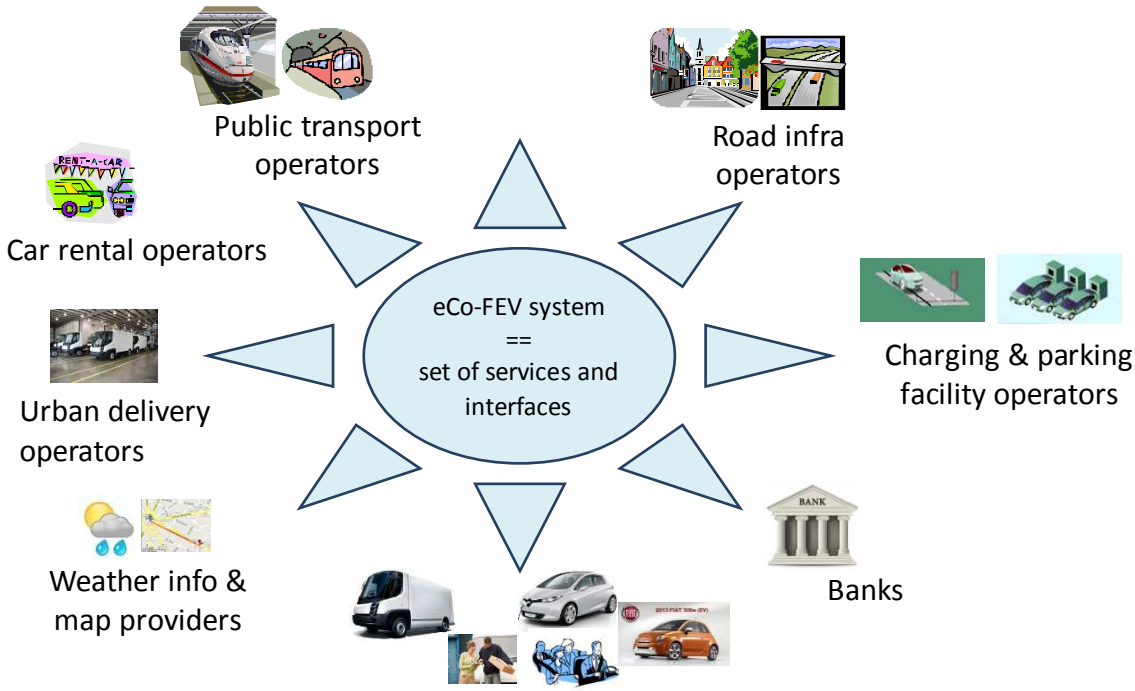

Figure 1: eCo-FEV ecosystem

1.1.2 Use cases

In eCo-FEV, two levels of use cases are defined. The primary use cases provide directly services to individual travellers or light urban delivery fleet drivers. The secondary use cases support the realization of the primary use cases. A secondary use case may be used by multiple primary use cases.

The table which follows gives the list of primary use cases:

Table 1: eCo-FEV primary use cases

Use case name	Short description
eCo-FEV subscription	This use case manages the registration processes of an eCo-FEV traveller to the eCo-FEV system identity provider. In particular, this use creates a list of its FEVs and sets its preferences and subscription options. The use case delivers the credentials necessary to consume the services from the entire eCo-FEV ecosystem.
Trip planning	The eCo-FEV system provides the estimated route for the FEV traveller based on the transmitted request e.g. destination, expected arrival time/departure time, current battery level, etc. The proposed itinerary may include a list of charging & parking facilities bookings along with a charging plan. A multimodal itinerary may be offered according to public transport availability and the traveller's preferences.
Trip assistance	This use case guides the traveller to the destination taking into account traffic and weather conditions, preferences and battery status. The eCo-FEV system monitors the trip progress with regards to a travel plan. If unexpected situations are detected, the itinerary and/or charging plan may be adjusted.
Daily delivery planning	Based on the daily delivery requirements, this use case provides assistance to define the daily delivery plan for urban delivery operators.
Delivery assistance	This use case addresses the urban deliver driver assistance during a planned route and schedule. As for the "Trip assistance" the trip is monitoring and if necessary it can be adjusted.
Free driving assistance	This use case delivers the FEV Driver assistance when the trip target is not known by the eCo-FEV system. The main objective of the assistance is to help the driver to avoid or to manage the autonomy issues and if necessary to guide him to a charging facility in his vicinity.
Ad hoc trip assistance	This use case demonstrates the possibility of launching the trip without the anticipated trip planning. It is simply the trip planning followed immediately by the trip assistance.
Ad hoc drive to facility assistance	This use case consists of providing guiding assistance for FEVs to drive to a charging facility in its vicinity.

The secondary use cases are listed below:

Table 2: eCo-FEV secondary use cases

Use case name	Short description
Trip, facility choice and booking	Based on FEV planned itinerary, a set of accessible facilities along the trip is proposed by the eCo-FEV system to the eCo-FEV traveller. The necessary facilities (e.g. parking, charging stations, and public transport tickets) are booked and prepaid if required by concerned operators.
Facility booking	This use case books the necessary facilities for a trip.
Facility access and payment	This use case handles the payment procedure.

Facility cancellation	This use case cancels a booking.
Trip monitoring	The eCo-FEV system monitors the FEV activities during the trip. It encompasses all other monitoring use cases.
Charging facilities accessibility monitoring	This use case is applied during a trip when the eCo-FEV traveller drives the FEV. It monitors the accessibility of any compatible charging point in the perimeter of the FEV autonomy or in the case of planned trip also the accessibility of the next programmed charging facility.
Charging monitoring	This use case is applied during a trip and when the "participating FEV" is under charge. It monitors the progress of the planned charging and in case of no respect of the expected SOC level; it verifies the consequences for the running trip.
Facilities access control	This use case is applied during the trip just before benefiting from booked facilities. It verifies the facility access authorization and if necessary also performs the payments.
Public transport monitoring	This use case monitors the state of public transports. The eCo-FEV system receives from public transport operators real time public transport and transport mode transit information e.g. public transport time tables, mode transit hub facilities, etc.
Traffic condition monitoring	This use case monitors traffic and weather condition.
Trip adjustment	This use case helps the eCo-FEV traveller to adjust the trip according to environmental events, FEV autonomy issues or to plan changes. Environment events can be related to the traffic or weather condition alterations, to pre-booked facility (i.e. parking, charging station) availability issues or to difference between planned and actual FEV charging program.
Delivery planning adjustment	**This use case adjusts the planning in case of unexpected situations encountered during the delivery. If necessary, the planning of the entire fleet can be adjusted.**

1.1.3 Architecture

The eCo-FEV overall functional architecture is depicted in Figure 2. The eCo-FEV system consists of the following sub systems:

1. In vehicle sub system: an On board unit (OBU) that provides communication capacity within the vehicle and with other eCo-FEV sub systems, and integrates eCo-FEV applications and functionalities. The OBU interacts with existing EV systems (e.g. in vehicle CAN bus) and with embedded EV charging systems.
2. Road side unit sub system: RSU is installed along the road and provides direct communication with FEVs to inform the real time traffic information to road users. RSU may also provide routing functionality to support connection between FEV and Backend operators. Depending on the deployment strategy of the RSU owner (e.g. public authority, traffic operator, service provider), an RSU may be integrated with other existing road side equipment or with charging equipment, in order to support

new services by integrating communication capacity of RSU to those existing equipment.

3. Charging infrastructure: this sub system provides charging services to FEV, including a backend operation solution to manage and monitor the charging procedure. This sub system may be considered as outside the eCo-FEV system in case existing charging infrastructure is used. Given that one research challenge of the eCo-FEV project is the static and mobile inductive charging, therefore, an inductive charging infrastructure is designed and developed by the project.
4. eCo-FEV backend: This sub system is connecting with OBU, RSU, charging infrastructure and a set of external infrastructure operation system to collect real time information. Based on further data aggregation functionalities, the eCo-FEV back end realizes a set of FEV user services from backend such as dynamic navigation, charging assistance service etc.

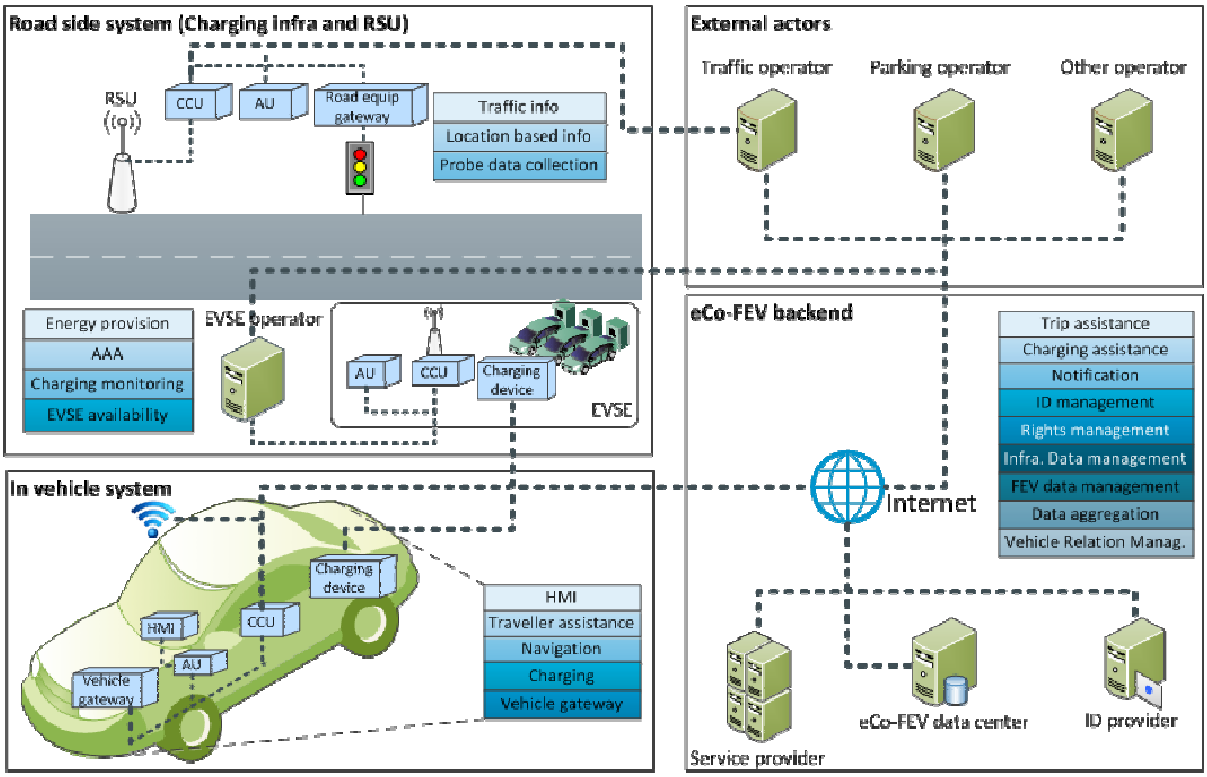

Figure 2: eCo-FEV system high level functional architecture

The figure which follows splits the eCo-FEV system back-end functionalities into four functional components:

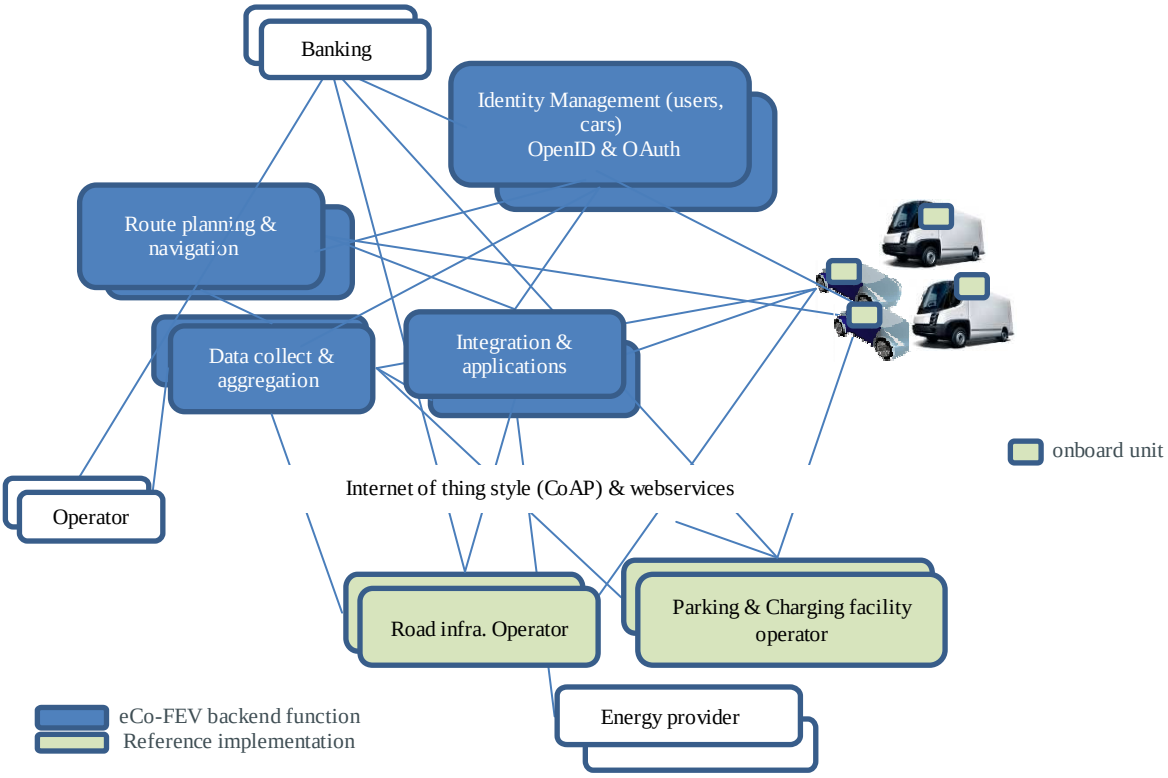

Figure 3: eCo-FEV architecture

The components (or functions) in blue will be implemented as a part of the eCo-FEV infrastructure. The components in green are not included in the infrastructure but their "reference implementations" will be realized by the eCo-FEV project.

