Green eMotion

Development of a
European Framework for Electric Mobility

Deliverable 3.9

ICT Standards & Protocols

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Terms, Nomenclature & Abbreviations

In this document some fundamental terms have been given a more precise interpretation which is as follows. Terms and definitions not listed below can be found in D3.2 and D3.3.

Specification:	*A detailed description identifying something precisely or stating a requirement precisely*
Recommendation:	*A statement which identifies an entity (concept, person or thing) as worthy or desirable. In some circumstances, a recommendation which has been accepted can be developed into a specification.*
Guiding Principle:	*Statement which articulates the fundamental values which provide overall direction to a program throughout its operation irrespective of changes in its goals, requirements or resources. In some circumstances, a Guiding Principle establishes a Code of Conduct*
Proposal:	*A plan or suggestion, especially a formal or written one, put forward for consideration or discussion by others. In some circumstances, especially in formal standardisation, a proposal bridges the gap from a recommendation to a specification*

It should be noted here that:

*Most standards are **voluntary** in the sense that they are offered for adoption by people or industry without being mandated in law. Some standards become mandatory when they are adopted by regulators as legal requirements in particular domains.*

*The term **formal standard** refers specifically to a specification that has been approved by a standards setting organization.*

Consequently, it is expected that the "ICT Standards & Protocols" task will deliver[1] a detailed *specification* but not a *standard* in its own right. It is envisaged that this specification which will then be submitted to one or more standards setting organisations as a *recommendation for adoption* into a formal standard.

Throughout this document the following abbreviations have been used:

ANSI	American National Standards Institute
B2B	Business to Business
B2C	Business to Consumer (aka: Business to Customer)
CDR	Charge Detail Record
CHAdeMo	CHArge de MOve

[1] Formally these are Green eMotion deliverables D3.9 and D3.10

CMS	Commercial Management System
CP	Charging Point
CU	Charging Unit
DSO	Distribution System Operator
EDI	Electronic Data Interchange
EVCOID	Electric Vehicle Contract ID
EVSE	Electric Vehicle Supply Equipment
EVSEID	Electric Vehicle Supply Equipment ID (Charge Point / Unit)
EVSP	Electric Vehicle Service Provider
HCPCS	Healthcare Common Procedure Coding System
HIPAA	Health Insurance Portability and Accountability Act
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IMS	Infrastructure Management System
ISO	International Organisation for Standardisation
IT	Information technology
NAESB	North American Energy Standards Board
OCPP	Open Charge Point Protocol
OEM	Original Equipment Manufacturer
OSI	Open Systems Interconnection
Payload	The essential data that is being carried within a packet or other transmission unit. The payload does not include the "overhead" data required to get the packet to its destination.
PLC	Power Line Communication
PRP	Public review period
STORK	Strategic Roadmap for Crypto (CORDIS FP7 Project)
TC	Technical Committee
TSO	Transmission System Operator
UML	Unified Modelling Language
V2G	Vehicle to Grid
V2H	Vehicle to Home
VIN	Vehicle Identification Number
W3C	World Wide Web Consortium
XML	Extensible Markup Language
XSD	XML Schema Definition

1 Executive Summary

The current electric mobility market in Europe encompasses a number of official pilot projects and implementations of IT services and transactions.
Proprietary solutions especially regarding EVSE – EVSE Op. back-end communication have been deployed, which highlights the need of integration and harmonisation effort regarding communication layers which are not target of current standardisation effort (e.g. ISO 15118 which focus on EV-EVSE communication).

At present, no coordinated EU wide activities exist for the realisation of an integrated system that can be successfully and easily used by all relevant players. Therefore a substantial need for action exists for the following basic services and functionalities best provided by an IT marketplace:

- the simple use and the interoperability (access, authentication, authorization, accounting/billing[2]) with the focus on (partially) public charging infrastructure
- the support of service and diagnosis processes as well as an intelligent networking of vehicle and infrastructure
- Support the increase in value-added services, like charge station reservations, advanced energy/grid management services, advanced navigation and routing services as well as intermodal mobility services

This deliverable is a first step to develop a missing standard. A method to derive the relevant business transactions from the use cases will be applied and the transactions have been classified for future standardisation:
To achieve EV charging there is a minimum specification for transactions – this is the ***mandatory*** part. There is, also, an ***optional*** part which refers to transactions which add value, but are not necessary to enable the end-to-end EV charging process (e.g. "can the grid sustain the demand"). Finally, there is a ***desirable*** (or, future,) part (e.g. "eco-routing") which is likely to drive future adaptation or extension to the EV charging model.
The IT service priorities already established (in Task 3.2 of Work Package 3) can be combined with the above classification to yield the initial standards specification focus and coverage.
As Task 3.8 relies strongly on the deliverables D3.5 and D3.6 the partners decided to update the timeline and stage Task 3.8 into phases:

1. The "now" – which is a snapshot of where the different pilot programmes are and, more specifically, a snapshot of the perceived requirements based on use case scenarios developed in the last 10 months. The ICT standards and protocols

[2] For instance, relating to the forwarding of the CDR for accounting or billing processes from the EVSP – in the assumption that a specific business model is in operation. This may not be the only scenario or business model.

thinking at the end of this phase will drive some of the Guiding Principles to be adopted by the ICT Reference Architecture.

2. The "next" – refers to the releases of the ICT System which have been planned and which will be executed in the next 24 to 36 months. This phase will provide several opportunities (at least 2) to "synchronise" the ICT standards and protocols specification with the implementations of the ICT System for EV Services Market (including the GeM B2B Marketplace). This is where some of the Guiding Principles of the previous phase will become specified in detail and supporting the ICT Reference Architecture (D3.2).
3. The "future" – refers to the ICT environment which will be deployed in practice and where the ICT standards and protocols drive the architectural principles and decisions to be adopted. This is the phase where the GeM Work Package 3 specification is fed into a formal and extensive consultation process to become a standard specification

By concentrating at the transaction level, the EV ICT standards can be designed to be independent of communication and software technologies (above the OSI layer). Thus the requisite transaction information can be transmitted using any methodology (protocol) - synchronous or asynchronous - agreed to by the sender and recipient.

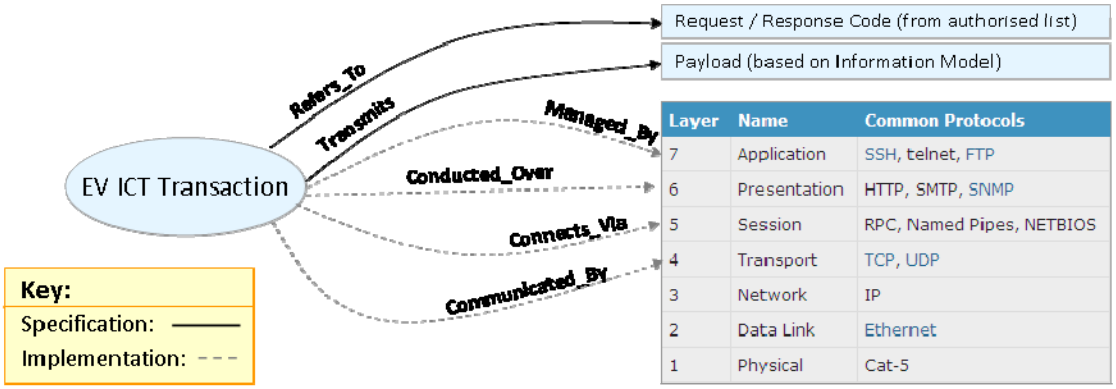


Fig 1-A: EV ICT Transaction enablement (equal fig 4-D)

According to the significant operational experience of some partners in Work Package 3 in the area of device identification the standardisaton of identifiers is an other initial focus is to ensure interoperability e.g. Electric Vehicle Contract ID (EVCOID) and Electric Vehicle Supply Equipment ID (EVSEID).

