

Deliverable 7.7

New Work Item Proposal on requirements for a Communication Protocol between EVSE and Backend system

Prepared by:

Luis de Prada, CIDAUT
luipra@cidaut.es
Sven Jundel, RWE
sven.jundel@rwe.com
Andreas Zwirlein, Siemens
zwirlein.andreas@siemens.com

Date: February 4th, 2015

Version: 5.0

Document Information

Authors

	Name	Company
Key author	Luis de Prada	CIDAUT
Further authors	Sven Jundel	RWE
	Andreas Zwirlein	Siemens

Distribution

Dissemination level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Revision history

Version	Date	Author	Description
1.0	July 15, 2014	Luis de Prada	ToC, Intro and general layout for further completion
2.0	August 19, 2014	Sven Jundel, Andreas Zwirlein	Contributions on all main sections
3.0	September 10, 2014	Luis de Prada, Sven Jundel, Andreas Zwirlein	Changes and comments
4.0	January 30, 2015	Luis de Prada	Final Draft
5.0	February 4, 2015	Luis de Prada, Sven Jundel, Andreas Zwirlein	Final version

Status	
For Information	
Draft Version	
Final Version (Internal document)	
Submission for Approval (deliverable)	x
Final Version (deliverable, approved on)	

Table of Contents (Subhead: Arial, 14 pt, bold)

1	Executive Summary.....	5
2	Introduction	6
2.1	New Work Item Proposal (NWIP).....	7
3	Steps and means	9
4	List of functionalities and explanation.....	11
5	The NWIP	12
6	eMI3 – After GeM.....	13
7	Conclusions	14

List of Figures

Figure 1: Examples of EVSE by Green eMotion partners, on the left RWE, Siemens at the centre, and ESB on the left..... 6

List of Abbreviations

AC	Alternating Current
CA	Consortium Agreement
CHAdeMO	Charge on the Move (one of the fast charging protocols)
DC	Direct Current
DoW	Description of Work (Annex I of Grant Agreement)
DSO	Distribution System Operator
eMI3	eMobility ICT Interoperability Innovation Group
EV	Electric vehicle
EVSE	Electric Vehicle Supply Equipment
GeM	The Green eMotion Project
HMI	Human Machine Interface
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IPR	Intellectual Property Rights
ISO	International Organization for Standardization
LoI	Letter of Intent
NWIP	New Work Item Proposal (for standardization bodies)
OCPP	Open Charge Point Protocol
SC	Subcommittees (of a standardization body)
TC	Technical Committee (of a standardization body)
WG	Working Group (of a standardisation body)
WP	Work Package

1 Executive Summary

The Green eMotion (GeM) project, with 42 partners and 12 demo regions involved, represented in its four years of activity an incredibly rich environment to perform analysis, tests, development and proposals on practically all the E-Mobility related aspects. Interoperability and standardization, in particular, covered a relevant part of the efforts, being considered as key aspects to boost a mass rollout of Electric Vehicles (EVs) in Europe.

The aim of this document is to present an overview of one of the activities carried out on this topic. In this case, although the activity was coordinated from WP7, the contribution from WP3 and WP4,5 was critical to cover the ICT and infrastructure related work. During the work in the Green eMotion project it became clear that a lot of partners were complaining about general incompatibilities between EVSEs of different suppliers and the corresponding charge management systems. There was always the need to have separate implementations in a charge management system for different charging points. This finding was even valid for chargers or management systems claiming to be compatible with an existing "open standard" called OCPP (Open Charge Point Protocol), in which some basic functions were defined, but there was no common way of implementing this "standard". The project partners identified several fields in which standardization activities were needed to ensure achieving interoperability at European level. In particular this deliverable has focused on harmonizing the interfaces attending to the communication between charging points (EVSE) and charging management system (identified and addressed also by WP3, and also known as backend systems).