Only few of components on the figure are represented as multi-instantiated (car, parking and road infrastructure). This will be the situation in our research context but not during the deployment phases. The architecture has to support the possibility of multi-instantiation and multi-sourcing for almost all components. Our target is to publish interfaces between all components and to give the possibility to existing and new actors to enter the electric mobility market. These interfaces will be based on standard technology like:

- OpenID & OAuth for authentication and authorization;
- Webservices (Soap & REST) and CoAP for information exchange;
- http and html classic HMI.

In other terms, we consider the eCo-FEV main objective is to define the "IT integration bus" and to demonstrate its completeness trough the project developed scenarios. The "IT integration bus" is based on the existing ICT technologies but introduces the eCo-FEV ontologies where the standards do not exist.

1.1.4 Telecommunications

The important effort of the eCo-FEV project was dedicated to the communication principle specifications.

The figure below summarizes the project proposed approach.

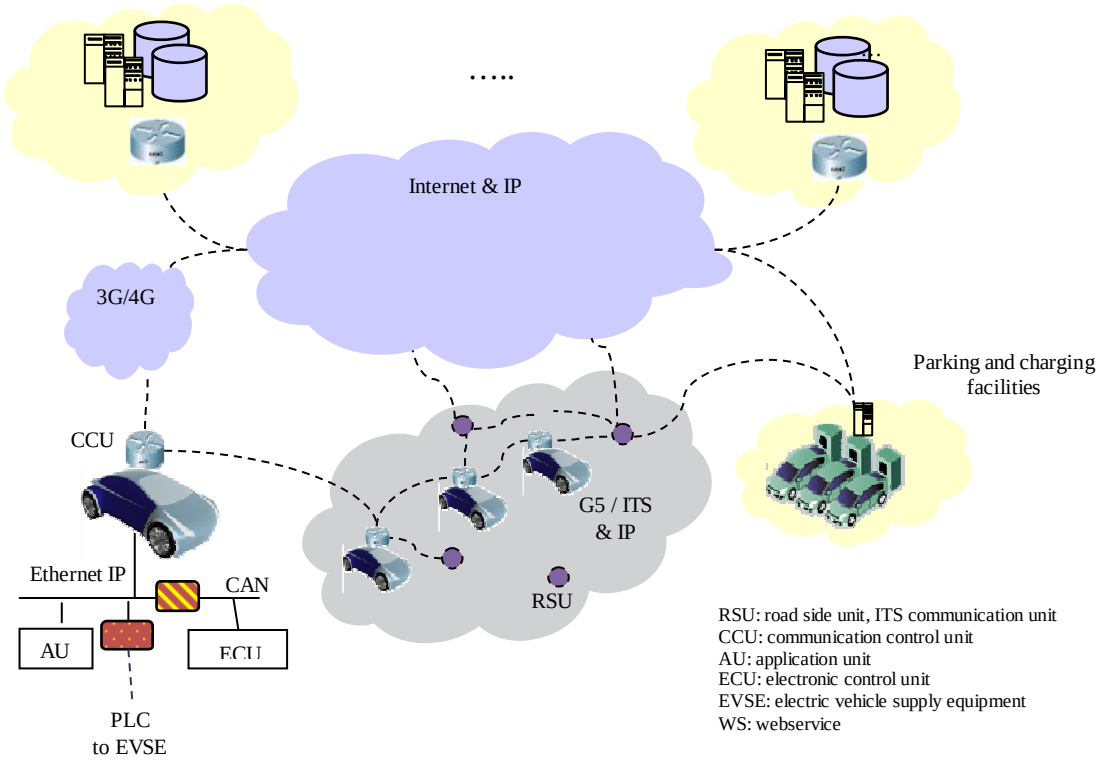

Figure 4: eCo-FEV ecosystem & communication

ITS communications based on 5.9GHz (ITS G5) is used to enable ad hoc communication between FEVs and between FEV and RSUs.

Both G5 and cellular network can be used to connect FEVs to the Internet and to enable communications between all eCo-FEV actors.

1.1.5 Charging facility interfaces

The charging facility booking, access control and monitoring constitute one of the pillars of the eCo-FEV architecture.

The figure below proposes a focus on the eCo-FEV chosen approach.

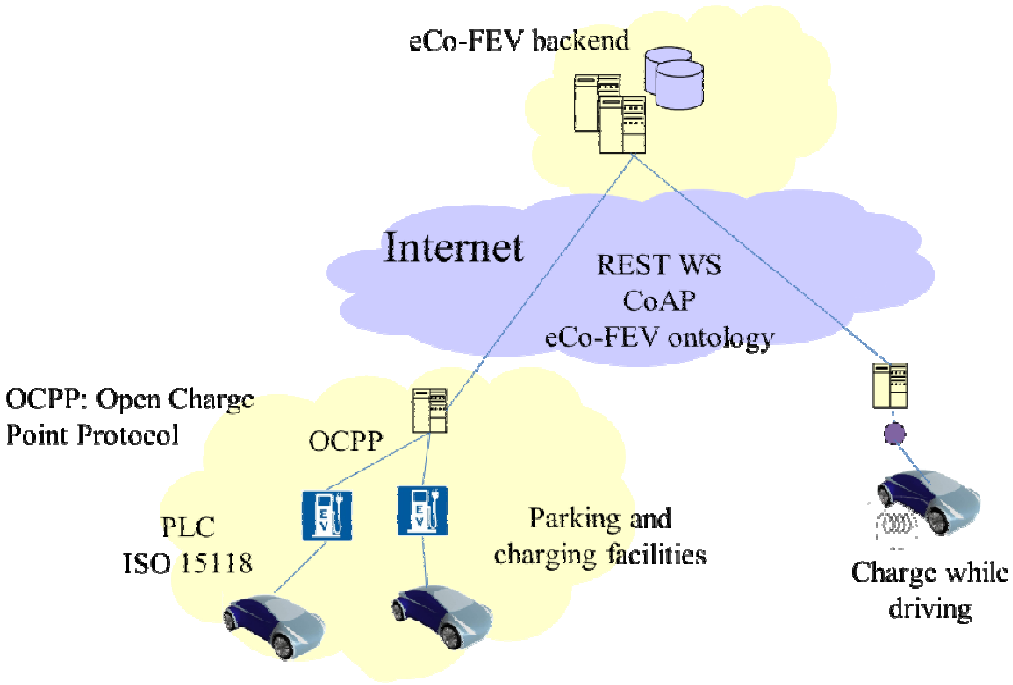

Figure 5: Charging facility interfaces

We propose to imply:

1. The REST webservices with the eCo-FEV ontology for the facility monitoring & booking
2. The OCPP (c.f. http://www.openchargealliance.org/) for the communication between the charging spots and the facilities management, in order to transmit the authorizations and the charging plan monitoring.

The ISO 15118 for the communication between the car and charging spot, in order to authenticate the car driver and to control the charging plan.

1.2 Mobincity

Mobincity has used a Use case driven methodology for project specification. In the use cases' design phase the behaviour of the system has been modelled. The requirements phase has collected what have to be accomplished in the project and how. The use cases' design and requirements analysis phases trend to be coupled and they influence each other. This influence has been reflected using traceability matrixes between user requirements and technical requirements, as well as between use cases and user requirements.

The following sections describe the architecture of the system, the actors and components involved, the use cases description and the list of user and technical requirements. All this information is included with further detail in Mobincity deliverables D1.1 (Use case scenarios) and D1.2. (System design and technical requirements).

1.2.1 Architecture

As it is shown in Figure 6, MOBINCITY is the kernel of the electromobility system. This electromobility system will be able to interact with the transportation and energy infrastructure using the interfaces and adapters that are going to be developed in the scope of the project. This definition of the system implies that MOBINCITY may be applied to any geographical area such as a city or a region.

The design of this adapters and interfaces will allow MOBINCITY to include as information provider any agent available in the selected geographical area to give information about weather, traffic, public transportation options, vehicle sharing alternatives and parking possibilities. MOBINCITY will be also able to communicate with the charging and energy infrastructure as well as the grid agents, such as retailers, distributed energy operator and distribution system operators.

For the adaptation of MOBINCITY system to each geographical are, the external agents may implement the APIs and communication protocols implemented in the adapters of the electromobility system. If this is not feasible, specific adaptors may be developed in the adaptable periphery of the kernel to interact with the external agents to meet their specific needs.

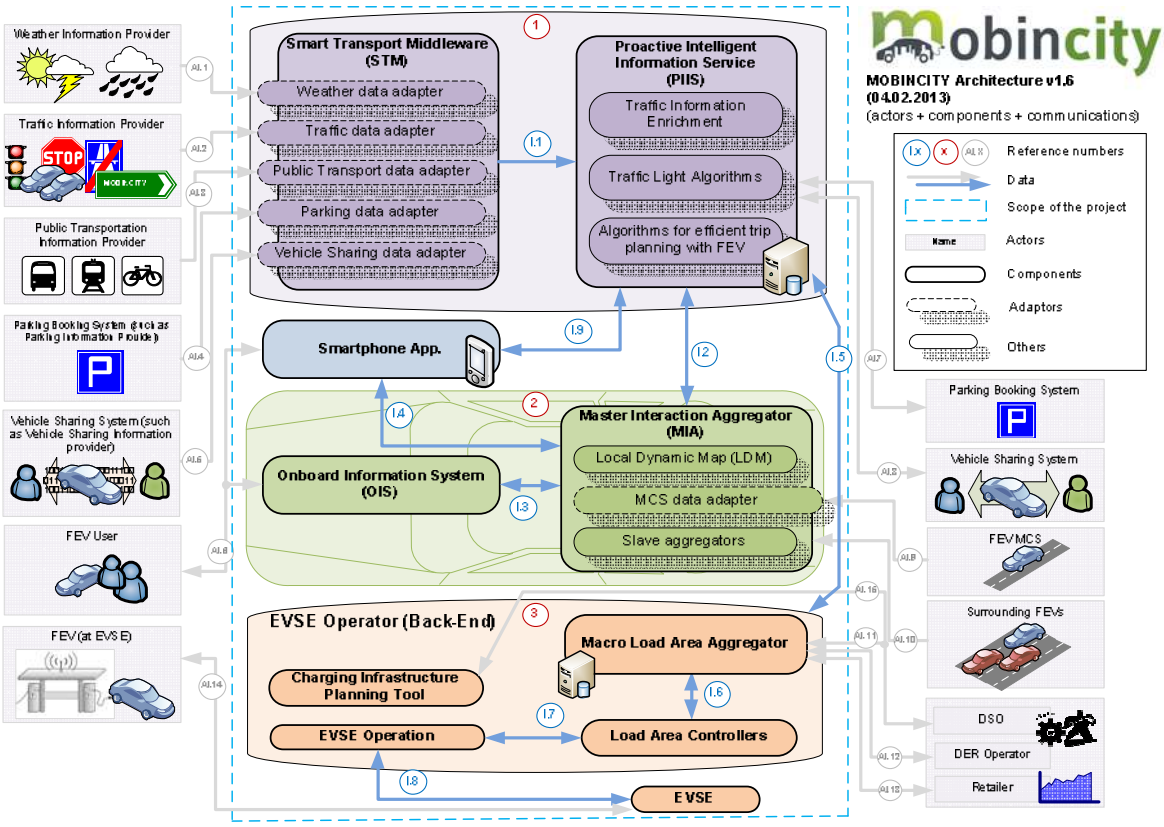

Figure 6: MOBINCITY Architecture

1.2.2 Actors and components

In the Unified Modelling Language (UML) system behaviours are modelled as use cases that may be specified independent of their realization. A use case is a description of a set of sequences of actions including variants that a subject performs to yield an observables result of value to an actor.

A use case involves the interaction of actors and the system or other subject. An actor represents a coherent set of roles that users of use cases play when interacting with these use cases. Actors can be human or automated systems.

The actors involved in the Mobincity system are:

- **Distributed Energy Resources** (DER) **Operator:** manages all the devices that produce electricity and are connected to the electrical system, either "behind the meter" in the customer's premise, or on the utility's primary distribution system. Electricity storage devices can also be classified as Distributed Energy Resources (DERs)
- **Distribution System Operator** (DSO): is a system intended to plan and execute distribution system operations to increase system efficiency, optimize power flows and prevent overloads. A DSO can interface with other applications such as

geographic information systems (GIS), outage management systems (OMS) and customer information systems (CIS).