Further, a maintenance process has been developed – consistent with the processes used in formal standards bodies – and will be engaged in subsequent phases of work within Task 3.8 in order to update specifications over high-level transactions.

Finally, this deliverable analysed the situation for ICT standardisation and described the strategy to go forward adapting the DOW to the current situation. After the completion of the deliverables D3.5 and D3.6 the next steps will be to:

- Workout and agree on a roadmap for specification releases 2a and 2b ensuring good synchronisation with the other WP3 task and work packages 4,5, and 7.
- Continuously communicate standardisation issues to the work packages 4,5 and 7.
- Cooperate with WP7, specifically with T7.3 to get specific transaction inputs
- Seek cooperation with other EV projects in the EU to raise the standardization need for basic identifiers like EVCOID and EVSEID to ease future integration and to motivate other projects to implement based on a "future proof" specification and update current systems.
- Develop the releases as stand alone documents based on this deliverable and decide on the appropriate distribution and way to cope with feedback received.

2 Introduction – Aim of the deliverable

Task 3.8 of Green eMotion is responsible for developing the ICT standards and protocols specification which will underpin the Marketplace and – by implication – enable a number of IT functions supporting electric mobility. The primary aim is to develop the detailed specification which can then be submitted to external standards bodies – and, possibly, go on to form the basis for establishing a common technical solutions framework to sustain the industry's effort across the EU regions.

The current electric mobility marketplace in Europe encompasses a number of official pilot projects and implementations. Our findings so far are that these pilot schemes have chosen several different ways to test and implement the available technologies and its extensive use of solutions under intellectual property merged with some standardised solutions in the general implementations. Taking into consideration the significant flux and the expected evolution of market propositions (business models) we believe that the best way to service the standardisation is by focusing on specifications which rise above the proprieties or peculiarities of individual implementations. We intend to reuse and adopt accepted specifications from existing implementations as appropriate and not "reinvent the wheel".

We will focus the Task 3.8 efforts in developing a specification of transactions – at the operations and content levels. The network connectivity and protocol areas (at the OSI level) are already heavily over-specified and a selection process is appropriate – this is also where Work Package 7 has concentrated some of its efforts. We will continue to interlock with WP7 to ensure consistency of approach and avoidance of overlaps.

The use case (business) scenarios developed within Work Package 3 for the ICT System for EV Services (including the services classifications) will be analysed based on a method we propose to obtain the detailed specifications for the business transaction operations and content. The W3C XSD 1.1 candidate standard will be used to specify the information structures. Standard UML approaches – aligned to the Open group – will be used in the analysis.

3 The EV Ecosystem

Electric Vehicle charging lies, functionally, at the core of the ICT Marketplace – it is the single most important objective to be fulfilled. In seeking to identify the services – and, by implication, the interactions – necessary to service EV charging, a number of components require consideration. These components form the EV charging ecosystem and are fundamental (key) to the functions that the ICT System for EV Services seeks to enable or provide.

3.1 Components

The key components or actors on the Marketplace (see D3.2), which can also be considered as *control point*s in the Electric Vehicle (EV) ecosystem are the:

- Electric Vehicle (EV) itself and the EV driver
- Charging Unit (CU) or Charging Point (CP)
- Electric Vehicle Supply Equipment (EVSE)[3] and the EVSE Operator
- Energy Suppliers
- Infrastructure Providers (DSOs and TSOs)
- Automotive OEMs
- Electric Vehicle Service Providers[4] (EVSP)
- Intermediaries & Aggregators[5]

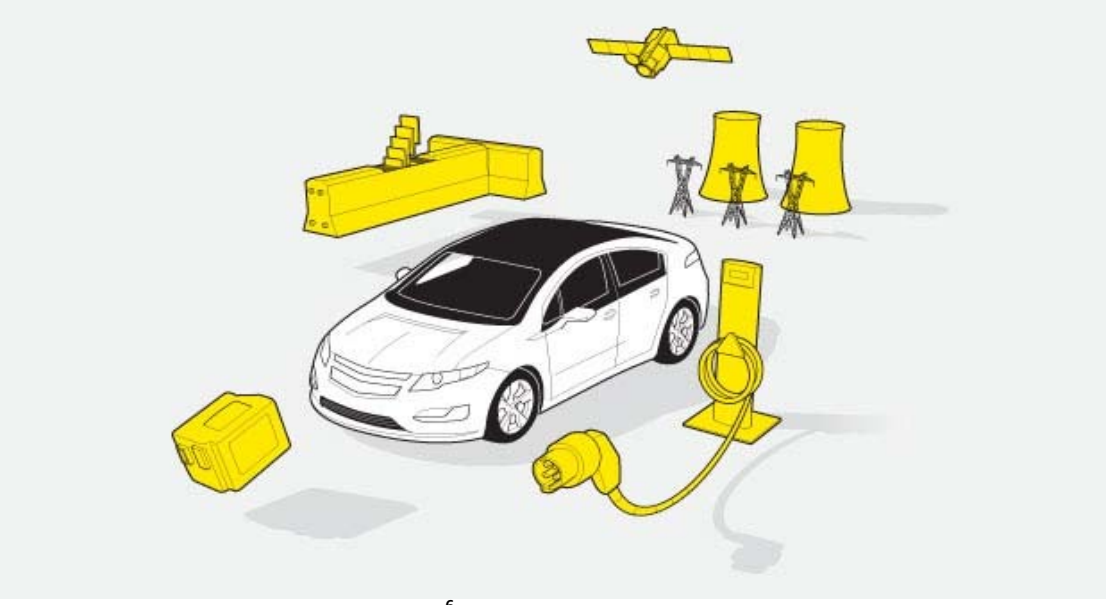


Fig 3-A: Some EV Ecosystem components[6]

[3] There is much debate whether the EVSE should be considered as a simple or a composite (i.e. front-end and back-end) unit. This document avoids prescription and considers the EVSE as a 'system' which can be implemented (and, therefore, divided) into one or more parts.

[4] For example: Fleet Operators; Local Government Agencies; Road use Charge Collectors; Billing Agencies, etc.

[5] For example: Clearing Houses; Marketplaces, etc.

3.2 Component Interactions

Component interactions provide the end-to-end EV charging service. At present, most of the identified[7] interactions are of a Business-To-Business (B2B) nature; this is very much the case in the existing EV pilot projects and it is anticipated that – at least in the near term – this type of interaction will persist. There are some Business-to-Consumer (B2C) interactions as well – but due to the specific objectives of pilot implementations currently being deployed, these are very much in the minority and are not anticipated to be at the heart of the EV Service Market development and roll-out, at least within the first release phase.