Partners involved in this task decided to define general requirements of the communication protocol between EVSE and its backend system. Since defining the actual protocol to be used was out of the scope of the project, the decision taken was to focus on defining the minimum information, the requirements, to be included in this communication. The different information required was defined by partners belonging to the main areas of electromobility, carmakers, equipment manufacturers, software designers and electric companies.

The decision was that the protocol should include functionalities that ensure:

- Management of EVSE, including controlling, monitoring, the maintenance, provisioning, firmware update, and configuration (profiles) of EVSE and associated backend system
- Authentication/authorization/payment of charging sessions, incl. roaming, pricing and metering information
- Management of charge session, incl. interface for HMI, reporting
- Information exchange, e.g. required energy, grid usage, contractual data, metering data
- Associated added-value services
- The different requirements for security, privacy and other safety associated issues should be integrated into the specifications
- The Electric Mobility Infrastructure Open protocol shall focus on the management of chargers following IEC 61851. This management shall include AC and DC charging, as well as different profiles for simple AC chargers, AC with ISO 15118, DC Combo, DC CHAdeMO, and inductive chargers

As a result from this work, a New Work Item Proposal was drafted to be addressed to the IEC in order to start defining the necessary standard. Since the project will end before the formal process was finished, initially it was decided to handle the document to eMI³ to complete the formal process. Nevertheless, at the end of 2014, IEC received a larger proposal covering, among others, the topics developed by GeM. So it was decided to present the document to IEC 57 in order to maximise the contributions from GeM work and lessons learnt.

2 Introduction

Electromobility, and its interoperability through out Europe, is a complex system much larger than simply the Electric Vehicle (EV). The EV is not an isolated item, in order to fully achieved its environmental and mobility potentials, EV required a charging infrastructure, and a smart grid that achieves the added value those vehicles present. Finally, to allow charging in all Europe countries roaming should be possible.

Green eMotion aims at enabling mass deployment of electromobility in Europe. To achieve this goal, major players from industry, the energy sector, municipalities as well as universities and research institutions have joined forces to develop and demonstrate a commonly accepted and user-friendly framework consisting of interoperable and scalable technical solutions in connection with a sustainable business platform.

Within GeM there is a work package, WP7, devoted to standardization. The objectives of this work package are to address the problem of standardization of key elements to allow the interoperability of EVs across Europe, with special reference to interfaces (power and signals), with an end goal of creating (de facto) standards. The method proposed started by an analysis of the protocols at the base of the demonstration projects at the light of the possible options contemplated by established standards and on-going standardization activities¹. Gaps and inconsistencies have been pointed out in view of future interoperability and indication of the needs and route towards the necessary standardization activities have been drawn². The Smart Grids development, innovative ICT solutions, different types of electric vehicles (EV) as well as urban mobility concepts have been taken into account for the implementation of this framework. Green eMotion will connect several ongoing regional and national electromobility initiatives leveraging on the results and comparing the different technology approaches to ensure the best solutions prevail for the EU single market.

A virtual marketplace has been created to enable the different actors to interact and to allow for new high-value transportation services as well as EV-user convenience in billing (EU Clearing House). Furthermore, the project is actively contributing to the improvement and development of new and existing standards for electromobility interfaces. This is the area shown in this report. In order to allow the future interoperability, the communication between EVSE (Electric Vehicle Supply Equipment, also known as charging points) and the backend systems (controlled by the DSO or an energy retailer) should be standardized.

¹ For further information, please check Deliverable 7.1 and 7.2, "Review of technologies and standards in the demonstration projects" and "Standardization issues and needs for standardization and interoperability" both are available for downloading at: <http://www.greenemotion-project.eu/dissemination/deliverables-standards.php>

² Detailed information available on Deliverables 7.4, 7.5, and 7.8: "Standardization Workshop for alignment with CEN CENELEC mandate", "Standardization Workshop for finalization of alignment in the demonstration projects", and "Guidelines for standardization and interoperability" also available at <http://www.greenemotion-project.eu/dissemination/deliverables-standards.php>



Figure 1 Examples of EVSE by Green eMotion partners, on the left RWE, Siemens at the centre, and ESB on the left.