- **Fully Electric Vehicle** (FEV) **at Electric Vehicle Supply Equipment** (EVSE). Any vehicle propelled by an electric motor drawing current from a rechargeable storage battery or from other portable energy storage devices (rechargeable, using energy from a source off the vehicle such as a residential or public electric service), which is manufactured primarily for use on public streets, roads or highways.
- **Fully Electric Vehicle Main Control System** (FEV MCS): includes the batteries and the Battery Management System (BMS) and gives the MOBINCITY System the information about the energy requirements of the FEV, SOC of the battery, etc.
- **FEV User:** the person or legal entity using the Fully Electrical Vehicle (FEV) and providing information about EV charging needs (e.g. charging mode/tariff, available time for charging) which consequently influence the charging load pattern. For all services related to the EV charging he concludes a contract with the E-Mobility Service Provider (EMSP).
- **Grid Agent**: generic actor that represents the electric infrastructure and market agents. Specifically: DER Operator, Retailer/EVSP and DSO.
- **Information Provider**: generic actor that represents the group of information providers. Specifically: Weather Information Provider, Traffic Information Provider, Public Transportation Information Provider, Vehicle Sharing System when acting as an Information Provider and Parking Booking System when acting as an Information Provider.
- **Parking Booking System**: actor that collects the information of the different parking stations of an urban area which have parking lots with or without charging stations. The Parking Booking System also delivers the information collected to the STM when it is requested *(Parking Booking System as an Information Provider*). Through the Parking Booking System, the reservation of car lot with or without a charging station is managed and coordinated with the different companies that offer this service.
- **Public Transportation Information Provider**: each one of the companies that deliver information about the public transportation infrastructure to the Smart Transport Middleware (STM) when it is requested. The information received by the STM may include timetables, station location, delays, level of occupation, etc. of different means of transport in cities (bus, metro, tram an train) in order to promote co-modality.
- **Retailer/EVSP**: is an entity selling electrical energy to consumers. Electric Vehicle Service Provider is an entity buying electrical energy from the Retailer and from the DER Operator and selling electrical energy to consumers for EV charging.
- **Surrounding FEVs**: FEVs around the MOBINCITY FEV that interact with the MOBINCITY FEV through standardized protocols: thus enabling the MOBINCITY FEV to infer additional information for the MOBINCITY system.
- **Traffic Information Provider:** each one of single and double traffic or computer vision detectors that deliver information about the traffic to the STM when it is requested. From these detectors the STM receives road information including

occupation, speed, intensity, composition of light and heavy vehicles, measured length of vehicles and average distance between vehicles. The number of vehicles is also received periodically according to the defined range of speeds.

- **Vehicle Sharing System**: actor that collects the information of the different vehicle sharing companies that hire cars to be used for several users at the same time. The Vehicle Sharing System also delivers the information collected to the STM when it is requested (Vehicle Sharing System as an Information Provider). Through the Vehicle Sharing System, the reservation of car to share is managed and coordinated with the different companies that offer this service.
- **Weather Information Provider**: each one of the weather stations that deliver information about the weather to the STM when it is requested. The information received on sensors refers to the relative humidity, temperature, wind speed, wind direction, pressure, solar radiation and rain and ice conditions, which can have effect in the road conditions and, consequently, in the electric vehicle performance.

Although in the Unified Modelling Language (UML) only involves actors, to ease Mobincity behavioural modelling process a new artefact <<Component>> has been created to model actor within the system scope. Components, in the way have been defined for Mobincity project, should be understood as actors that are automated systems than are going to be developed in the scope of the project.

The components involved in the Mobincity system are:

- **Charging Infrastructure Planning Tool** (CIPT): software application that integrates data from the electricity grid and mobility information obtained from different sources (e.g. traffic information and mobility flows, public transport infrastructure, GIS information), to analyze and produce optimal placements for charging stations connected to the secondary substations of the electric energy distribution grid.
- **Electric Vehicle Supply Equipment** (EVSE): consists of conductors, including the phase, neutral and protective earth conductors, the EV couplers, attachment plugs, and all other accessories, devices, power outlets or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the EV and allowing communication between them if required. In colloquial language the term Charging Station(s) is commonly used instead of EVSP.
- **EVSE Operation**: is an interface between the Load Area Controller with the EVSE. Manages each individual charging session in terms of charging station reservation, authorization for charging, issuing information on charging to the EV user and transmission of charging session data to other components of the EVSE Operator Back-End (billing, maintenance, historical database of charging sessions).
- **Load Area Controller** (LAC): control centre for control of charging stations at local Load Area level. In execution of control it may consider also data from local DER.

- **Macro Load Area Aggregator** (MLAA): collects the information from the different external actors and components and includes the intelligence to create the forecasted aggregated reference load of Load Area Controllers.
- **Master Interaction Aggregator** (MIA): is the vehicle's central point of data acquisition operating within the vehicle and is one of the key modules developed within the scope of the MOBINCITY project.
- **Onboard Information System** (OIS): component that allows the user to interact with the MOBINCITY System and introduce the trip parameters and its preferences during the trip.
- **Proactive Intelligent Information Service** (PIIS): integrated smart system able to select the essential information from the STM and process it for driving optimization calculating the optimal route for the FEV.
- **Smartphone App**: application for Smartphones that let the user interacts with the MOBINCITY System and introduces the initial parameters of the trip and its preferences in the stage of trip planning.
- **Smart Transport Middleware** (STM): component able to collect information from external sources with influence in the operation of the FEV, including traffic information, weather and road conditions, unforeseen events, etc.
- **User Interface**: generic component that represents the elements that the user has to interact with the MOBINCITY System. Specifically: Smartphone App and Onboard Information System.

1.2.3 Use cases

In the Mobincity project, the use cases have been classified into four categories: Trip Planning, On-Trip Services, Charging and Secure Policies trying to reflect four groups of behaviours that the Mobincity needs to cover all the functionalities defined in the project's objectives. It is important to keep in mind that each category, and also each use case, does not define isolated behaviours but sequences of actions that a system performs that yield observable results of value to a particular actor, so there are relationships between them, as can be seen in the use cases' context diagrams.

The category ***Trip Planning*** describes the functionalities that the Mobincity System has to cover in the planning period, when the trip has not started and the user is still out of the car. It is divided into two high level use cases: ***UCTP0100 Information Gathering*** and ***UCTP0200 Trip planning***.

The first one describes the behaviour of the system to gather information about weather (***UCTP0101 Integration with Weather Information Providers***), traffic (***UCTP0102 Integration with Traffic Information Providers***), public transportation alternatives (***UCTP0103 Integration with Public Transportation Infrastructure***), parking status (***UCTP0104 Integration with Parking Booking System***), vehicle sharing possibilities (***UCTP0105 Integration with Vehicle Sharing System***) or grid and market parameters (***UCTP0106 Pricing and Energy Information Collection***).

The second one include detailed use cases to describe how the traffic information is enriched in the PIIS using the GLOSA algorithms (***UCTP0201 Planning GLOSA and UCTP0202 Updating GLOSA)*** to calculate the optimal route from the information gathered and the user preferences (***UCTP0205 Trip routing***) and to manage a reservation for a parking lot (***UCTP0203 Parking Lots Reservation***) or a vehicle to share (***UCTP0204 Sharing Vehicle Reservation***).

The category ***On-Trip Services*** describes the functionalities that the Mobincity System has to cover when the route has already started and the user is driving the FEV. It only contains a high level use case: ***UCTS0100 Trip Optimisation/Re-routing.***

This use case describes the behaviour of the Mobincity System when the route has already been calculated by the PIIS and it receives an order from the user to change any of the initial parameters of the trip (***UCTS0101 Trip Re-Routing on Driver's Request***), from the PIIS because of an unforeseen event in the route (***UCTS0102 Trip Re-Routing on PIIS's Request***) or from the FEV MCS because there is not enough energy stored in the FEV battery to finish the trip (***UCTS0103 Trip Re-Routing on FEV MCS Request***), so that it is necessary to change the route of the trip and optimise it again. It also contains a detailed use case that describes the behaviour of the system to maximise the energy saving with deactivation of unused components and functions (***UCTS0103 Adaptive Energy Management***).

The category ***Charging*** describes the functionalities that the Mobincity System has to cover to interact with the electric grid, not only in the process of obtaining energy from the grid and how is this process scheduled, but also the development of the charging infrastructure that is required and how the grid agents (DSO, DER Operator and Retailer/EVSP) participate in this process. It is divided into two high level use cases: ***UCIE0100 Charging Strategies*** and ***UCIE0200 DSM Policies***.

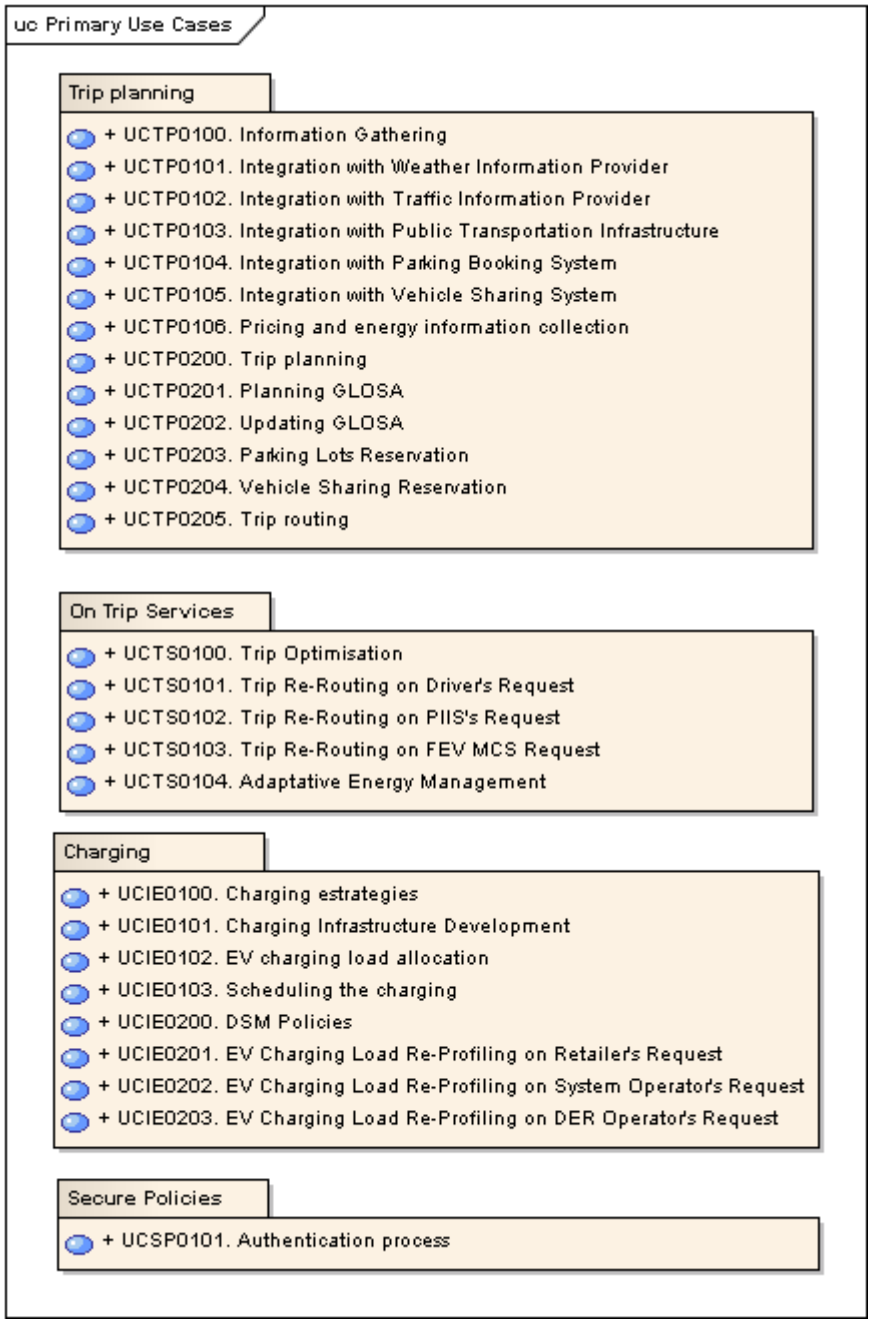

Figure 7: UML diagram with the listing of use cases by category

The first one describes the behaviour of the Mobincity System to calculate the optimal location of the new charging stations to be erected (***UCIE0101 Charging Infrastructure Development***), to manage the load of the distributed charging stations through the Macro Load Area Aggregator (***UCIE0102 EV Charging Load Allocation***) and to attend user needs for charging its FEV (***UCIE0103 Scheduling the charging***).

The second one describes the DSM policies that consists in the interaction of the Retailer (***UCIE0201 EV Charging Load Re-profiling on Retailer's Request***), the Distributed System Operator (***UCIE0202 EV Charging Load Re-Profiling on System Operator's Request***) and the Distributed Energy Resources Operator (***UCIE0203 EV Charging Load Re-Profiling on DER Operator's Request***) with the Mobincity System to modify the FEV charging processes

integrating active demand products and distributed energy resources (among them also renewable energy resources) in the system.

The category ***Secure Policies*** describes the authentication process of the FEV User that the Mobincity system follows to grant the correct identification of the user to its information. It only includes a detailed use case (***UCSP0101 Authentication process***).

1.2.4 Requirements

The requirements phase collects what have to be accomplished in the project and how. User requirements express what have to be accomplished. The technical requirements indicate how these objectives have to be met in the way of technical descriptions, application and information flows.

1.2.4.1 User requirements

The user requirements description follows the structure of the use cases (UCs) with three main different categories: Trip Planning, On Trip Services and Charging. Within each category a list of user requirements was elicited from the UCs, resulting in a list of 51 requirements.

The category Trip Planning involves the user requirements regarding the users need to have a friendly interface where to take complete trip information and other functionalities before starting it. Also regarding the necessity of including in the optimization model the full integration of the FEV charging needs and vehicle routing objectives

The user requirements included in the category On Trip Services involve the functionalities to interact with the people that are using the system, giving as much useful information as possible to provide a safe and comfortable trip to users.

Finally, the category Interaction with the Energy Infrastructure (or Charging) involves the user requirement regarding the location of charging stations, charging preferences, charging prices, charging reliability and transparency and accessibility of data related to charging.

1.2.4.2 Technical requirements

Technical requirements describe from a technical point of view all the issues that the system needs to solve. These technical requirements have been related with the components of the system and the user requirements. They have been classified into four categories: interaction of FEV with transportation infrastructure, interaction of FEV with energy infrastructure, communication system and adaptive strategies for trip planning, charging and driving. Within each category a list of technical requirements was elicited from the user requirements and the architecture, resulting in a list of 63 requirements.

Regarding the interaction of FEV with transportation infrastructure, the technical requirements describe a system to be installed within the vehicle able to receive information from the surrounding environment that can have influence in the vehicle performance (traffic information, weather and road conditions and energy grid).

The technical requirements regarding the interaction of FEV with energy infrastructure include enhancing the currently available ICT solutions for charging infrastructure management with advance control capabilities, an integrated control of FEV charging process and allowing to fully exploiting the FEV charging capabilities achieving significant improvements in grid operation and including Renewable Energy Resources in the local FEV charging networks.