It is anticipated that, over time, the interaction models will change in line with evolving or new (emerging) business[8] models. For example, some of the key components (as listed in section 2.1 above) which are tied into exclusive communication mode with their adjacent components may – in future – be mandated to be made open to interaction with the end-users. While this is currently beyond the scope of this work, every effort will be made to include relevant recommendations as appropriate.

B2B interactions will be the primary focus of this work. B2C interactions will be considered for specification if they are high priority items; recommendations will be made for B2C interactions.

In the ICT System for EV Services Market space, several use case scenarios are being considered (in Tasks 3.1 & 3.2 of Work Package 3) and a first classification has been made according to the implementation priorities. The interactions - *transactions which are electronic exchanges involving the transfer of information between two parties for specific purposes*[9] - which are described by these scenarios are also subject to a priority classification.

To achieve EV charging there is a minimum specification for transactions – this is the ***mandatory*** part. There is, also, an ***optional*** part which refers to transactions which add value, but are not necessary to enable the end-to-end EV charging process (e.g. "can the grid sustain the demand"). Finally, there is a ***desirable*** (or, future,) part (e.g. "eco-routing") which is likely to drive future adaptation or extension to the EV charging model.

[6] Sketch sourced from inc.com - Copyright © 2012 Mansueto Ventures LLC
[7] Through the work done in Work Package 3 Tasks 3.1 and 3.3
[8] An example of this relates to payments for charging: at the moment most of these are on a "pre-pay" (subscription) basis and this will most likely to move to a "pay-as-you-charge" (point-of-sale) model
[9] According to ANSI guidance on transactions

This[10] classification of transactions can provide the following "rule of thumb":

	Meaning	Action
Mandatory[11]	"Must Consider"	Provide a clear and unambiguous specification
Optional[12]	"Should Consider"	Provide a proposed standard specification or guiding principle
Desirable	"Could Consider"	Reference standards and make recommendations

The service priorities already established (in Task 3.2 of Work Package 3) can be combined with the above classification to yield the initial standards specification focus and coverage.

Category	Business scenario	Priority	Standards Focus
Charging	Charging (a). at home/ (b). semi-publicly / (c). publicly	R1	Mandatory
	Differentiation of customer contracts, SLA- Check	R2	Optional
	Mono-directional control of charging	R1	Mandatory
	Bi-directional control of charging (V2G, V2H)	R2	Optional
Service	Marketplace: buying, selling, routing	R1	Optional
	Service detail records for accounting and billing	R1	Mandatory
	B2B contract management	R1	Optional
	Service provisioning/registration/life cycle management	R1	Optional
	Standardization of interfaces, messages (for remote customer service)	R1	Mandatory
	B2B partner management	R1	Optional
Roaming	Roaming between EVSPs in one country	R1	Mandatory
	Roaming between countries (contractual clearing)	R1/R2	Optional
	Financial clearing	R2	Optional
OEM	Basic charging	R1	Mandatory
	Enhanced charging	R2	Optional
	Other Functions (value added services: analytics and reporting, eco-routing))	3	Desirable
	CO_2 and other legislation-based Reporting	R2	Optional
Energy	Grid related services (centralized congestion management)	R1	Optional
	Aggregator grid services, energy trading value added services (VPP, imbalance)	R2	Desirable
	Monitoring of EVSE	R2	Desirable

Fig 3-B: Service priorities[13] driving standards specification

Figure 3-B provides the current (as of January 2012) classification of the ***priorities*** for standards specification by Task 3.8 of Work Package 3. The priority is set by efforts spanning across the whole of the work package – the ICT ***standards focus*** is

[10] This classification was current at beginning of January 2012; as it is a rolling programme it is subject to change (and may have already as of the time of this writing). The up-to-date classification can be obtained from the Task 3.3 leader of Work Package 3.
[11] Mandatory to fulfil to comply to the future standard
[12] As optional part of a future standard
[13] There are a number of planned releases to support the identified use case scenarios: R1 – Release 1, R2 – Release 2 and R3 (or 3) for Release 3. These are driven by work in tasks 3.2 and 3.3 (currently).

considered by task 3.8 and is described in this document. This prioritisation scheme will be used to define the "analysis criteria" for the parts eventually[14] to form the ICT standards specification. This specification has to be reviewed and adopted as the project evolves.

3.3 How the ecosystem needs might develop over time

Electric mobility is a central challenge for the automotive industry, the energy industry, technology and infrastructure companies as well as the telematics sector. As we approach the start of volume market for electric mobility and conclude the numerous demonstration projects around the globe, important lessons and experiences have been gained regarding the successful implementation of a complete e-mobility ecosystem. Significant progress has been reached regarding the individual elements of this system: from the electric vehicles themselves, to battery charging systems, plugs and connectors as well as the charging infrastructure.

There have also been successful demonstrations and first implementations of IT-Platforms and businesses that interconnect the various business components within the electric mobility ecosystem. Unfortunately, most IT-Platforms developed to date have been primarily regionally focused and lacking connectivity with similar systems: as a matter of fact, proprietary solutions especially regarding EVSE – EVSE Op. back-end communication have been deployed, which highlights the need of integration and harmonisation effort regarding communication layers which are not target of current standardisation effort (e.g. ISO 15118 which focus on EV-EVSE communication).

Without integration efforts, the usability for the end user may be regionally limited and offerings of advanced services may be hindered due to integration barriers to realize economies of scale.

In order to test and generate know-how for future activities, there are currently several, regionally limited research and infrastructure projects with small electric vehicle fleets spread throughout Europe. These projects are locally funded and have primarily a regional or country based focus.

In addition, car manufacturers have announced several electric vehicle products in mass market volumes in the 2012/2013 time frame. The structures and bilateral business relationships currently being experimented with at present do not reflect

[14] An important side note to be considered here regards the grid related services (e.g. centralised congestion management). Such family of scenarios deals with the management of charging point according to grid-related priority issues (e.g. quality of service, network safety) and eventually customer-based requests (e.g. queue on public charging spots, remote load management for cost saving, renewable integration). The priority of standards and requirements on transactions involving this family of scenario is strictly dependant on the EV market share penetration and the situation may change from optional to mandatory in the next years in order to follow up the needs and chances that may be raised from the development of electric mobility market during this very first years.

the true future market conditions nor do they reflect the necessary business structures for a successful electric mobility eco-system: broad electric vehicle offerings, multiple forms of mobility services as well as a heterogeneous landscape of operators for semi public and public load infrastructure with different business models and regulatory framework to be compliant with, all these points will eventually lead to the need of a common framework in which B2B deals will be established.

The isolated solutions currently implemented with different forms of technical implementation and IT-integration, hinder a wide-spread roll-out of electric mobility in Europe. Due to the implementation of differing technical standards or a limited contractual business relationships among EVSE operators, basic customer expectations (e.g. being able to charge at all openly accessible charging stations, i.e. Roaming), are currently not met.

The perception and acceptance of electric mobility by customers will depend crucially on a robust, seamless, user-friendly and comprehensive charging infrastructure. Availability, simplicity and interoperability of charging services will be customer prerequisites. Beyond these very basic customer requirements, it is also of mid-term importance to support the future mass integration of electric vehicles into the energy system. The cities and municipalities will play an important role for the creation of positive border conditions as well. The support of the build up of an (public) charging infrastructure can be influenced by local regulations and regimes and the realisation of certain end user services such as e.g. the reservation of charging poles (EVSE) in the (semi-) public area rely on local support as well. This issue will be specifically addressed in Work Package 2.