Standards in this particular area will allow controlling the charging processes, coping with the demand on the electric grid. At the same time, if this protocol is standardized it will allow the interoperability of EV since the information shared between EVSE and the backend system will be easily shared via market place. WP7 partners identified this need, and prepared a new Work Item Proposal for the standardization bodies.

2.1 New Work Item Proposal (NWIP)

A proposal for new work in the standardization bodies generally originates from industry via a National Committee. It is communicated to the members of the appropriate Technical Committee (TC) or Subcommittees (SC) accompanied by a form. This form is called New Work Item Proposal.

A new work item proposal is a proposal for:

- a new standard;
- a new part of an existing standard;
- a Technical Specification

This may be made by:

- a national body;
- the secretariat of that technical committee or subcommittee;
- another technical committee or subcommittee;
- an organization in liaison;
- the technical management board or one of its advisory groups;
- the Chief Executive Officer.

In the case of International Electrotechnical Commission (IEC)³, the process is the following: A new work item proposal is approved after a 3 months commenting and voting period, if:

- a simple majority of the committee's P-members approve the new work item and
- if the minimum number of experts are nominated by P-members' approving the new work item proposal. For committees with 16 or less P-members, a minimum of 4 experts and for committees with 17 or more P-members, a minimum of 5 experts.

Green eMotion partners in WP7 decided to follow this process, by developing the new work item proposal document for the communication protocol between EVSE and its backend system. In the following sections the process followed in this development, as well as the content is presented. Partners in this activity decided to handle the actual NWIP within eMI3, since the project has a longer time frame, which is helpful since the formal process towards standardization might take longer than GeM lasts.

Nevertheless, during September 2014, Chinese state grid issued a NWIP aiming for a central charge management system. Due to the related nature of the work developed in GeM, the decision was taken to provide the work developed in the project to the IEC TC57 in order to maximise the impact of GeM results.

³ <http://www.iec.ch/standardsdev/how/processes/development/proposal.htm>

3 Steps and means

This deliverable is related to Task 7.5 *“Green eMotion activities to raise awareness of the standardization bodies to promote electromobility in Europe”*, and answers the interest raised by the European Commission to communicate the project results to the standardization bodies.

During the work in the Green eMotion project it has become clear that a lot of partners were complaining about general incompatibilities between EVSEs of different suppliers and the corresponding charge management systems. There was always the need to have separate implementations in a charge management system for different charging points. This finding was even valid for chargers or management systems claiming to be compatible with an existing “open standard” called OCPP (Open Charge Point Protocol), in which some basic functions were defined, but there was no common and universal way of implementing this “standard”. The project partners identified several fields in which standardization activities were needed to ensure achieving interoperability at European level. In particular this deliverable has focused on harmonizing the interfaces attending to the communication between charging points (EVSE) and charging management system (identified and addressed also by WP3, and also known as backend systems).

During January 2013, at the Tech Board meeting held in Málaga (SPAIN), a technical parallel session was held among WP7 task leaders (RSE, TNO and CIDAUT), together with ENEL, RWE, Siemens and Bosch. The objective of the meeting was to develop a working plan for analyzing the requirements of communication among EVSE and its backend systems.

It was agreed that this was a very relevant topic towards interoperability of EV. The aim of this activity was defined as follows: to elaborate a new work item proposal (NWIP) for standardization bodies on communication messages. This proposal focused on the content of this interface, not on the specific protocol to be used. Partners in Task 7.5 decided to identify the information needed to ensure interoperability, and later write it down in a proposal form to be addressed to the IEC.

A second working meeting was organized, and later held by Siemens in Munich in March 2013. During this meeting the specific requirements to be included in the communication protocol were identified. Green eMotion partners from WP3, 4, 5 and 7, and relevant external stakeholders participated in this meeting. A full list of requirements was defined, and the next steps of preparing the NWIP were planned.