Communication technical requirements are a key aspect in the development of the server interactions involved in the project. Communication has to be reliable to obtain the full optimization potential of the smart FEV. Communication systems have to be defined in detail since several different variants of these systems will interact in the envisioned usage scenarios.

Regarding adaptive strategies for trip planning, charging and driving the technical requirements developed include developing automated and semi-automated methods taking into account he information coming from external sources (mainly traffic and energy infrastructure), and also from driver needs, using the information about traffic timing signal to switch on an off the engine and other control systems to maximize the efficiency and controlling additional systems as Air-Conditioning to make them more efficient with the use of this information.

1.3 Mobility 2.0

The following sections describe the architecture of Mobility 2.0 system, the actors and components involved, the use cases description and the list of user and technical requirements. All this information is included with further detail in Mobility 2.0 deliverables.

1.3.1 Architecture

The functional blocks of Mobility 2.0 architecture are derived from the use case descriptions and are kept general in order to allow for definition of project- and test-site specific requirements and services.

Figure 8 Mobility 2.0 introduces services including CS planning, CS notification/aggregation etc., but does not depict any interaction among the services. However, it is worth noting that the services can interact directly in the service delivery domain, i.e. the architecture allows for distributed services. Also, the general functional view, which covers the functions across the various tasks in the project, does not specify how the services operate rather just mentions what the services intend to do, thus maintaining the generality.

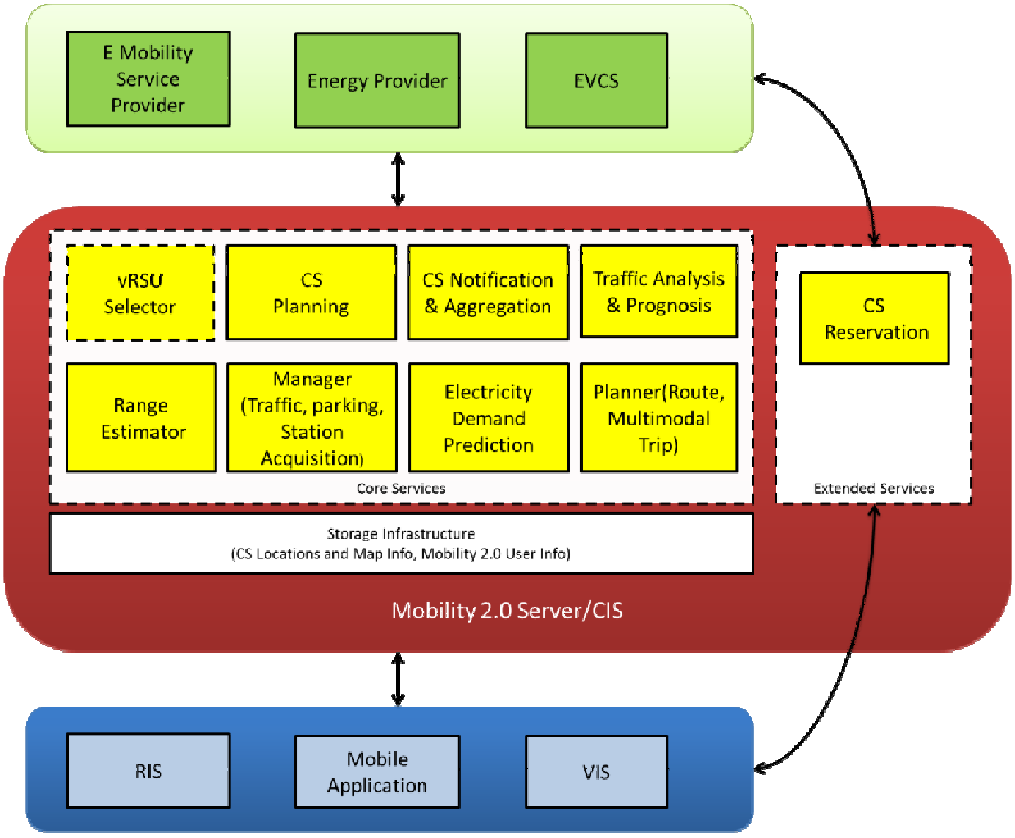

Figure 8: The Mobility 2.0 Server focused functional view

- (v)RSU Selector: The functionality of this block which is responsible for selecting the (v) RSU to send the CS notification message is carried out by the geo-server. The box is shown in dotted format to signify that the election of virtual RSU can be carried out in a decentralized manner.

- Range Estimator: Estimates the remaining range of the vehicle.
- CS Planning: This module optimizes the usage of (re)charging spots and is dependent on Range Estimator, Electricity Demand Prediction and traffic status.
- Manager: Responsible for data acquisition, parking station information and traffic information.
- CS Notification & Aggregation: It is responsible for aggregating the (re)charging spot information and generates the CS notification message (based on the ETSI standard).
- Traffic Analysis and Prognosis: Responsible for aggregating the traffic information and acts as an input for CS Planning and Planner (multimodal and route).
- Electricity Demand Prediction: Depending on the reservation status of (re)charging slots, this component provides an estimate of the electricity demand in the city, a city area, or only at a single (re)charging station.
- Planner: Performs multimodal trip planning and route planning for FEVs according to the given preferences of a user.
- RIS: Is the Road Side ITS-Station, which receives the CS notification message from the server and further disseminates to the users.
- Mobile App: An application running on the Nomadic Device through which the end user can access Mobility 2.0 services.
- VIS: Vehicle ITS-Station / OBU, which receives information from Mobility 2.0 services.
- CS Reservation: running on a separate reservation server, and will be prototyped in the project, and seamlessly integrated into the Mobility2.0 client application. This is signified in the architecture, by depicting the reservation server as an extend service which will be logically be a part of Mobility2.0 server
- E-Mobility Service Provider: Any service provider utilizing Mobility 2.0 platform to enhance FEV penetration.
- Energy Provider: The utility, which provides energy to the city.
- EVCS: The unit responsible for the function of (re)charging station/spots.
- Storage Infrastructure: It is a database, which maintains driver information, CS location data, etc.

This high-level functional view provides the framework about the various functions, which will be developed throughout the lifecycle of the project. In the current phase, based on the use case requirements, the architecture identifies the high-level scope of the functions and the possible inter-dependencies. Note that the function interactions are not shown in Figure 8, however, based on the requirement each function can interact with every other function within the service delivery domain. Except for vRSU selection and CS notification, the details of the functions in the service delivery domain and their interactions are described in Deliverable D 3.1. The vRSU selection procedure is independent from other functions and the methods to

elect a vRSU are detailed further in this deliverable, and the CS notification, also a part of this document, is based on the ETSI standard.

The described architecture is based on the simple client-server model and hence it adopts a request-response approach for the exchange/flow of information. The client application running on the Nomadic Device (ND) or On Board Unit (OBU) can request for a particular service from Mobility 2.0 Server and the function responsible for that service will respond to the request. In order to execute the application requests, the functional components within Mobility 2.0 Server can also request data/information from vehicles and service providers (charging station operators).

1.3.2 Use cases and Requirements

The work in Mobility 2.0 follows a user centred design approach. Such design process is an iterative cycle where every step is evaluated against the initially identified requirements of users and is iterated until these requirements are met (Figure 5).

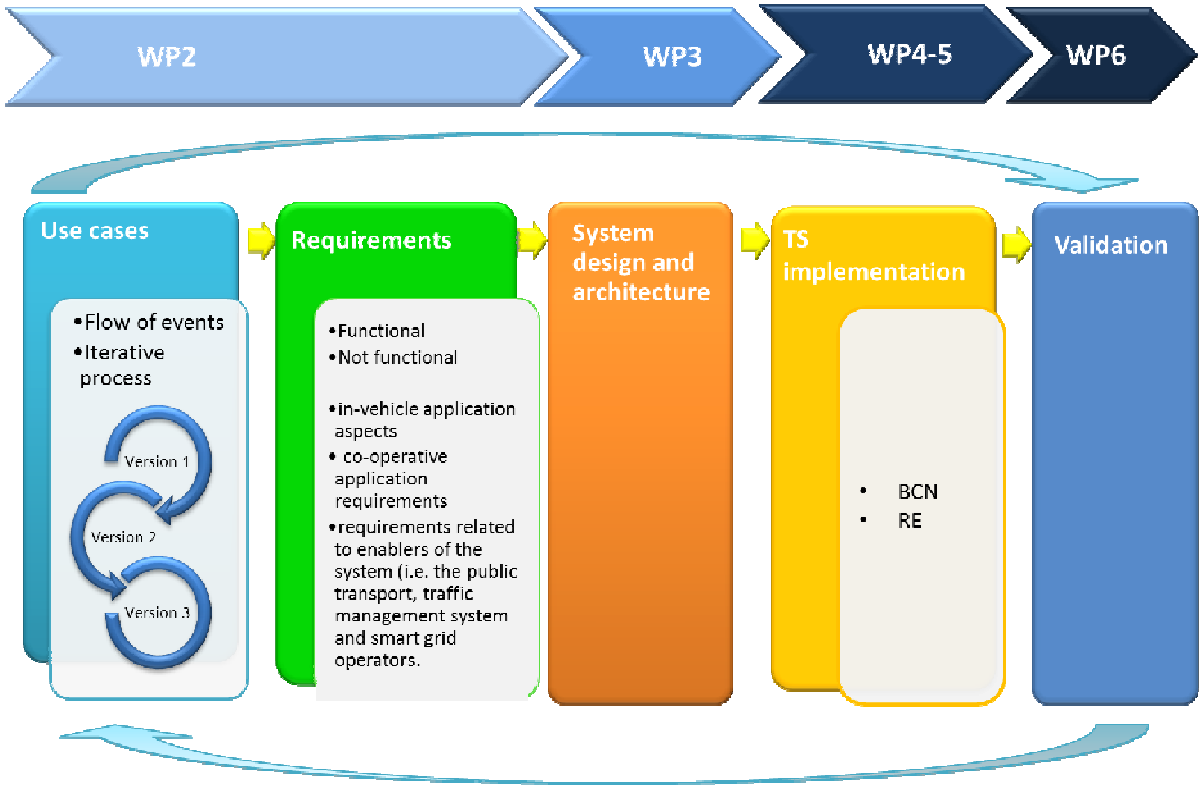

Figure 5 - Workflow in Mobility 2.0

The worked out Mobility2.0 use cases comprise of the following list:

- Assisting the urban daily commuting for a FEV user by proposing an optimum multi-modal route, while taking into account:
  - the FEV remaining range
  - City public transport network and traffic events

  - The user's commuting preferences
  - Other FEV users' Charging Spot (CS) reservations
  - (optional) Grid load balancing recommendations
- Value-added telematics services:
  - Mobility 2.0 server geo-broadcasts CS notifications
  - FEV acts as virtual G5 RSU, forwarding notification from the Mobility 2.0 server
  - CS reservation from the FEV on-board unit or the user's smartphone

As shown in figure 6 below, based on the defined set of use cases, the Range anxiety is addressed in Mobility2.0 through a combination of approaches:

- Multi-modal routing, which makes range issue less critical
- Development of Re-charging spot reservation protocol and its standardization at ETSI ITS (Elvire study provided by a review has been taken into account in the process)
- System-level optimization of re-charging spot allocation
- Provision of accurate EV range estimation information

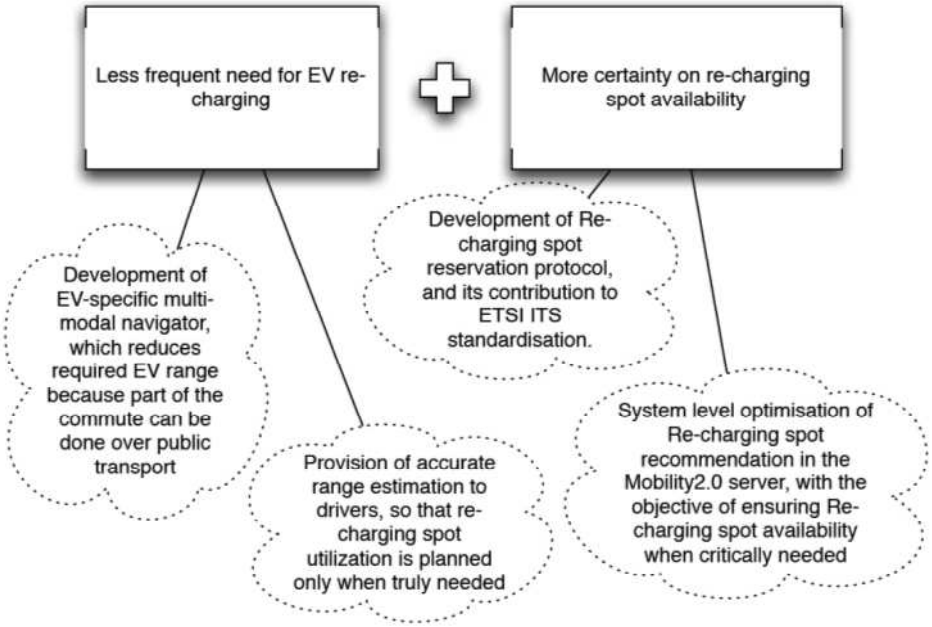

Figure 6 - How is range anxiety tackled through the Mobility2.0 use cases

The set of above-defined use cases are visualized through the system model shown in the following figure.