At present, no coordinated activities exist for the realisation of an integrated system that can be successfully and easily used by all relevant players. Therefore a substantial need for action exists for the following basic services and functionalities:

- the simple use and the interoperability (access, authentication, authorization, accounting/billing[15]) with the focus on (partially) public charging infrastructure
- the support of service and diagnosis processes as well as an intelligent networking of vehicle and infrastructure
- Support the increase in value-added services, like charge station reservations, advanced energy/grid management services, advanced navigation and routing services as well as intermodal mobility services

[15] For instance, relating to the forwarding of the CDR for accounting or billing processes from the EVSP – in the assumption that a specific business model is in operation. This may not be the only scenario or business model.

3.4 Phases of ICT System for EV Services Market standards specifications

Given the present state of flux and prospective evolution in both the technological and the ICT areas, it would be premature to attempt a definitive specification of the standards and protocols concerned. The primary concerns so far have been to:

- Set the scope and direction for the specification
- Identify the bounds of ICT specification – especially avoiding overlaps
- Develop a phased plan which allows the specification to evolve at the same pace as the experiences and pilot implementations

Consequently, it is expected that the efforts undertaken in other tasks within Work Package 3 (and, also, Work Package 7) will provide feeds into this specification.

There are three identifiable phases:

1. The "now" – which is a snapshot of where the different pilot programmes are and, more specifically, a snapshot of the perceived requirements based on use case scenarios developed in the last 10 months. The ICT standards and protocols thinking at the end of this phase will drive some of the Guiding Principles to be adopted by the ICT Reference Architecture.
2. The "next" – refers to the releases of the ICT System which have been planned and which will be executed in the next 24 to 36 months. This phase will provide several opportunities (at least 2) to "synchronise" the ICT standards and protocols specification with the implementations of the ICT System for EV Services Market (including the GeM B2B Marketplace). This is where some of the Guiding Principles of the previous phase will become specified in detail and supporting the ICT Reference Architecture (D3.2).
3. The "future" – refers to the ICT environment which will be deployed in practice and where the ICT standards and protocols drive the architectural principles and decisions to be adopted. This is the phase where the GeM Work Package 3 specification is fed into a formal and extensive consultation process to become a standard specification

The phasing – including specific characteristics – is shown in Figure 3-C. Some of the anticipated "feed forward" links are also shown as an example of the anticipated dependencies.

Accordingly, it is anticipated that Deliverable 3.9 will span Releases 1 and 2 (with a number of sub-releases which have been identified already). More specifically, Release 2a will publish the ICT interactions specification directly related to the Priority 1 aspects of the use case scenarios. Release 2b will formalise the Priority 1

and publish the Priority 2 aspects. Release 3 as shown in figure 3-C will correspond[16] to GeM Deliverable 3.10.

This staggering of releases is necessary to maintain close synchronicity between the ICT architecture constructs (which address the use case requirements) and the dissemination necessary to achieve the requisite visibility – which will advance the Task 3.8 specifications to a more formal level with the rest of the Green eMotion Work Packages as well as with external bodies.

[16] For practical purposes, a draft of the Release 3 deliverable could be used to facilitate detailed discussions with standards bodies and, therefore, could be a pre-release of D3.10.

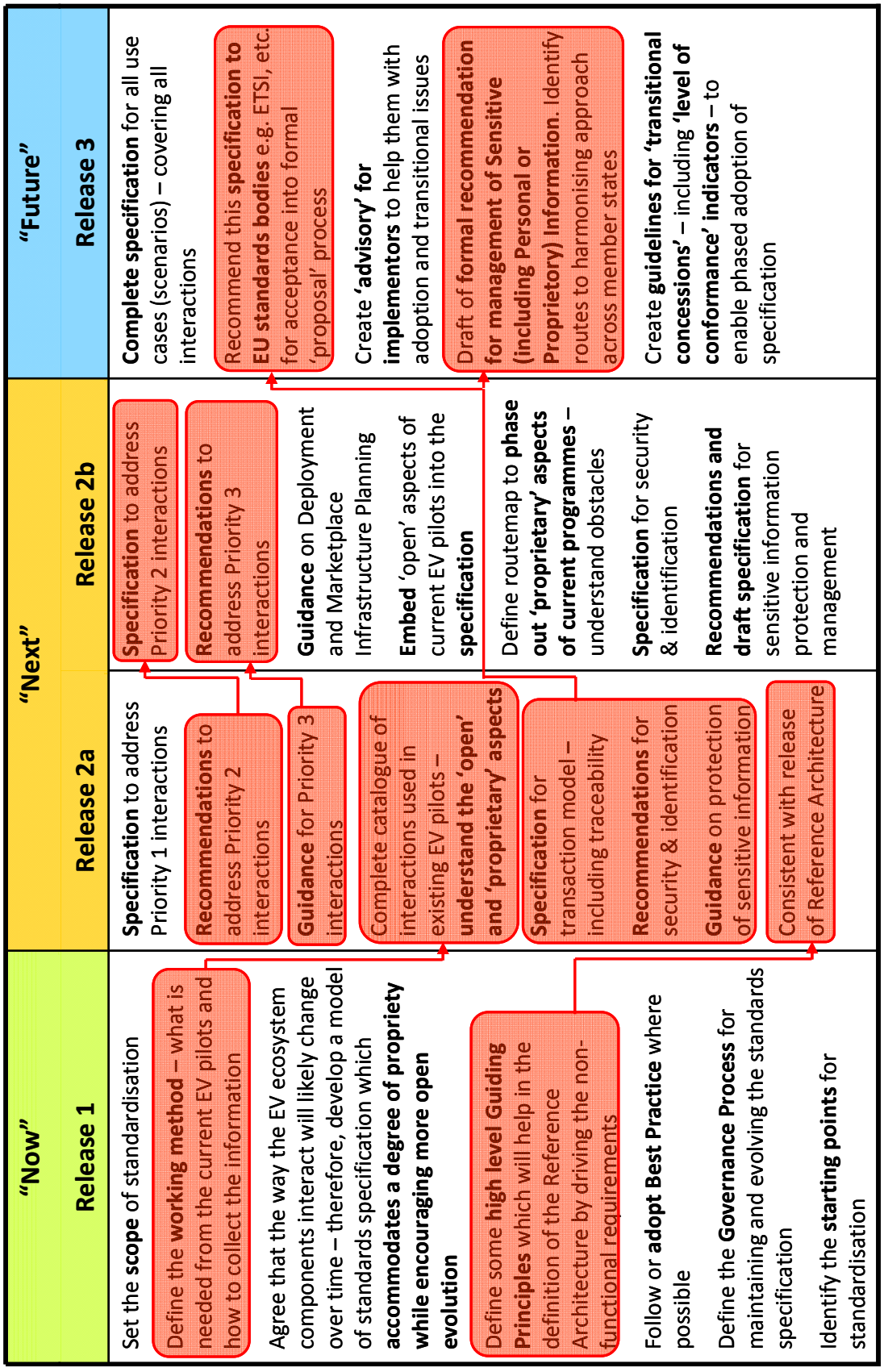


Fig 3-C: ICT Standards and protocols deliverable phases

4 Scope of the ICT System for EV Services Market

The “transaction chains” between EV ecosystem components are likely to vary by implementation: for example, it is anticipated that the EV will communicate via an Automotive OEM Aggregation Gateway or optionally in the future with the GeM Marketplace directly[17]. Two interaction diagrams can be used to illustrate how a given functionality (service) can be implemented in these two different ways.