Participants of the meeting included Thierry Brincourt (EDF), Giovanni Coppola (ENEL), Luis De Prada Martin (CIDAUT), Matthias Duckheim (Siemens), Evgeny Finkel (Better Place), Frank Geerts (E-laad Alliander), Thomas Gereke (Siemens), Fainan Hassan (Alstom), Sven Jundel (RWE), Joost Laarakkers (TNO), Brendan McMahon (ESB), Amélien Ouelette (EDF), Raul Rodriguez (Tecnalia), Thomas Stiffel (Bosch), Stephan Voit (RWE), Arjan Wargers (E-laad), Amit Yudan (Better Place), Silvio Weeren (IBM), and Andreas Zwirlein (Siemens).

During the following three months, CIDAUT, Siemens and RWE prepared the NWIP form that was later agreed among all WP7 partners. This document, together with the recommendation of addressing the National bodies to start the formal process to create a working group was sent to eMobility ICT Interoperability Innovation Group⁴ (eMI3).

The decision to send over eMI³ was taken to enlarge the number of industries involved, as well as to make sure that the process continued at the end of Green eMotion life.

⁴ <http://emi3group.com/>

eMI3 then acknowledged the Green eMotion proposal and established a new working group “WG5” on the topic communication protocol. The group is lead by Joost Laarakkers (TNO), who has taken over this work as part of his Green eMotion commitments.

The group decided to improve the NWIP by preparing an annex document which can then be later used for a more sophisticated NWIP to the IEC. This annex document shall provide requirements and use cases for the upcoming protocol.

In order to create such document the group started a call for protocols to find possible candidate protocols already available on the market. These protocols are currently analyzed for functionality and help create the use cases and requirements document.

Due to legal reasons it took some time to gather the proprietary protocols of the partners. Currently available to the group are OCPP 2.0, Siemens and Enel protocol. Furthermore partners supplied information out of different other protocols.

Call for protocols was in September 2013 and it ended in November 2013. Due to the reasons mentioned above the analysis only started around April 2014 and has gained momentum in fall of 2014. A preliminary version of the use-case and requirements document was ready by the end of 2014, which was in time according to the original schedule. This preliminary document is available as an annex document for a possible NWIP. In the meantime the group still meets on a regular basis to define e.g. non functional requirements, which shall also be covered by the document to be created. The use-case and requirements document is therefore updated on a regular basis.

In September 2014, Chinese state grid issued a NWIP aiming for a central charge management system, this proposal was broader than the one developed within GeM. In order to use the project findings and work, the partners in this activity decided to accelerate the process and start discussing how to present our NWIP to the IEC. The decision taken was to start a discussion to TC 57 and present the findings and the document prepared within GeM.

A meeting to discuss this approach was held in Amsterdam in October 2014. It was decided to update the NWIP document, prepare supporting material for the NWIP. The work on the requirements & use-case document was therefore concentrated on supporting the NWIP. The updated NWIP draft was finally presented to IEC TC57 and they encouraged us to hand in the NWIP with minor changes. It is currently not decided who will enter the NWIP to a local standardization body, which is the first step to start the NWIP process within the IEC.

Even when the work will start within IEC, eMI3 experts can still join the work via an IEC type D liaison.

Finally TC69, to which the Chinese NWIP was aimed, recommend joining efforts between the Green eMotion NWIP proposal in TC57 and the Chinese NWIP in TC69 by creating a joint working group.

4 List of functionalities and explanation

As explained in the previous sections, the Green eMotion partners involved in this task decided to define the communication protocol between EVSE and its backend system. Since defining the actual protocol to be used was out of the scope of the project, the decision taken was to focus on defining the minimum information, the requirements, to be included in this communication.

The different information required was defined by partners belonging to the main areas of electromobility, carmakers, equipment manufacturers, software designers and electric companies.