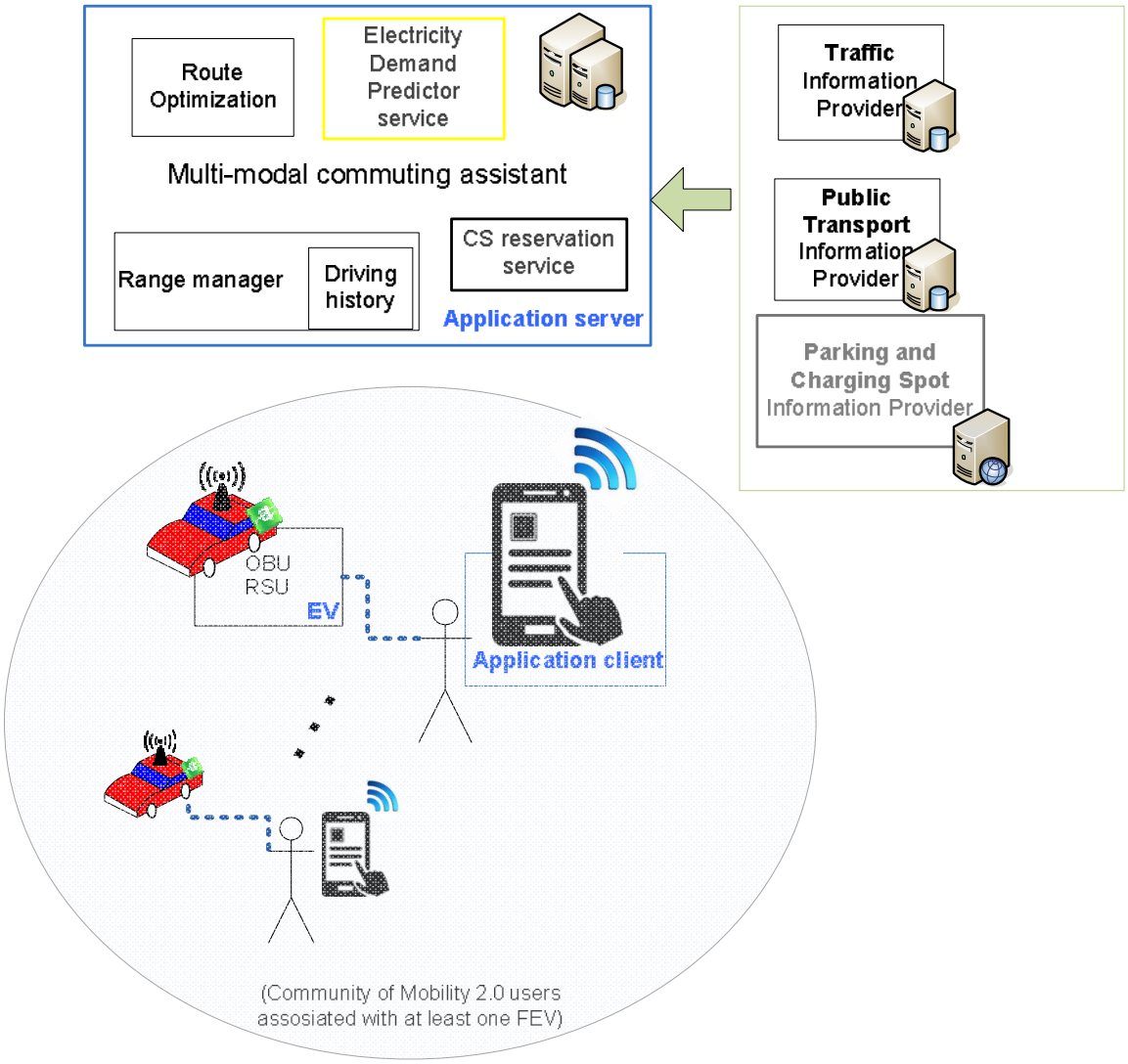

Figure 7: System diagram visualizing the set of the Mobilty2.0 Use Cases (component in yellow will be based on simulation).

A preliminary test-site specific validation plan has been defined, including expected achievements, effectiveness and success criteria per Use Case.

2 Standardization

This chapter provides first the Bodies involved in standardization related to the 3 projects, and then a list of common standards, which could be simply adopted by the 3 projects or to which the 3 projects contribute within the standardization Bodies.

2.1 Bodies

Electromobility Standardization is becoming an important issue and a pre-requisite to increase the EV penetration. The role of these standardization activities is to define technical solutions for interfaces which will ensure interoperability between the vehicle and the supporting infrastructure. Moreover, to encourage innovation and to create larger acceptability, standards should also concentrate on performance aspect rather than being descriptive. The main Standards Development Organization's (SDO's) involved in standardization of electromobility and related concepts in Europe and around the world are depicted in Figure 9. In addition, a set of Industrial Consortium Specifications may be considered by a project, in order to satisfy the functional requirements or test site deployment requirements e.g. Open Charge Alliance. These specifications are considered as potential standards to be integrated into the standardization work appropriate SDOs in the future.

Figure 9. Electromobility related SDOs

In this context, European Commission has delivered a standards mandate to CEN/CENELEC and ETSI (Mandate 468) concerning the charging of electric vehicles. CEN/CENELEC has formed a focus group on European Electro-Mobility and provided a report as reply to the mandate. ETSI is playing an observation role in this focus group. According to CEN's focus group the current perspective of SDO's in EU with respect to electromobility is:

- Ensure interoperability and connectivity between the electricity supply and onboard chargers of electric vehicles, so that they can be connected and be interoperable in all EU States
- Ensure interoperability and connectivity between "off-board" chargers and the electric vehicle and removable batteries

- Consider any smart-charging issue with respect to the charging of electric vehicles
- Consider safety risks and electromagnetic compatibility of the charger of electric vehicles in the field of relevant directives

The report mentioned in [1] has done an analysis on the specific standardization requirements for European electro-mobility and provides several recommendations on the future standards needs of E-Mobility in multiple aspects, e.g. charging or connectors. The present project groups are realizing R&D activities in relationship with some of important gaps identified by this report. It is expected that the project outputs will be provided to standards works. In particular, the following aspects pointed out by the report can be contributed by projects (i.e. eCo-FEV):

- Wireless communication directly between EV and operator.
- Wireless charging of electric vehicles.
- V2G based on wired or wireless communications.

The key standardization groups that the clustering activity aims are summarized in Table 3

Table 3: Key Standardization Bodies

STANDARDIZATION GROUP/BODY	GOALS AND INFORMATION
ETSI TC ITS	• Communication standardization on EV telematics services such as EVSE Point Of Interest service, reservation of EVSE. • Collaboration with ISO/IEC for wireless communication for EV charging. • ITS networking and transport layer protocol standardization. • ITS G5A ITS access technology standardization.
ETSI – TC Smart M2M	• Developing standards for Machine to Machine Communications. • Technical specifications for a common M2M Service Layer • Addressed to a wide industry segment regarding electromobility: energy, transportation, public services, etc.
Electro-mobility coordination group on smart grids:	• coordination of ISO, ETSI and M2M to avoid overlapping of activities • group seems to be in need of further developments

IEEE Transport Electrification	• Co-ordinates various IEEE standards to achieve cooperative electromobility e.g. IEEE P2030.1, IEEE 1901, IEEE 1609 • collaboration with ANSI for EV related standards.
IETF	• Internet communication protocol such as web service protocol, • M2M communication protocol.
Open Charge Alliance	• Industrial consortia • Open Charge Point Protocol for AAA and monitoring of charging procedure.

2.2 List of standards

This section aims at defining a list of common standards required by the three projects.

The lists of standards are drawn up on the basis of the projects' functional requirements, specifications, system concepts and definitions. In the present document, which is the 1st Release of the common Deliverable, three tables separately identify the standards related to each project. At a later stage, after analysing all collected standards, these tables will be merged into a single table that will only contain the shared standards, that is the existing standards relevant to eCo-FEV, Mobility2.0 and Mobincity. Standards in a drafting stage will be considered, too.

Clustering group has set up a list of relevant standards to projects. This list of standards can be grouped in three categories:

- Standards on the domain of ITS, traffic management and telematics services such as Cooperative ITS standards, road infrastructure information exchange standards and telematics services standards; these standards are developed to support mobility and traffic management applications and services.
- Standards on the domain of EV charging, including conductive and inductive charging technologies.
- Standards on the communications, to support information exchanges and interoperability.

According to the relevance of the project and its development needs, a standard may be implemented and tested in a project. Testing results and lessons learned will be provided to the standards bodies as dissemination activities. Furthermore, some partners are actively contributing to some on-going standard development procedure, specifications developed in the project can be provided as inputs to Standards bodies during standards development process.

Given the large number of regional and international standards developed or under development, it is important to harmonize and coordinate standardization activities. European commission has issued relevant standard mandates for this purpose:

1. Mandate related to the charging of electric vehicles M468.

   See in section 2.1

2. Mandate related to the smart grid (M490).

   CEN, CENELEC and ETSI joint Working Group on standards for smart grids worked between June 2010 and March 2011 on the production of a report addressing standards for smart grids. Based on this report [2], a coordination group on smart grid is established, in order to coordinate standardization activities in different standard bodies. In the scope of cluster projects, each project will identify the need to follow or contribute to the standardization activities in smart grid. Due to the absence of power supply operator in the project consortium, the standard dissemination for the smart grid related standards may be limited.

3. Mandate related to smart metering (M441):

   Cluster project do not consider to provide standard dissemination activities in the scope of smart metering, because out of scope of project.

2.2.1 eCo-FEV

Table 4: List of Standards related to the project eCo-FEV

No.	Title	Current status
ITS, traffic management and telematics		
EN 602 637 – 2	Technical Specification Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specification of Cooperative Awareness Basic Service	Under EN approval
ETSI EN 302 637-3 V1.2.0 (2013-08)	Technical Specification Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specification of Decentralized Environmental Notification Basic Service	Under EN approval
ETSI TS 101 556-1	Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communication; Electric Vehicle Charging Spot Notification Specification	Published
TS 101 556-3	Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communications; Communications system for the planning and reservation of EV energy supply using wireless networks EV charging using wireless networks	Work in Progress
DATEX2 (easyway)	DATEX 2 protocol for information exchange in traffic management infrastructures	Release V2.1 published

CEN/TS 15531 – 1,2,3	Public transport - Service interface for real-time information relating to public transport operations.	Published
KML	https://developers.google.com/kml/documentation/kmlreference?hl=fr	Published
CEN TS 19321	Intelligent transport systems (ITS) — Co-operative systems — Dictionary of in-vehicle information (IVI) data structures	On going
Charging		
ISO IEC 15118 -2	Road vehicles — Vehicle-to-Grid Communication Interface — Part 2: Network and application protocol requirements	On going
IETF RFC2865, 2866 and 3579	Remote Authentication Dial In User Service (RADIUS); RADIUS Accounting; RADIUS (Remote Authentication Dial In User Service) Support For Extensible Authentication Protocol (EAP)	Published
IETF RFC3411 – RFC 3418	Simple Network Management Protocol, SNMP standard series	Published
OCPP	OCPP 1.5 Stub Developer Guide, 3 January 2013, V0.2	Published
DIN SPEC 91286 :	Electric mobility - Schemes of identifiers for E-Roaming - Contract ID and Electric Vehicle Supply Equipment ID (2011-11)	Published
Communication		
ETSI EN 302 665	Intelligent Transport Systems (ITS); Communications Architecture	Published
ETSI TS 102 636-6-1 V1.1.1 (2011-03)	"Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 6: Internet Integration; Sub-part 1: Transmission of IPv6 Packets over GeoNetworking Protocols"	Published
IETF RFC 2818	HTTP Over TLS	Published
IETF RFC 2460	Internet Protocol, Version 6 (IPv6) Specification	Published
RFC 793	TCP	Published
RFC 791	IPv4	Published
RFC 3963 of IETF	"Network Mobility Basic Support Protocol (NEMO)	Published
IETF CoAP	IETF: Constrained Application Protocol (CoAP)	Published
OpenID	[28] OpenID Connect Core 1.0 draft 14	
RFC6749:	The OAuth 2.0 Authorization Framework	Published
TS 102 636-4-1	Intelligent Transport Systems (ITS); Vehicular communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality	Published, EN revision work in progress
ETSI EN 302 636-5-1 V1.2.0 (2013-10)	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5: Transport Protocols; Sub-part 1: Basic Transport Protocol	Under EN approval

ETSI ES 202 663 V1.1.0:	Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band.	Published
ETSI EN 302 571 V1.1.1 (2008-09)	Intelligent Transport Systems (ITS); Radio communications equipment operating in the 5 855 MHz to 5 925 MHz frequency band	
IEEE 802.3	Ethernet	Published
ISO/IEC 15118-6-7	Promotes access, protocol and application technologies; V2G Interface (standard to develop vehicle to grid interface); New work item to define wireless communication during inductive charging	

2.2.2 Mobincity

Table 5: List of Standards related to the project Mobincity

No.	Title	Current Status
Communication		
ETSI EN 302 665	Intelligent Transport Systems (ITS); Communications Architecture	Published
ETSI ES 202 663	Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band	Published
ETSI TS 102 636	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking;	Published
ETSI EN 302 636-4-1 V1.2.0	Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality	Drafting stage
IEEE 802.11	WLAN	Published
IEEE 802.3	Ethernet	Published
IEEE 802.15.1	Bluetooth	Published
RFC 2818	Hypertext Transfer Protocol Secure	Published
JSON-RPC 2.0	http://www.jsonrpc.org/specification	Published
RFC 4627	The application/json Media Type for JavaScript Object Notation (JSON)	Published