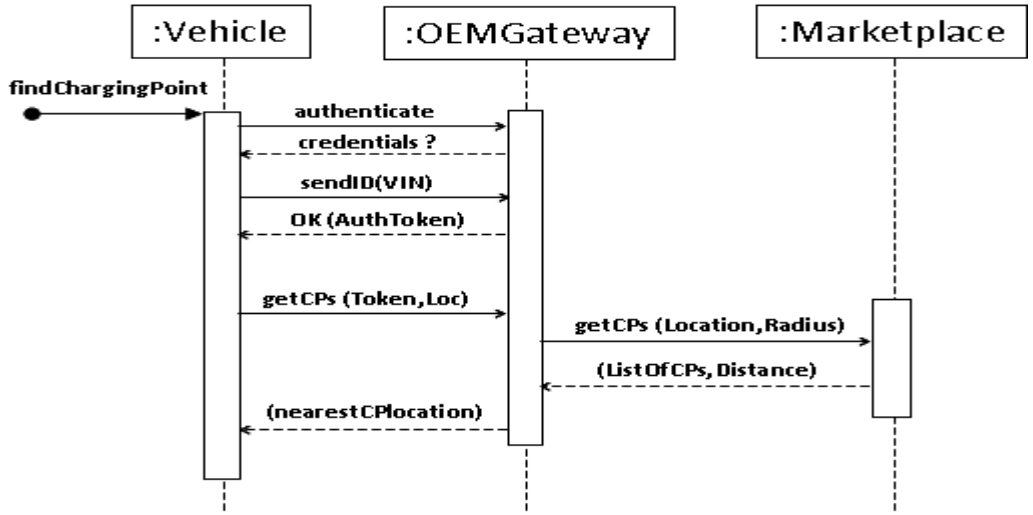


Fig 4-A: Example 1 - Vehicle to GeM Marketplace via OEM Gateway

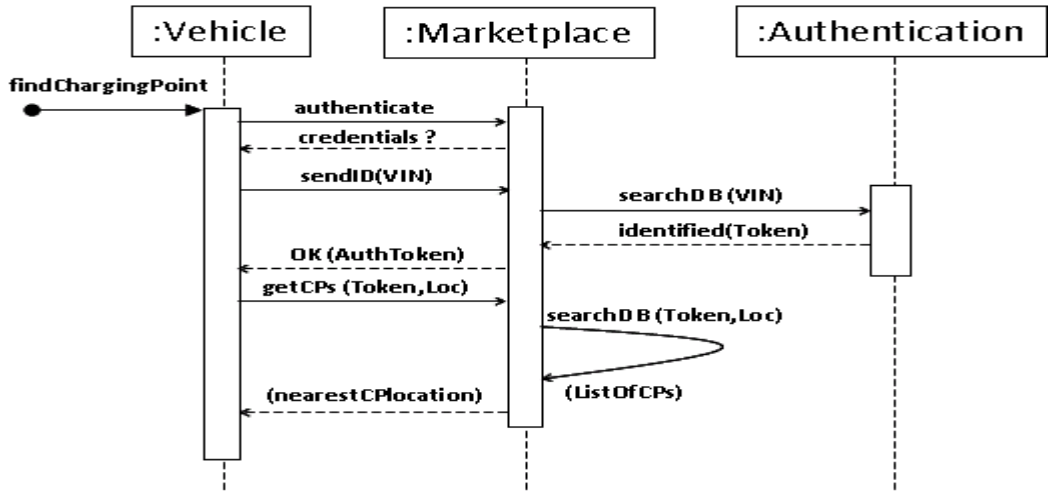


Fig 4-B: Example 2 - Vehicle to Marketplace direct (optional for the future)

[17] A lot of debate has been had on whether this scenario is within the scope of task 3.8 – the argument being that this scenario has not been formally considered by all of the partners. It is not part of D3.2. For clarity, the example is included here to ***illustrate that different implementation scenarios may exist or may emerge in the future*** – it is an illustration rather than a formal position or recommendation.

The immediate benefit is that an implementation can contain both "standard" as well as "proprietary" interactions; (this is already the case in the EV regional demonstrators) – thus, the speed/ease of deployment increases while the cost remains low. The business (or, functional) integrity of the transaction is safeguarded irrespective of the implementation.

4.1 Expected services around the GeM Marketplace

With the introduction of EV starting now, as a first step, some basic end user services need to be provided to European customers to allow charging and operation of the vehicles. Over time, the functionality of the EVs including connectivity and communication capabilities will be extended, therefore allowing further, value added services, to be considered and developed.

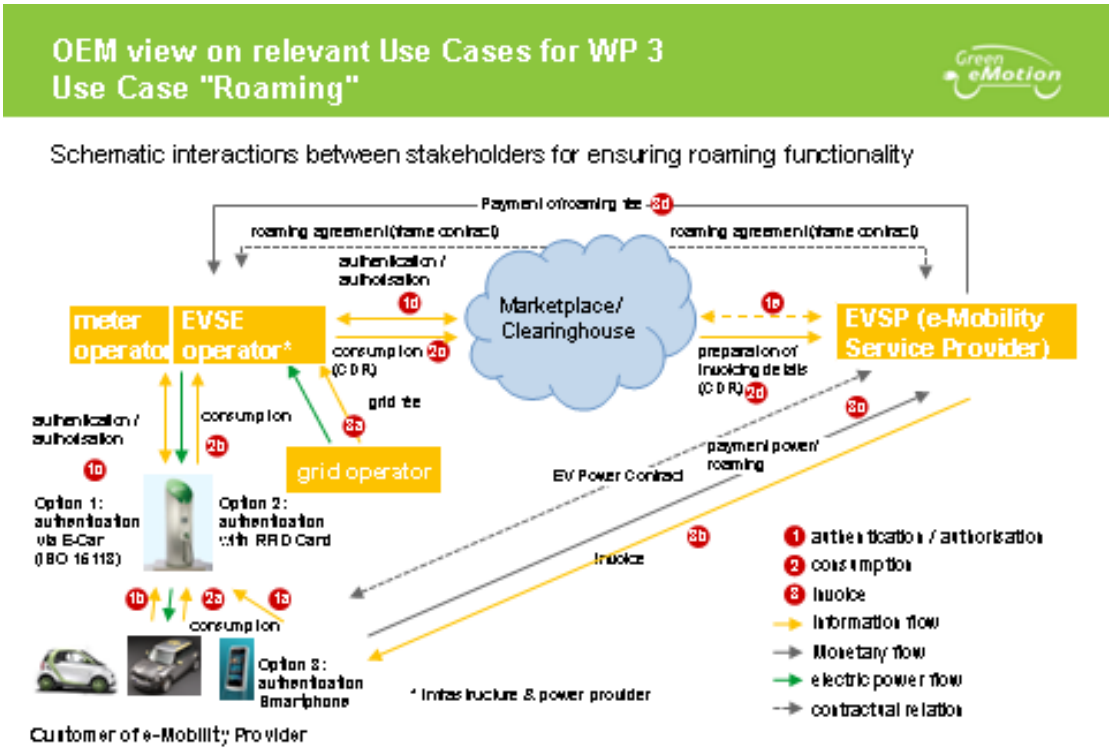


Fig 4-C: Processes and communication steps related to the use case roaming[18]