The decision was that the protocol should include functionalities that ensure:

- Management of EVSE, including controlling, monitoring, the maintenance, provisioning, firmware update, and configuration (profiles) of EVSE and associated backend system
- Authentication/authorization/payment of charging sessions, incl. roaming, pricing and metering information
- Management of charge session, incl. interface for HMI, reporting
- Information exchange, e.g. required energy, grid usage, contractual data, metering data
- Associated added-value services
- The different requirements for security, privacy and other safety associated issues should be integrated into the specifications
- The Electric Mobility Infrastructure Open protocol shall focus on the management of chargers following IEC 61851. This management shall include AC and DC charging, as well as different profiles for simple AC chargers, AC with ISO 15118, DC Combo, DC CHAdeMO, and inductive chargers

There are currently various protocols available and used on the market, which are partly available as open protocols, but most of the protocols are proprietary. The protocols are incompatible and therefore prevent interoperability between different charge management systems and the EVSE. Furthermore the available protocols only cover parts of the functionalities which were specified as a basic functionality set in the working group.

This is why Green eMotion encouraged all members in the consortia and partners around to collaborate for achieving a unique method of managing EVSE charging stations. The effect would be security of investments for many parties in the market. On the one hand public authorities can refer to such international standard, which puts them into a position where they can exchange suppliers for charging infrastructure as well as for operating backend-systems. On the other hand EVSE manufacturers and backend-providers only need to implement and maintain one single interface, which limits implementation and operation costs, as e.g. there are situations, that some stations are obliged to have several interfaces to serve different markets in Europe.

5 The NWIP

The scope of this New Work Item Proposal was to create three documents, designed as IEC xxxx-1, IEC xxxxx-2, and IEC xxxxx-3; each of the documents shall cover a different section of a standard:

- (1) The basic definitions and use cases related to the Electric Mobility Infrastructure Open Protocol. This document IEC xxxx-1 shall be named "Electric Mobility Infrastructure Open Protocol -- Part 1: General information and use-case definition",
- (2) The technical specifications and requirements for the Electric Mobility Infrastructure Open Protocol. This document IEC xxxx-2 shall be named "Electric Mobility Infrastructure Open Protocol -- Part 2: Network and application protocol requirements", and
- (3) The interoperability tests to be performed on the Electric Mobility Infrastructure Open Protocol. This document IEC xxxx-3 shall be named "Electric Mobility Infrastructure Open Protocol -- Part 3: Network and application protocol conformance test".

The reason for the split into three parts of the proposed standard can easily be revealed by having a closer look on the content of each.

As the first part of the proposed standard has its focus on the use cases and general information it is obvious that this part will serve as a guideline for people understanding what will follow in the subsequent parts. It will contain terms and definitions for all special terminology between an Electric Vehicle Supply Equipment (EVSE) and its Back-End counterpart. Focus is to draw an architectural overview including all primary (directly involved: EVSE, Backend) and secondary actors (indirectly involved: e.g. DSO, TSO, Retailer, Clearing House) in the communication between the two communication partners. Therefore the purpose of this part of the proposed standard is the description of terms and definitions, general requirements and use cases as the basis for the other parts of the series. It shall provide a general overview and a common understanding of aspects influencing the communication to the charging station/backend and attached actors.

The second part of the proposed standard (Network and application protocol requirements) specifies the communication between an EVSE and the Backend on a technical level. The application layer message set which needs to be defined is designed to support the information transfer from an EVSE to any backend. The purpose of this part is to detail the communication between an EVSE and the Backend. Aspects are specified to detect an EVSE in a communication network and enable a most probably Internet Protocol (IP) based communication between the actors. Therefore this part should define messages, data models, based data representation formats, and the usage of all network layers. In addition, it describes how data link layer services can be accessed from a layer 3 perspective.

The third part (Network and application protocol conformance test) should target the interoperability question. Resulting from the expected complexity of the network and application protocol requirements defined in the second part of the standard, it requires a considerable amount of testing in order to enable interoperability between independent implementations. This part of the standard therefore should define a conformance test suite for the network and application layer protocols in order to derive a common and agreed basis for conformance tests. The resulting test suite is a necessary prerequisite for downstream interoperability tests. Since interoperability furthermore involves the actual application logic of an implementation those tests are beyond the scope of this standard.