ECMA-404	JavaScript Object Notation - JSON	Published
ECMA-262 3rd Edition	ECMAScript Language Specification	Published
ISO/IEC 40210	W3C SOAP (Simple Object Access Protocol)	Published
RFC 793	TCP	Published
RFC 791	IPv4	Published
RFC 5849	The OAuth 1.0 Protocol	Published (obsolete by RFC 6749)
RFC 2460	Internet Protocol, Version 6 (IPv6) Specification	Published
ITS, traffic management and telematics		
ETSI TR 102 863	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Local Dynamic Map (LDM); Rationale for and guidance on standardization	Published
ETSI EN 302 895	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Local Dynamic Map (LDM) Specification	Drafting stage
ETSI EN 302 637-2	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service	Drafting stage
DATEX2 easyway	Datex2 protocol for information exchange in traffic management infrastructures	Published
GTFS	General Transit Feed Specification Reference https://developers.google.com/transit/gtfs/reference	Published
Energy Infrastructure		
ISO/IEC 15118-1	Road vehicles - Vehicle to grid communication interface Part 1: General information and use-case definition	Published
ISO/IEC 15118-2	Road vehicles - Vehicle to grid communication interface Part 2: Network and application protocol requirements	Drafting stage
ISO/IEC 15118-3	Road vehicles - Vehicle to grid communication interface Part 2: Physical and data link layer requirements	Drafting stage
IEC 61851-1	Electric vehicle conductive charging system - Part 1: General requirements	Published
IEC 62196-2	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles	Published
IEC 61850	Communication networks and systems in substations	Published

IEC 61850-90-8	Object Models for Electrical Transportation	Drafting stage

2.2.3 Mobility 2.0

Table 6: List of Standards related to the project Mobility2.0

No.	Title	Current status
EV Charging Infrastructure & Grid		
ETSI TS 101 556-1	CS Location/Booking	Published
ETSI TS 556-3	Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communications; Communications system for the planning and reservation of EV energy supply using wireless networks EV charging using wireless networks	Work in progress
draft-karagiannis-problem-statement-geonetworking-01.txt	Internet-wide Geo-networking Problem Statement	Work in progress
IEC 61851-1, -22(AC), -23(DC)	Charging Modes	Published
IEC62196 (Type2,3), SAE J1772 (Type1)	Connector	Published
IEC/ISO 15118	Communication	Drafting Stage
IEC 61850-n	Communication	Drafting Stage
IEC/ISO 15118	Communication	Drafting Stage
IEEE P2030.1		Under development
ETSI TC ITS WG1 ITS0010031	Communication before recharging phase (planning); Charging spot reservation; Possibility to develop work item by the three projects	Started in June 2012 Stable draft status
Communication		
ETSI ITS G5	Communication	

3 Standards and architecture links

Standardization of interfaces between stakeholders participating to the E-Mobility is essential in order to ensure the communication interoperability and operational interoperability. Therefore, the development of a set of necessary standardized interfaces is also a key element to enable the scaling up of deployment of an E-Mobility platform. On the other hand, attention should be made to avoid over standardization, in order to leave open space for market competition.

The objective of this common deliverable is to identify a common general functional architecture of the future E-Mobility platform, guided by agreement among projects on the standardized interfaces required for the implementation, deployment and set up of an E-mobility platform. Such standardized interfaces are denoted as exposed interface in the present deliverable.

These exposed interfaces are identified, based on:

- Identification of stakeholders and actors relevant for the E-Mobility platform, based on combining analysis of use case definition of each project.
- Identifications of communication and information exchange needs and requirements between stakeholder systems, based on combining analysis of architecture definition of each project.
- Benchmarking and selection of appropriate protocols to be used for each interface.

As summary, the Figure 1 illustrates the relevant stakeholders and communication interfaces as commonly identified by three clustering projects. In the following list, all communication interfaces are defined based on their functionality.

Communication between vehicles:

- V2V: messages exchanged between vehicle and vehicle

Communication between vehicle and grid infrastructure:

- V2G_1: vehicle to EVSE communication, ISO 15118 and extensions for CWD
- V2G_2: EVSE and EVSE operation communication, for AAA and monitoring

Communication between vehicle and infrastructure:

- V2I_1: RSU to vehicle communication
- V2I_2: vehicle to backend communication
- V2I_3: RSU to eCo-FEV backend communication
- V2I_4: message exchanged between vehicle and application provider web services

Communication among components and stakeholders in the infrastructure

- I2I_1: messages exchanged between backend and EVSE operator
- I2I_2: messages exchanged between backend and applications.
- I2I_3: Messages exchanges between eCo-FEV backend and ID provider
- I2I_4: message exchanges between eCo-FEV backend and RSU

- I2I_5: message exchanges between backend and parking operator
- I2I_6: messages exchanges between backend and traffic operator
- I2I_7: messages exchanged between backend and public transport operator
- I2I_8: messages exchanged between backend and fleet operator
- I2I_9: messages exchanged between backend and weather operator
- I2I_10: messages exchanged between energy service provider and EVSE
- I2I_11: data exchanged between energy service provider and EVSE operator for load allocation and load re-profiling

Interaction with the user:

- UI_1: interface between the user and the on-board information system
- UI_2: interface between a portable device (smartphone) and the backend
- UI_3: interface between a portable device and the EVSE

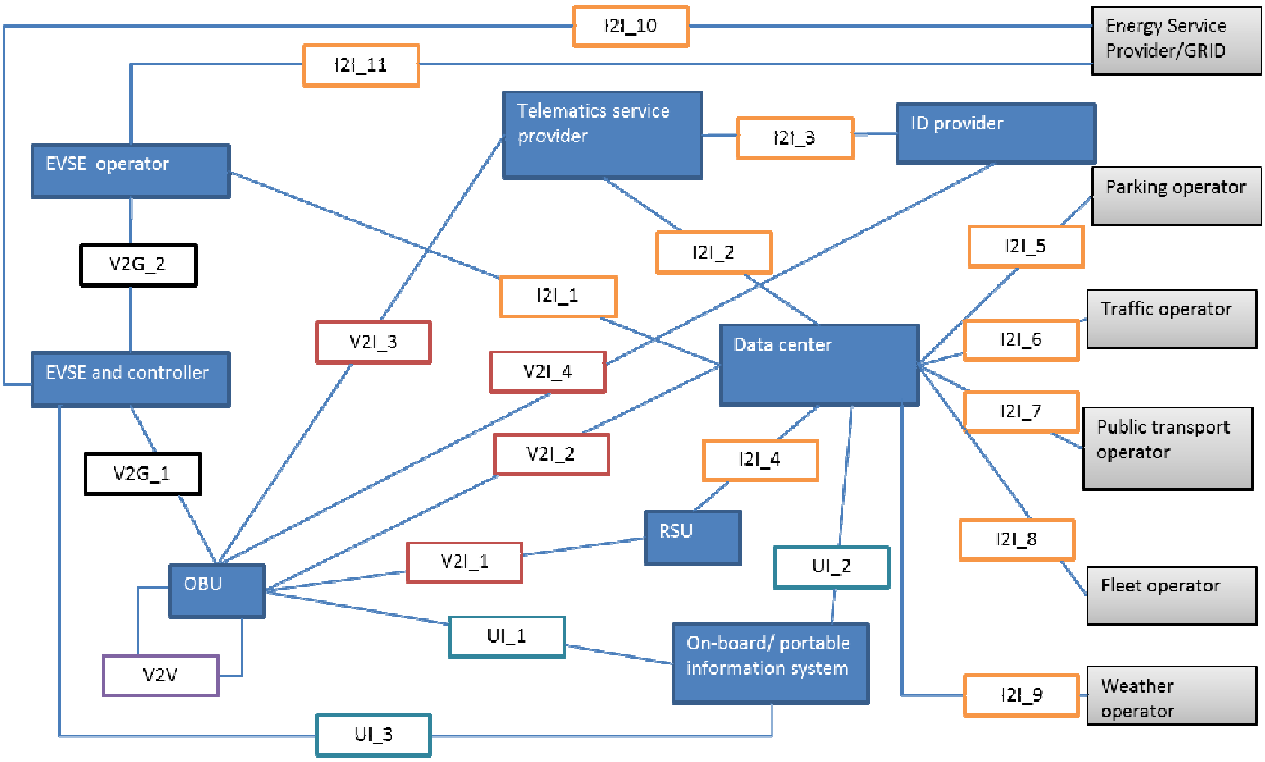

Figure 10: Stakeholders and communication interfaces common to the three projects

In the following sub section, we would like to summarize the applicable standards being used for each interface, layered by the access layer, networking & transport layer, application and facilities layer, security layer and management layer. It should be highlighted that, in a real deployment, different communication solutions may be chosen, in particular e.g. access technology, networking protocol (IPv4 or IPv6), depending on the deployment status of the communication infrastructure and deployment strategy. Therefore, the communication technologies being presented in the following table should not be seen as the only possible solution but as examples that may be considered in deployment architecture. However, special focus is put on the higher layer protocols, since these higher layer interfaces specifies procedure and message format on how the stakeholder

information is exchanged, as well as features to enable different data exchange modes. The standardization of such interfaces, as well as the make these standards communication technology agnostic is within the objective of this common deliverable.

3.1 List of messages exchanged over the exposed interfaces

Apart from communication protocol, the present deliverable further provides specifications on the message content being exchanged over the exposed interface.

The following tables provide a complete list of messages being exchanged over the exposed interfaces as identified in Figure 10, as well as applicable standards.

Table 7: Communication interfaces for V2V

V2V: Communication between vehicle and vehicle			
Name of message	**Standard**	**Dissemination mode**	**Direction**
CAM (Cooperative Awareness Message)	ETSI EN 302 637 - 2 [4]	Broadcast, GeoNet, G5	FEV → FEV
DENM (Decentralized Environmental Notification Message)	ETSI EN 302 637 – 3 [5]	Broadcast, GeoNet, G5	FEV → FEV
LDM (Local Dynamic Map)	ETSI TR 102 863, ETSI EN 302 895	Broadcast, GeoNet, G5	FEV → FEV

Table 8: Communication interfaces for V2G

Name of message	**Standard**	**Dissemination mode**	**Direction**
Session Setup request	ISO 15118 [6]	EXI, IP	V2G
Session Setup response	ISO 15118 [6]	EXI, IP	G2V
Service Discovery request	ISO 15118 [6]	EXI, IP	V2G
Service Discovery response	ISO 15118 [6] extension	EXI, IP	G2V
Service and Payment Selection request	ISO 15118 [6]	EXI, IP	V2G
Service and Payment Selection response	ISO 15118 [6]	EXI, IP	G2V
Payment Details request	ISO 15118 [6]	EXI, IP	V2G
Payment Details response	ISO 15118 [6]	EXI, IP	G2V
Contract Authentication request	ISO 15118 [6]	EXI, IP	V2G
Contract Authentication response	ISO 15118 [6]	EXI, IP	G2V
Charge Parameter Discovery request	ISO 15118 extension	EXI, IP	V2G
Charge Parameter Discovery response	ISO 15118 [6] extension	EXI, IP	G2V

Power Delivery request	ISO 15118 [6]	EXI, IP	V2G
Power Delivery response	ISO 15118 [6] extension	EXI, IP	G2V
Current Demand request	ISO 15118 [6] extension	EXI, IP	V2G
Current Demand response	ISO 15118 [6] extension	EXI, IP	G2V
Terminate Charging request	ISO 15118 [6]	EXI, IP	V2G
Terminate Charging response	ISO 15118 [6]	EXI, IP	G2V
Session Stop request	ISO 15118 [6]	EXI, IP	V2G
Session Stop response	ISO 15118 [6]	EXI, IP	G2V
Max power of battery charger, requested energy, departure time	IEC 61851		V2G

V2G_2: communication between EVSE and EVSE operator

Name of message	Standard	Dissemination mode	Direction
Messages for AAA	RFC 2865 [7], RFC 2866 [8], RFC 3579 [9]	TCP/IP	C/S controller <--> EVSE operator
Messages for C/S Monitoring	RFC 3411- RFC 3418 [10], [11], [12], [13], [14], [15], [16] and [17] .	TCP/IP	C/S controller <--> EVSE operator
AAA and Monitoring	OCPP 1.5 [18]	SoAP/TCP/IP	C/S controller <--> EVSE operator

Table 9: Communication interfaces for V2I

V2I_1: Communication between OBU and RSU

Name of message	Standard	Dissemination mode	Direction
CAM (Cooperative Awareness Message)	ETSI EN 302 637 - 2 [4].	Broadcast, GeoNet, G5	RSU --> FEV
DENM (Decentralized Environmental Notification Message)	ETSI EN 302 637 – 3 [5].	Broadcast, GeoNet, G5	RSU --> FEV
In vehicle signage	CEN on-going standards	Broadcast, GeoNet,G5	RSU --> FEV
EVSE POI message	ETSI TS 101 556-1 [19].	Broadcast,GeoNet,G5	RSU --> FEV
POI public transport message		Broadcast,GeoNet,G5	RSU --> FEV

V2I_2: Communication between OBU and backend data centre

Name of message	Standard	Dissemination mode	Direction

Vehicle Relationship Message	CoAP, UDP/IP, 3G	FEV --> Data Center
Routing and re-routing information	W3C SOAP/ Web services	Backend → FEV

V2I_3: Communication between OBU and eCo-FEV application centre

Name of message	Standard	Dissemination mode	Direction
Authentication request message	openID [20].	web service	FEV --> Service provider
Authentication response message	openID [20]	web service	Service provider --> FEV
trip planning request		web service	FEV --> Service provider
recommended route guidance message		KML, web service	Service provider --> FEV
POI	ETSI TS 101556-1 [19].	Point to point, IP, 3G	Service provider --> FEV
C/S booking request message	ETSI TS 101556-3 [21].	Point to point, IP, 3G	FEV --> Service provider
C/S booking confirmation message	ETSI TS 101556-3 [21].	Point to point, IP, 3G	Service provider --> FEV
Event notification message		Point to point, IP, 3G	Service provider --> FEV

V2I_4: Communication between OBU and ID provider centre

Name of message	Standard	Dissemination mode	Direction
authentication response	OpenID [20].	web service	ID provider --> FEV

Table 10: Communication interfaces for I2I

I2I_1: Communication between EVSE operator and data center

Name of message	Standard	Dissemination mode	Direction
C/S accounting and monitoring message		Web service	EVSE operator → data center
EVSE booking request	ETSI TS 101556-3 [21].	Web service	Data center → EVSE backend
EVSE booking confirmation	ETSI TS 101556-3 [21].	Web service	Data center → EVSE backend
FEV user preferences		Web services	Data center → EVSE operator
EVSE details and availability		Web services	EVSE operator → data center