Based on these expectations, for example, the Green eMotion Automotive OEM Partners and the energy industries expect the EV Market to include support for the following services from 2013 onwards:

Basic mobility services (link to Task 3.5):

- obtaining EVSE technical specifications and charging parameters (2013)

[18] Supplied by work carried out within other tasks in Work Package 3 e.g. D3.3

- optimisation of parameters (rate, price) and suggestion to end user (2013)
- EVSE Access – Model Roaming (2013)
- EVSE Access – Model Third Party Access (2014)
- CO2 reporting (2014)

Value added Services (link to Task 3.6):

- obtaining EVSE availability and location (2013)
- EVSE reservation[19] (2013)
- social networks links/ download updates to EV, smart personal devices (phone, PC, other - paired with the EV)(2014)
- eco-routing (Sensitive to SOC, geo-profile, climate)(2014)

Battery is also made available for further Value added Services

- V2H (modulate the electricity consumption of households) (2014)
- V2G (offered by the aggregator) (2020)
- offer capacity to the system (balancing, intra-day market) (2020)
- virtual power plant (2020)

The end user will engage these services under a customer relationship with an EVSP (Electric Vehicle Service Provider) and needs to communicate with the EVSP Backend. If, in addition for certain uses cases a direct communication between the end user and the market place needs to be established, the different communication channels between the end customer or his vehicle with the EVSP Backend need be taken into account for the market place ICT requirement as well.

Figure 4-C provides an illustration of the OEM view of the processes and communication steps between the actors for the use case roaming. Here the end user will have the options PLC/ ISO15118, smart phone and RFID card for the authentication at the EVSE.

4.2 B2B and B2C eTransaction Enablement

By concentrating at the transaction level, the EV ICT standards can be designed to be independent of communication and software technologies. Thus the requisite transaction information can be transmitted using any methodology (protocol) - synchronous or asynchronous - agreed to by the sender and recipient.

[19] Probably through the use of an EVSEID

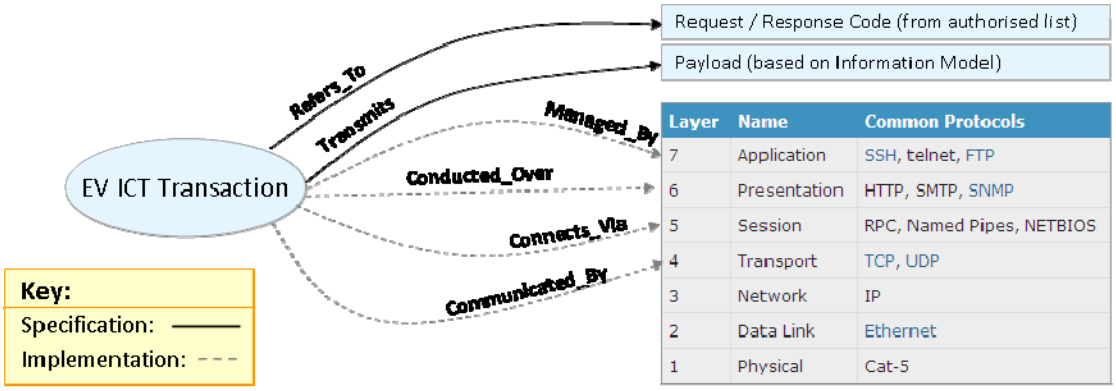


Fig 4-D: EV ICT Transaction enablement

Concentrating the standardisation effort in Task 3.8 beyond the OSI layer means that there is clear differentiation – both in work effort and in content – between Work Package 3 and 7. Indeed, so far Work Package 7 has shown a tendency to address the OSI layers and a lot has been learned[20] through these efforts.
Enabling the transaction by specifying content and operations is the approach which has been taken for EDI interactions (e.g. UN/EDIFACT, TRADACOMS, ODETTE, etc.) and demonstrates excellent re-use of existing standards while concentrating new standards and protocols specifications to the specific domain of application. In Task 3.8, this provides with the opportunity to adopt "best practice" which has been shown to work in a variety of industries elsewhere.

Furthermore, this approach would allow the adoption of suitable specifications on operations and payloads from existing standards in these areas – realistically, it avoids re-inventing the wheel. For these reasons, from an ICT (GeM Task 3.8) perspective:

"EV transaction support" (i.e. interactions between EV Ecosystem components) will be the primary subject of standardisation specification & recommendations.

4.3 Security

When a transaction is conducted over a network, the information contained in it (the message) will most likely pass through a number of parties – some of which cannot be trusted. The possibilities for interference are endless (and there are lots of examples of information leakage or interference already in other domains).

The sheer volume of messages flowing across a network cannot be relied upon to "hide" any number from special attention – deep packet inspection has been shown to be possible in near-real-time and, therefore, it would be naïve to assume that

[20] An additional benefit of the Task 3.8 approach is that it avoids having to deal with the complexities – manifested as a multitude of inter-related and overlapping standards at the OSI stack. While it is necessary to decide the standards and protocols at that level, the exercise could become one of "choosing" rather than "specifying". Pilot EV implementations have also added a lot of propriety.

interference will not be possible. Furthermore, the leakages which international, commercial organisations have demonstrated over the past few years suggest that the argument of "securing communication via an agent's intranet" is also naïve and misguided – simply put, the axiom here is that information will be tampered or interfered with as a matter of course.

What is needed for the transactions is security:

- Integrity – the content should arrive exactly as sent. If there has been any change the receiver should be alerted.
- Authenticity – the sender and the receiver should be who they claim to be. It should not be possible for someone to impersonate someone else. The authenticity of data origin (e.g. car information) has to be encompassed as well.
- Non-repudiation – any retrospective doubt that the sender sent or the receiver received a given message as part of a business transaction must be avoided
- Confidentiality and privacy – if required, only authorized receivers can read the message. To anyone else, the content should be meaningless.

Transaction security is necessary to satisfy legislation as well as to satisfy confidence in the overall system. Security is most effectively implemented if it has been designed into the system[21].

4.4 Identification & Authentication

The United States Government "NATIONAL STRATEGY FOR TRUSTED IDENTITIES IN CYBERSPACE" strategy paper provides a very eloquent justification on the need for identification and authentication in cyberspace – it is reproduced, in part, below:

[21] For example, see here: http://www.shift4.com/CC_security.cfm

The Internet has transformed how we do business, opening up markets and connecting our economy as never before. It has revolutionized the ways in which we communicate with one another, whether with a friend down the street or a colleague across the globe. And as we have seen in recent weeks, it has empowered people all over the world with tools to share information and speak their minds. In short, the growth of the Internet has been one of the greatest forces for innovation and progress in history.