IEC TC57 also suggested splitting the NWIP into three separate NWIP documents describing the three planned documents separately. This will help balancing the timeframe for publishing the documents more easily to their experience, allowing more flexibility in setting milestones.

6 eMI3 – After GeM

Taking into account the results achieved by the Green eMotion project so far, most of the industrial partners strived for more effective standardization (GeM with limited project duration, coverage of countries / charge pole installations) and initiated a meeting inviting many relevant EU EV players (July 2012). They decided to form an industry EV standardisation organisation called eMI3 (eMobility ICT Interoperability Interest Group). Based on a LoI, eMI3 started in Oct2012 with 15 members (GeM being one) to develop a technical work plan & roadmap which was presented at the GeM stakeholder forum in Nov 2012 by 26 members covering more than 80% of public charge poles in many EU countries.

eMI3 has selected ERTICO as organisation to host the group and is currently working out the legal setup (ToR including IPR rules) with currently 37 members including 2 from the US. ICT standardisation issues arising in GeM are discussed with WP7 and if appropriate, are effectively transferred to eMI3 for further consideration and resolution. Thus eMI3 efforts are treated as GeM WP3, WP5 or WP7 efforts respectively approved by the project coordinator.

eMI3 has three technical working groups where GeM delivers a great part of the input:

- WG Use Cases and service (WG UC)
- WG Architecture and Interfaces (WG AI)
- WG Business Objects (WG BO)

WG UC develops a common understanding within the group after assessing existing standardization developments (like ISO/IEC15118 and IEC SG WGSP) and prioritizes the work items. WG AI develops an architecture framework to support and implement the agreed use cases and identifies the requirement for business objects like unique identifiers to be developed by WG BO).

As a first result, eMI3 has acted on the most pressing issue identified in D3.9 and produced a first draft standard with updated unique identifiers contact and EVSE IDs and sent it to DIN and ISO/IEC15118 for review and inclusion.

To reach the goal of global harmonization, eMI3 has worked out a liaison agreement with NEMA in the US which is currently working on corresponding issues.

Within its work eMI3 has been chosen as the natural resource to carry out the NWIP on the communication protocol between EVSE and its backend system. eMI3 has invited OCA (Open Charge Alliance, the former OCPP forum) and has formed a working group to standardize this communication in concert with the other activities.

The eMI3 group is still working on a requirement and use-case document describing the new protocol. There is good progress with this work. The NWIP has been derived from the work done within the eMI3 working group.

7 Conclusions

1. A deep analysis was carried out on existing standards on electro-mobility. Together with the requirements from a common market place and the business cases developed in GeM, it was concluded that current communication protocols between charging infrastructure and its backend systems lacked a requirement standard to ensure all necessary information was duly transferred.
2. GeM partners from all industrial sectors decided to focus on defining the required information needed on the communication protocol between EVSE and its backend system that will ensure interoperability of EV. The decision was to define the contents and not the language of the protocol. The technical details will have to be handled within the standardization group.
3. GeM partners defined the following information to be included in the communication protocol:
 - a. Management of EVSE, including controlling, monitoring, the maintenance, provisioning, firmware update, and configuration (profiles) of EVSE and associated backend system
 - b. Authentication/authorization/payment of charging sessions, incl. roaming, pricing and metering information
 - c. Management of charge session, incl. interface for HMI, reporting
 - d. Information exchange, e.g. required energy, grid usage, contractual data, metering data
 - e. Associated added-value services
 - f. The different requirements for security, privacy and other safety associated issues should be integrated into the specifications
 - g. The Electric Mobility Infrastructure Open protocol shall focus on the management of chargers following IEC 61851. This management shall include AC and DC charging, as well as different profiles for simple AC chargers, AC with ISO 15118, DC Combo, DC CHAdeMO, and inductive chargers
4. eMI3 was the chosen vessel to finish the process due to the temporary limitations on GeM (finishing at the end of February 2015.)
An updated NWIP is available and agreed on between the partners and IEC. Next step is handing in the NWIP via one national standardization body by a partner.