I2I_2: Communication between eCo-FEV data centre and eCo-FEV backend application centre

Name of message	Standard	Dissemination mode	Direction
route search request		Web service	app centre --> data centre
route search response		Web service	data centre --> app centre
C/S search request		Web service	app centre --> data centre
C/S search response		Web service	data centre --> app centre
booking and cancellation request	ETSI TS 101556-3 [21].	Web service	app centre --> data centre
booking confirmation	ETSI TS 101556-3 [21].	Web service	data centre --> app centre
Range estimation request		Web service	app centre --> data centre
Range estimation response		Web service	data centre --> app centre

I2I_3: Communication between App centre and ID provider centre

Name of message	Standard	Dissemination mode	direction
Authentication request	OpenID [20].	web service	app centre --> IP centre

I2I_4: Communication between RSU and eCo-FEV backend data centre

Name of message	Standard	Dissemination mode	Direction
DATEX 2 message	Datex 2 EASYWAY [22].	SoAP web service, XML	Data center --> RSU

I2I_5: Communication between data centre and parking operator

Name of message	Standard	Dissemination mode	direction
parking status			Parking operator → data centre
parking regulation			Parking operator --> data centre
Free parking slots		SOAP/ Web services, XML	Parking operator → data centre

I2I_6: Communication between data centre and traffic management operator

Name of message	Standard	Dissemination mode	Direction
Traffic condition	Datex2 EASYWAY [22].	SoAP web service, XML	TMC --> data centre

weather condition	Datex2 EASYWAY [22]	SoAP web service, XML	TMC --> data centre
road event information	Datex2 EASYWAY [22].	SoAP web service, XML	TMC --> data centre

I2I_7: Communication between data centre and public transport operator

Name of message	Standard	Dissemination mode	Direction
public transport status	SIRI	web service	public transport operator --> data centre
Public transport options	GTFS	SOAP, (Google Maps API) Web services, XML	public transport operator --> data centre

I2I_8: Communication between data centre and fleet operator

Name of message	Standard	Dissemination mode	Direction
request (trip assistance by driver) confirmation		web service	data centre--> Fleet operator
request trip assistance (by fleet operator) (vehicleID)		web service	Fleet operator --> data centre
event notification (unexpected situation happen)		web service	Data centre-->Fleet operator
alternative itinerary in unexpected event		web service	Data centre-->Fleet operator
itinerary changes (approved/not approved)		web service	Fleet operator-->Data centre
request confirmation (request trip adjustment by driver)		web service	Data centre-->Fleet operator
request trip adjustment (vehicle ID) by operator)		web service	Fleet operator-->Data centre
adjustment result/not approval result		web service	Data centre-->Fleet operator

I2I_9: Communication between data centre and weather operator

Name of message	Standard	Dissemination mode	Direction

Weather conditions	RFC 4627 ECMA-404	W3C SOAP, XML	Weather operator → data centre

I2I_10: Communication between EVSE Controller and Energy Provider			
Name of message	**Standard**	**Dissemination mode**	**Direction**
Grid Status	IEC 62056	Point to point	Electric grid→ EVSE

I2I_11: Communication between EVSE operator and Energy Provider			
Name of message	**Standard**	**Dissemination mode**	**Direction**
Load Allocation		SOAP/ Web Services	Energy provider → EVSE operator
Load Re-profiling		SOAP/ Web Services	Energy provider → EVSE operator

Table 11: Communication interfaces UI

UI_1: Interface between OBU and on-board/ portable information system			
Name of message	**Standard**	**Dissemination mode**	**Direction**
FEV Data	Bluetooth	Point to point	OBU → portable device
Current route	Bluetooth		OBU → On-board/ portable device
POIs and traffic light positions	Bluetooth		OBU → On-board/ portable device
User selected options	Bluetooth		On-board/ portable device → OBU

UI_2: Interface between data center and on-board/ portable information system			
Name of message	**Standard**	**Dissemination mode**	**Direction**
Process Requests		3G/LTE	Portable Device→ Backend
Traffic data		UMTS	Portable Device→ Backend
FEV user preferences		UMTS	Portable Device→ Backend

UI_3: Interface between EVSE and portable information system			
Name of message	**Standard**	**Dissemination mode**	**Direction**

Reservation Request	ETSI TS101 556-3	3G/LTE	Nomadic EVSE	Device→

4 Common activities

In this section cluster's planned, current and future activities are described.

4.1 Overview

The agreed common activities to be performed within the cluster are organised through two main lines of actions:

1. Organisation of joint workshops, phone conferences and meetings in order to share lively common experiences and manage common activities of the clustering community.
2. Share of information and production of common information, e.g. respectively business models/public deliverables and common dissemination.

These activities shall also lead us to define and follow common paths within the three projects and to agree in a common pre-standardisation process.

4.2 Joint Workshops

4.2.1 Introduction and plan

Three common workshops are planned throughout the cluster´s lifespan. The initial proposal for the meetings is:

1. **Use cases and architecture** workshop: around October 2013. In this workshop we will share the architecture and business use cases that are common to the three projects. The objective of this workshop is to present the synergies among the three projects in terms of interfaces, architecture design, and use cases. By that date the use case and requirement analysis and the technical design shall be already performed in the three projects. In this workshop we will prove how the design and requirements of the three projects have influence each other.

   This 1st Workshop took place on September 20th 2013 in Brussels, see section 4.2.2.

2. **Proof of concept and standardisation** workshop: around October 2014. Presentation of the common reference architecture where the interfaces and synergies between the projects will be proved. Reporting on the pre-standardisation process where the detected gaps in the current standards will be presented together with the line of actions to try to close them. Present and future activities with standardisation bodies will be discussed and presented.

3. **Final demo and exploitation of the technologies** on April 2015. Final demonstration of the synergies among the projects in the cluster. Presentation of the conclusions and final report on standardisation.

   Due to the different ending dates of each project (Mobility 2.0 on 02/2015, eCo-FEV on 04/2015 and Mobincity on 06/2015) and the logistics implied for the demos it shall

be evaluated the convenience or not of celebrating this common workshop. The alternative is to make independent workshops in the final stages of each project.

4.2.2 Use cases and architecture workshop

The eCo-FEV, Mobility 2.0 and Mobincity projects jointly organized a workshop "Use cases and requirements" on September 20th 2013 that was the first event of a series of 3 joint workshops.

AGENDA

The preparation of the joint workshop agenda has been thoroughly discussed among the three projects and the agreement on the final version has been achieved unanimously.

Table 12: Agenda of the "Use cases and requirement" Workshop

Time	#	Topic	Responsible
9:00-9:30	1	Welcome & Introduction	Massimiliano LENARDI (HIT) Andras KOVACS (BroadBit) Raúl SORIANO (ITE)
9:30-10:30	2	Use cases & requirements - Mobincity - eCo-FEV - Mobility2.0	Irene Aguado (ITE) Witold Klaudel (REN) Andras KOVACS (BroadBit)
10:30-11:00		*Coffee*	
11:00-12:00	3	Architecture design - eCo-FEV - Mobility2.0 - Mobincity	Daniel Roiu (CRF) Nitin Maslekar (NEC) Irene Aguado (ITE)
12 :00-13:00		*Lunch*	
13:00-14:00	4	Interfaces - Mobility2.0 - Mobincity - eCo-FEV	Jens Mittag (Barcelona Digital) Angela Budroni and Michael Spähn (Fraunhofer ESK) Lan Lin (HIT) + other partners
14 :00-14:30		*Coffee*	
14:30-15:00	5	Outlook : Towards release 2 - Common standards - Next steps: Targets for the 2nd year	Massimiliano LENARDI (HIT) Andras KOVACS (BroadBit) Raúl SORIANO (ITE)
15:00		End of event	

Participants

The 1st clustering workshop was limited only to participants from the clustering projects. The next workshops will be opened for the external public. In total, 29 experts attended the project. Detailed list of the participants is shown in the table below.

Table 13: Participants of the "Use cases and requirements" Workshop

First name	Last name	Company	Project
Alejandro	Martínez	CIT	Mobincity
Alexandru	Petrescu	CEA	eCo-FEV
Anastasia	Bolovinou	ICCS	Mobility2.0
Andras	Kovacs	BroadBit	Mobility2.0
Andrea	Tomatis	Hitachi Europe	eCo-FEV
Angela	Budroni	Fraunhofer	Mobincity
Arnaud	Kaiser	CEA	eCo-FEV
Bruno	Dalla Chiara	Politecnico di Torino	eCo-FEV
Cedric	Gouy-Pailler	CEA	eCo-FEV
Daniel	Roiu	CRF	eCo-FEV
Filip	Prebeg	EIHP	Mobincity
Francesco	Guaraldi	Prive	Mobility2.0
Franco	Roncaglione Garoffo	Energrid S.P.A.	eCo-FEV
Hristiyan	Stoyanov	EICT	eCo-FEV
Irene	Aguado	ITE	Mobincity
Jean-Christophe	Maisonobe	Conseil General de l'Isère	eCo-FEV
Jens	Mittag	Barcelona Digital	Mobility2.0

First name	Last name	Company	Project
Judith	Gierig	Facit Research	eCo-FEV
Lan	Lin	Hitachi Europe	eCo-FEV
Massimiliano	Lenardi	Hitachi Europe	eCo-FEV
Michael	Spähn	Fraunhofer	Mobincity
Nadim	El Sayed	DAI-Labor, TU Berlin	eCo-FEV
Nadja	Rappold	Facit Research	eCo-FEV
Nitin	Maslekar	NEC	Mobility2.0
Paolo	Bargero	Bluethink S.p.A.	eCo-FEV
Paolo	Guglielmi	Politecnico di Torino	eCo-FEV
Raúl	Soriano	ITE	Mobincity
Sarah	Metzner	EICT	eCo-FEV
Witold	Klaudel	Renault	eCo-FEV

DESCRIPTION

A particular focus of the meeting was to present the current development status of cooperative systems for fully electric vehicles (FEV) and share the latest results in the context of use cases, architecture design and specifications.

In particular, the workshop objectives were to:

- Share the latest research achievements
- Share perspectives and recommend standards
- Align the common work towards standardization
- Set future activities and topics of common interest
- Facilitate networking and discussion among the participants

The workshop started with opening remarks by Mobility 2.0 Project officer Myriam Coulon-Cantuer from DG INFSO. It was followed by introduction presentations of the 3 project coordinators. The importance of this synergy and the benefits it will bring by sharing the outside perspectives and clarifying the differences in use cases and architecture was pointed out.

Three consecutive presentation sessions provided the platform for interactive discussion between the participants and the bi-directional flow of information on:

- Use cases and requirements
- Architecture design
- Interfaces

Eventually, the coordinators of the three clustering projects outlined the common goals and targets for the 2nd year and the participants discussed the alignment of common work towards standardization and the release of the 2nd shared deliverable.

All presentations are available for download from the Redmine platform set up by eCo-FEV project.

CONCLUSIONS

On September 20th 2013, the eCo-FEV, Mobility2.0 and Mobincity projects co-organized the 1st clustering workshop on "Use cases and requirements". 29 experts attended the workshop, hosted by EC in Brussels. The European Commission was represented by Mobility 2.0 Project officer Myriam Coulon-Cantuer from DG INFSO.

An outcome of this workshop is the fact that the overall system concept & definitions as well as the high level architecture and interfaces defined by the 3 projects were shared leading to an efficient information exchange and thus allowing the participants through real interaction to benefit from the outside perspective of the clustering projects.

In addition, the common work toward standardization and dissemination activities were outlined and discussed in details. The plan for the next period was agreed upon and the release of the 2nd common deliverable coordinated.

The next common workshop on "Proof of concept and standardization" is planned for October 2014 where the results of the development phase and standardization will be shared.

The 3 clustering projects wish to acknowledge the kind hospitality of EC, DG CONNECT – UNIT H5 for hosting the 1st clustering workshop "Use cases and requirements", and to acknowledge the kind and active participation of all participants from the clustering projects that attended the joint workshop.

Figure 11: Use cases and architecture Workshop. Picture 1

Figure 12: Use cases and architecture Workshop. Picture 2

4.3 Meetings

The cluster shall meet every two months on a regular basis for monitoring and control of common activities and for setting up a common forum of discussion.

All the common activities related to standardisation procedures, dissemination activities and convergence activities (through common use cases and business modelling) shall be discussed in these meetings.

Specific meetings can also be arranged when required at request by any member

The following table shows the meetings already done.