That is why we are strengthening our communications infrastructure. That is why we are making it easier for the private sector to expand wireless broadband across America. And that is why I am outlining a strategy to make online transactions more secure for businesses and consumers alike: the National Strategy for Trusted Identities in Cyberspace.

The rapid and vastly positive changes that have followed the rise of online transactions – like making purchases or downloading bank statements – have also led to new challenges. Few have been as costly or nerve wracking for businesses and families as online fraud and identity theft. These crimes cost companies and individuals billions of dollars each year; and they often leave in their wake a mess of ruined credit and damaged finances that can take years to repair. But there are other costs for our economy that are more difficult to measure. The potential for fraud and the weakness of privacy protections often leave individuals, businesses, and government reluctant to conduct major transactions online. For example, providing patients with access to their medical records from their home computers requires that hospitals be able to confidently identify that patient online.

Giving consumers choices for solving these kinds of problems is at the heart of this new strategy. And it is one that relies not on government, but on the private sector to design the technologies and tools that will help make our identities more secure in cyberspace and to make those tools available to consumers who want them. It asks companies to pursue these solutions in ways that will not impinge on the vitality and dynamism of the web, or force anyone to give up the anonymity they enjoy on the Internet.

The simple fact is, we cannot know what companies have not been launched, what products or services have not been developed, or what innovations are held back by the inadequacy of tools, like insecure passwords, long ago overwhelmed by the fantastic and unpredictable growth of the Internet. What we do know is this: by making online transactions more trustworthy and enhancing consumers' privacy, we will prevent costly crime; we will give businesses and consumers new confidence; and we will foster growth and innovation, online and across our economy – in some ways we can predict, and in other ways we can scarcely imagine. Ultimately, that is the goal of this strategy.

The complete document can be accessed here[22]. The force of the statements in this paper is unmistakable: trusted identification is at the heart of electronic transactions and must be addressed – by reference rather than by specification – in Task 3.8 (and, by way of recommendation, by the other the Green eMotion Work Packages and tasks).

4.5 Relevant Standards for Green eMotion ICT Release 1

According to the significant operational experience of some partners in Work Package 3 in the area of device identification the standardisation of identifiers should be another initial focus.

The charging and discharging of Electric Vehicle (EV) at an Electric Vehicle Supply Equipment (EVSE) within an existing contract requires a set of identifiers that are guaranteed to be unique beyond organizational and country borders.

[22] See: http://www.whitehouse.gov/sites/default/files/rss_viewer/NSTICstrategy_041511.pdf

The unique identification of the following entities is required for efficient inter-organizational interoperability (Roaming between EVSP/EVSE and countries, third party access):

- Electric Vehicle Service Provider (EVSP)
- Electric Vehicle Operator (EVSE)
- Electric Vehicle Contract (EVCOID)
- Electric Vehicle Supply Equipment ID (EVSEID)
- Vehicle Identification Number (VIN)

The identifiers should be persistent during the life of the identified entity.

The identifiers should be used to support the processes for the clearing house services and defined basic and value end-user services.

Clearinghouse service will use the identifiers[23] for the following process-steps:

1. Validation of customer (Identification (Authentication), Authorization)
2. Routing of charge data (CDR) between roaming partners (EVSP / EVSE)

The partners recognized that today different structured EVCOID and EVSEID are used in the demo regions and thus a work-around will be needed to implement roaming. The details are being worked out for D3.5 and the uniqueness will be ensured within the GeM project using a single list for registering EVCOID and EVSEID.
The results will also be communicated to WP5 for implementation and to WP7 as request for standardisation.

Below specifications are based on a RWE proposal (follow link for detailed information) which has been developed into a DIN 91286 standard. This will be used within GeM.

EVCOID Specification

The EVCOID must match the following structure: EVCOID = <Country code> <S> <Provider ID (EVSP)><S><Instance><S><Check Digit> An example for a valid EVCOID is “DK8AA123A563”

EVSEID Specification

The EVSEID must match the following structure: EVSEID = <Country code> “*” <Spot Operator ID> “*”<Power Outlet ID> An example for a valid EVSEID is “+45*123*456*789”

Usage of electric vehicle identifiers in IT Systems:

[23] Since these IDs could not change, tracking and profiling of charging habits is possible for intermediate systems. Therefore, confidential information (e.g. personal user data) linked to the identifiers should never be communicated together with the identifier.

The IT systems handling the specified identifiers should be able to cope with identifiers with a length of up to 255 characters, since the future enhancements of this standard may require this.

The encoding of the identifiers in IT systems should be UTF-8.

While there may be limitations inherent in this approach – for example: the business model being assumed, the encoding of the identifiers, the fact that constraints will need to be attached regarding the treatment of Sensitive Private Information – the operational experience should be capitalised upon.

This allows approaches – and in-the-field best practice - such as the one above to be extended appropriately to meet all perceived future needs – rather than enforce a mechanism (by enshrining it into a standard specification) which aims to solve a problem from a specific perspective.

5 Objectives for Standardisation

Success in the ICT standards and protocols task will be measured by the degree of acceptance of the specifications it produces by the wider community. To ensure that progress is visibly made, therefore, it will be necessary firstly to engage with external standards bodies and organisations at as early a stage as possible. Secondly, as the work is very closely interlinked with the work in Work Package 7, coordination with these partners is essential. Finally, the specification needs to be inclusive of best practice, especially learning from areas where practical and widespread experience exists – the ICT standards and protocols specification must not be shy of imitation and adoption.

The figure below shows how and when the task 3.8 deliverables may be injected into the external standards process.

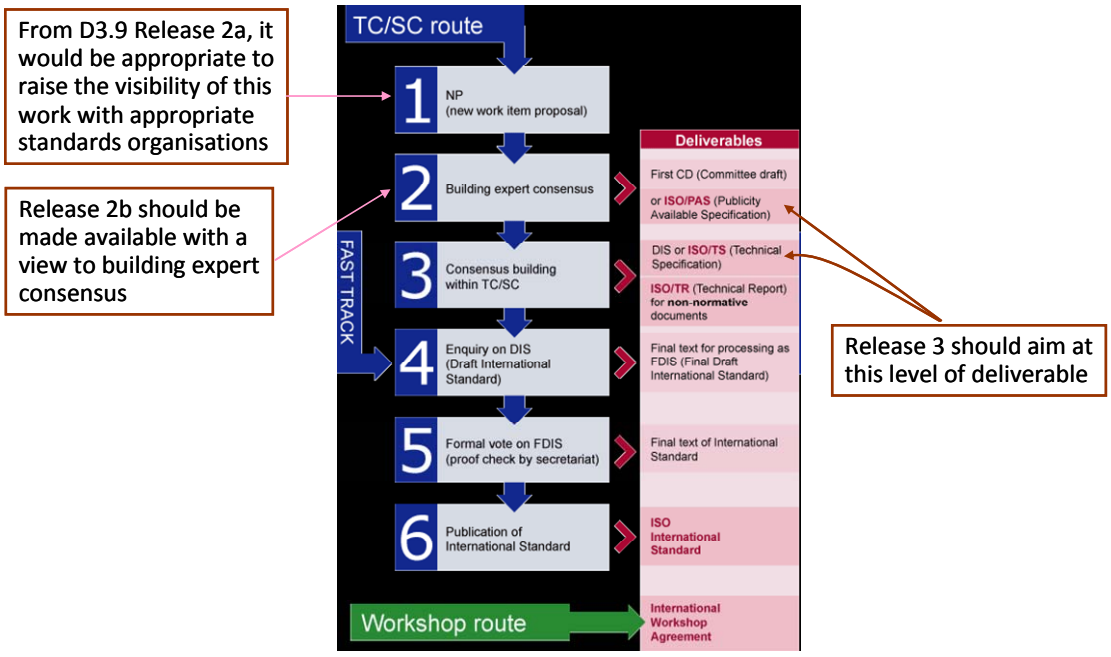


Fig 5-A: How to feed the D3.9 specification (release 2 and 3) into the formal standards process