Table 14: Meeting regarding the clustering activities

Date	Item	Contribution	Participants
04.10.2012	Web conference	• Presentation of clustering activities. • First ideas regarding common deliverable • Editing plan and structure for the common deliverable: 1. List of standards 2. Standardization bodies 3. Possible activities/workshops 4. Liaison Information exchange	Massimiliano Lenardi Andrea Tomatis Lan Lin Henrike Inhülsen Anja Winzer Andras Kovacs Andreas Festag Raul Soriano
02.11.2012	1st Draft deliverable	Provide draft template	
06.11.2012	2nd Clustering Call	• "Architecture responsible" per project • Chapter authors for the "Clustering deliverable" • Timeplan for deliverables development • Possibility to circulate project newsletter via other project mailing lists? • Further standardization bodies	Massimiliano Lenardi Lan Lin Henrike Inhülsen Andras Kovacs Raul Soriano Sixto Santoja

23.11.2012	2nd Draft Deliverable	Provide Input to 1st Draft Project description p.4 Executive Summary p.7 1. Standardization / Bodies p.8 1. Standardization / List of standards p.9 2. Possible Common Activites p.10 3. Information Exchange / Liaisons p. 11 4. Conclusion p.12	
30.11.2012	3rd Clustering call	• Review of the common deliverable	Massimiliano Lenardi Lan Lin Henrike Inhülsen
18.12.2012	4th Clustering call	• Delivery planning of the clustering deliverable's first version • Review of document editing tasks and responsibilities per section • Next conference call to discuss clustering input to the EM-AHG document. • Use case sharing among the projects	Massimiliano Lenardi Lan Lin Henrike Inhülsen Andras Kovacs Maslekar Nitin Angela Budroni Raúl Soriano
15.04.2013	5th Clustering call	• Review of the status of the projects • Initial discussions about preparation of the Common deliverable release 2 • Proposal of dates for the 1st Common Workshop.	Massimiliano Lenardi Henrike Inhülsen Hristiyan Stoyanov Sarah Metzner Andras Kovacs Nitin Maslekar Angela Budroni Raúl Soriano
16.05.2013	6th Clustering call	• Review of the status of the projects • Common deliverable r2. Discussion about the deliverable's content. • 1st Common workshop: Date fixed to September the 20th in Brussels. A rough description of the scope is done.	Massimiliano Lenardi Henrike Inhülsen Hristiyan Stoyanov Sarah Metzner Andras Kovacs Raúl Soriano

04.07.2013	7th Clustering call	• Review of the status in the sharing of deliverables for each project. • Definition of the common deliverable r2 structure and work distribution • Workshop organization. Discussion about the WS content and agenda	Massimiliano Lenardi Sarah Metzner Andras Kovacs Raúl Soriano Angela Budroni
30.07.2013	8th Clustering call	• Common deliverable r2: Final agreement on deliverable's structure and distribution of work. • 1st Common Workshop: Final agreement on the agenda	Massimiliano Lenardi Hristiyan Stoyanov Andras Kovacs Nitin Maslekar Angela Budroni Raúl Soriano Lan Lin
05.09.2013	9th Clustering call	• Working in the draft version of the Common deliverable r2. • Preparation of the 1st Common workshop (participants, speakers, etc.)	Massimiliano Lenardi Sarah Metzner Andras Kovacs Angela Budroni Raúl Soriano Lan Lin Michael Spähn
04.10.2013	10th Clustering call	• Discussion about the results of the 1st Clustering Workshop. • Common deliverable r2: Draft preparation. Proposal and agreement of a TOC. Tentative work allocation.	Massimiliano Lenardi Andras Kovacs Nitin Maslekar Raúl Soriano Lan Lin
18.11.2013	11th Clustering call Common deliverable r2	• Review of the status of the contributions. • Review of the content and the deliverable's structure	Massimiliano Lenardi Andras Kovacs Nitin Maslekar Raúl Soriano Angela Budroni
06.12.2013	12th Clustering call Common deliverable r2	• Review of the status of the contributions. • Rearrangement of some sections • Reschedule of the contributions	Massimiliano Lenardi Andras Kovacs Nitin Maslekar Raúl Soriano Angela Budroni

19.12.2013	13th Clustering call Common deliverable r2	• Review of the status of the contributions. • Review of the scope of section related to communication standards and how to link them to the architectures.	Massimiliano Lenardi Nitin Maslekar Raúl Soriano Angela Budroni Lan Lin
11.02.2014	14th Clustering call Common deliverable r2	• Review of the status of the common deliverable Release 2 v1.6	Massimiliano Lenardi Nitin Maslekar Irene Aguado
26.02.2014	15th Clustering call Common deliverable r2	• Review of the status of the common deliverable Release 2 v1.7 • Review of the contribution to section 3 • Agreement on 7th March as submission date to the EC.	Massimiliano Lenardi Nitin Maslekar Irene Aguado Angela Budroni Lan Lin Andras Kovacs Hristiyan Stoyanov
06.03.2014	16th Clustering call Common deliverable r2	• Review of the final version of the common deliverable Release 2 (v2.0)	Massimiliano Lenardi Nitin Maslekar Irene Aguado Lin Lan Angela Budroni Sarah Metzner

4.4 Cluster's common dissemination activities

At least a common paper shall be submitted with the results of the cluster's activities. It shall be decided the final subject of the paper (or papers) and where to present it (conference proceedings, specialized publication, etc.).

Possible subjects can include standardization processes, collaboration models, common outcomes, results, etc.

Possible events to attend:

- ITS World Congress 2015 in Bordeaux (France). The congress will be in October, deadline for submission is in January 2015
- 2015 IEEE 18th International Conference on Intelligent Transportation Systems (ITSC 2015) in Las Palmas de Gran Canaria (Spain). The congress will be in September, deadline for submission is in April 2015.

4.5 Business modelling

A possible exchange of information on business modelling activities among the clustering members can be beneficial and lead to synergies. A common business model might be agreed if such synergies are detected and a deep inter-project integration is achieved. These synergies will be carefully studied in future meeting of the clustering group.

4.6 Projects' deliverables' sharing

Projects' public deliverables will be automatically shared among the 3 cluster projects.

Within each cluster project, discussions will be raised case by case about sharing project restricted deliverables, eventually portions of them, if considered relevant for the cluster.

By implementing this information exchange, each cluster project may review the outcomes of the other 2 projects and profit from the commonalities of each other.

This reviewing process might lead to a common architecture design via this Deliverable, using the common shared interfaces between all the projects.

Public deliverables related to requirements, use cases, architecture design, communication standards, and business models are firm candidates to be shared.

4.6.1 Shared Deliverables

The following Table summarizes the currently shared deliverables; they concern Use Cases, Requirements and Specifications of the 3 Projects.

Table 15: Brief description of the shared deliverables

Project & Deliverable name	Short description
eCo-FEV: D200.1 "Use Cases and Requirements for an efficient cooperative platform"	This deliverable specifies a list of use cases being targeted by the eCo-FEV project. Each use case is defined in a way to guide the system architecture design instead of imposing any system architecture. Therefore, the use cases are defined from a functional viewpoint. For each use case, a set of functional and operational requirements, which shall be supported by eCo-FEV system, are identified for the realization of these use cases.
eCo-FEV: D200.2 "Overall architecture and functional design for e-mobility cooperative infrastructures"	The present deliverable takes D200.1 as inputs and targets at defining the architecture of the eCo-FEV system. Different viewpoints are taken to describe the eCo-FEV system. eCo-FEV system architecture is defined as an ensemble of sub systems， namely in vehicle On Board Unit (OBU), road side unit (RSU), charging infrastructure system and eCo-FEV backend sub system. These sub systems are interacting with each other, and with different FEV related infrastructure systems, in order to realize the eCo-FEV use cases.

Mobincity: D1.1 “Use case scenarios”	After a brief introduction (section 3) to summarize the context and opportunity of the project and specifically of the use cases definition, in section 4 is described the methodology followed to define the project specifications. This description goes through the identification of system actors and stake-holders, the definition of high level and detailed use cases and the main links among them, until the relation between the user requirements and the use cases identified condensed into a matrix of traceability. In section 5, the Mobincity architecture and its needs and boundaries are detailed. First of all, the user needs and constraints are analyzed covering the constraints of energy grid parameters, traffic in-formation and communications. Next in line a synopsis of the architecture designed, there is a complete description of the actors and components identified in the Mobincity project which have been used in the use cases. Section 6 contains a summarized description of the use case scenarios defined which includes the context or sequence UML diagrams depending on the use case type considered (high level or detailed). In this section, the three categories in which the use cases are classified, Trip Planning, On-trip Services and Charging, are described and related with the functionalities that may be covered with the Mobincity System.
Mobincity: D1.1 “Annex A Use cases description”	A detailed explanation of the use cases can be found. Each use case is described using three sections: description, diagramming and step by step analysis. In the description section the use case is identified indicating its parent use case and category, the referenced information and standards are listed, the scope and objective are defined, a complete description is provided and also the actor and components included in the use case and the preconditions, events and assumptions required. Diagramming section provide the UML diagrams of the use case. Finally, the step by step analysis section lists the normal sequence and alternative scenarios and describes them using the sequence UML diagram defined.
Mobincity: D1.2 “System Design and Technical Requirements”	This deliverable explains the user requirements and its technical requirements to achieve them. With these requirements architecture of the system has been designed, developing description of all the components involved. Deliverable has been divided in the following main sections: User requirements, Technical requirements, Technical design, and Security analysis. With these sections the current deliverable provides a complete procedure to define the system that has to be developed in the scope of MOBINCITY’s project.
Mobility2.0: D2.2 “User requirements of the ‘Cooperative FEV commuting assistant”	The scope of this deliverable is to describe the use cases identified in the MOBILITY 2.0 project, as well as user and infrastructure requirements for the Commuting Assistant application development. A description of the methodology used to collect and define them is presented as well. Moreover, this deliverable includes part of the Security and Privacy analysis carried out in T2.3 (Security and Privacy analysis). User requirements (UR) collection and analysis aims at providing insights on user needs, as well as on the nature of the project applications/services. The UR methodology that is followed in MOBILITY 2.0 includes the usage of personas, the definition of a set of use cases by the test sites owners and the technical partners of the Consortium, and the formulation of a set of application requirements, on the basis of the use cases.

Mobility2.0: Architecture Deliverable“, chapter 1 “Design and Specification of Mobility 2.0 FEV interfaces and protocols”	This chapter specifies the reference architecture for electro-mobility services, which will be developed within the framework of Mobility 2.0. It discusses the deployment architecture and high level view for electro-mobility projects. Based on these views, the project refines and enhances the architecture in order to specify the Mobility 2.0 specific architecture components and specific functional architecture.
Mobility2.0: Recharging spot notification and reservation specifications	As part of an ITS system functionality FEVs need to get information regarding (re)charging spots through (v) RSUs. This chapter describes how the infrastructure of (v) RSUs can be used to disseminate such notifications to vehicles and outlines the (re)charging spot notification protocol in accordance to the ETSI specification. The scenario to be developed in Mobility 2.0 for CS notification message is in line with the deployment scenario B mentioned in the Clause 4.3 of the standard. According to this, the Central ITS-Station builds an updated list of FEV (re)charging stations and sends it to the Road Side ITS- Stations.
Mobility2.0: Specifications Annex - ASN1 encoding and References	Design and Specification of Mobility 2.0 FEV interfaces and protocols

5 Conclusions

This common Deliverable reports the clustering activities of the three projects eCo-FEV, Mobility2.0 and Mobincity. These activities mainly include synchronization on the system architecture achieved by common standardization targets, and common dissemination actions.

This Deliverable is a living document, with three Releases planned. The 1st Release is providing the clustering activities' intentions, and has been published in December, 2012. The present 2nd Release presents the use cases and architectures of the three projects and the relevant standards for each project, together with a preliminary common set of interfaces of a potential common architecture. Furthermore, the sharing of related projects' deliverables within the cluster and the planning of common dissemination activities has been documented. This release will be updated with further plans and description of concluded joint activities in the 3rd/final Release, planned (tentatively) for January/February 2015.

The three projects identified the Standardization Bodies' Committees which are relevant for the clustering activities. For each Committee, the relevant existing standards are listed per project; the possible clustering contributions are and will be discussed through dedicated meetings or conference calls and reported in the next 3rd Release of this common Deliverable. This list of communication standards of common interest has been updated with respect to the 1st Release, and has been taken into account for architectural alignments.

Also, the three projects refined in this 2nd Release some planned common Dissemination activities, including Workshops, Webinars or Symposia, information exchanges (the projects' other deliverables), and possibly a common conference paper. The 1st common Workshop, internal to the 3 projects, took successfully place in September 2013, and is reported here; it was organized in order to share and discuss the first results of the 3 projects. The 2nd Workshop will be open to external attendees and will focus on common standardization and interfaces.

This common Deliverable represents formally the Liaison among eCo-FEV, Mobility2.0 and Mobincity clustering projects.

Abbreviations

CEN
European Committee for Standardisation 33

eCo-FEV
efficient Cooperative infrastructure for Fully Electric Vehicles 10

EM-AHG
E-Mobility Ad Hoc Group 57

EV
Electrical Vehicle 35

IEEE
Institute of Electrical and Electronics Engineers 35

IETF
Internet Engineering Task Force 37

ITS
Intelligent Transportation Systems 35

LDM
Local Dynamic Map 39

SDO
Standards Development Organization 33

V2G
Vehicle to Grid 34

References

[1] "Standardization for road vehicles and associated infrastructure", CEN,CENELEC, Focus Group on European Electro-Mobility, Oct. 2011

[2] "Recommendations for smart grid standardization in Europe Standards for Smart Grids" CEN, CENELEC, ETSI Focus Group on Smart grid.

[3] "ETSI TR 102 863 v1.1.1 - Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Local Dynamic Map (LDM); Rationale for and guidance on standardization" Technical Report, Jun. 2011.

[4] ETSI EN 302 637-2 "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service"

[5] ETSI EN 302 637-3 "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service"

[6] ISO 15118 "Road vehicles; Vehicle to grid communication"

[7] RFC 2865 "Remote Authentication Dial in User Service (RADIUS)"

[8] RFC 2866 "Radius Accounting"

[9] RFC 3579 "RADIUS; Support For Extensible Authentication Protocol (EAP)"

[10] RFC 3411 " An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks"

[11] RFC 3412 "Message Processing and Dispatching for the SNMP"

[12] RFC 3413 "SNMP Applications"

[13] RFC 3414 "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMP-v3)

[14] RFC 3415 "View-based Access Control Model (VACM) for the SNMP"

[15] RFC 3416 "Version 2 of the Protocol Operations for the SNMP"

[16] RFC 3417 "Transport Mappings for the SNMP"

[17] RFC 3418 "Management Information Base (MIB) for the SNMP"

[18] OCPP 1.5 "Interface description between Charge Point and Central System"

[19] ETSI TS 101 556-1 "Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communication; Electric Vehicle Charging Spot Notification Specification"

[20] OpenID "www.openid.net"

[21] ETSI TS 101 556-3 "Intelligent Transport Systems (ITS); Infrastructure to Vehicle Communication; Planning and Reservation of EV Energy Supply"

[22] Datex 2 EASYWAY "www.datex2.eu"