At this point in time, there is no prescription on which standards body is the most appropriate. Figure 5-A shows the ISO process but only as an example rather than an informed choice). Figure 5-B shows the Standards Ecosystem in Information and Communication Technologies (ICT). It is expected that, ultimately, the recommendations made by Task 3.8 will be submitted to one (or a combination of) these dependant on criteria like existence of suitable TCs, maturity of the specification, anticipated needed speed for updates and the potential influence of the Green eMotion partners on the standard.

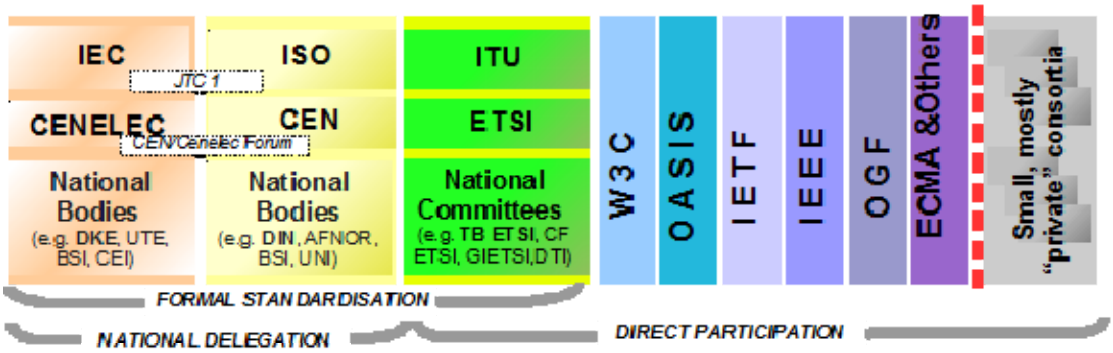


Fig 5-B: Standards Ecosystem in Information and Communication Technologies

The overall aim is to enable the vehicle[24] to interact with the infrastructure for charging purposes. This means that all involved actors are able to communicate both on a device level (e.g. meter, car, mobile phone, PDA) and on the level of business systems related to ICT.

A number of objectives are described below to guide the ICT standard and protocol requirements effort of this task.

5.1 Integrate the pilot efforts

The Green eMotion EV Services Market including the GeM B2B Marketplace should endeavour – as much as possible within the time and resource constraints – to demonstrate how it can service the needs of the regional pilots. In doing so, it will also demonstrate the commonalities in needs – i.e. the potential integration points – across the different implementations. This will provide a good idea of the gaps and the conformance issues to be addressed in a future deployment.

As an example, Better Place is planning a number of regional demonstrations:

- Provide own customers with services
- Provide open access to services for "non-customers" (Access to services independently of any service provider)
- Provide services to roamers (based on bilateral agreements between service providers or facilitated by a marketplace)

Pilot efforts by Better Place and Siemens (amongst others) aim to demonstrate how the GeM EV Services Market and GeM B2B Marketplace can accommodate the regional pilots on 3 core areas:

- Interface between service providers
- Interface between service providers and a clearinghouse(s)

[24] Which could mean: " The end-user of electric vehicle" (whether under the provisions of a supply contract or not)

- Interface between service providers and energy suppliers (consumption and forecasts)

The communication interface can either be bilateral between actors or via a GeM B2B Marketplace. This point reinforces the position that the ICT specification needs to be made implementation agnostic.

5.2 Establish & Secure minimum provision

Defining standards and protocols specifications which are aligned with the prioritised scenarios in Work Package 3 and their supporting services is another objective. The minimum provision is set by these and Task 3.8 should align completely. The prioritised scenarios and services are grouped within 6[25] service domains of the electro-mobility ecosystem: charging services, roaming services, energy services, core services on the GeM Marketplace and driving and cross-domain services. The specification will address all of these domains.

5.3 Re-Use

It is essential that the Green eMotion partners do not "re-invent the wheel" in their quest to specify appropriate standards and define protocols. It is important that the partners seek to build on the experience and knowledge of their organisations and the progress done in cross-organisational, international as well as national, standards and protocol groups. It is a core objective to find and use best practice and reference existing standards as much as possible, allowing the partners to invest more resources in the main areas of concern.

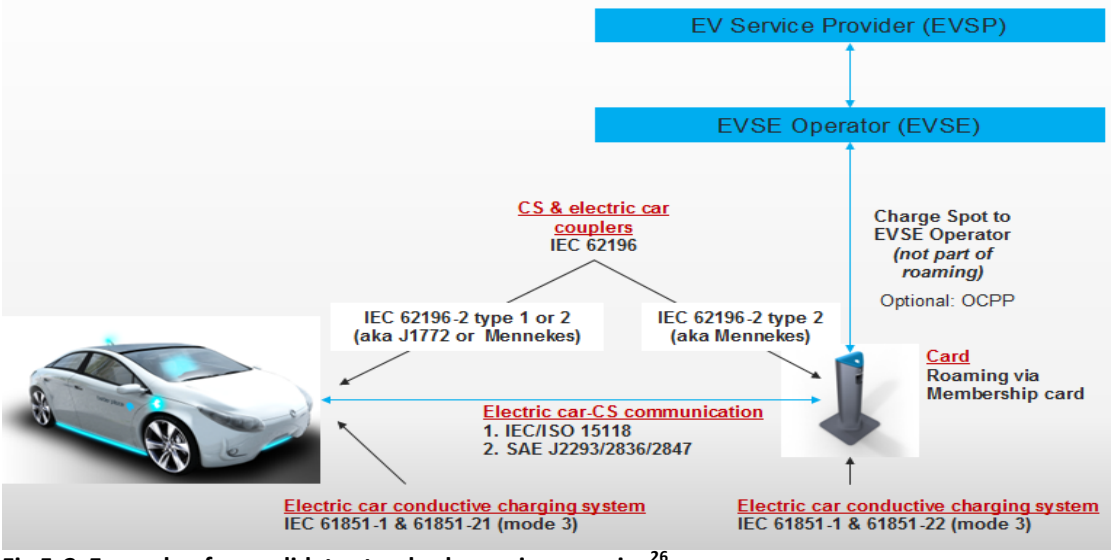


Fig 5-C: Example of a candidate standard covering roaming[26]

[25] Described in detail in D3.3

[26] Supplied by BetterPlace as part of work done in other Work Package 3 tasks with Siemens, BMW and Daimler (amongst others)

Figure 5-C illustrates an overview of existing standards and on-going standards and protocols efforts within roaming. It is worth noting that the roaming standards shown in Figure 5-C are primarily concerned with electric mobility and are not quite the same as the roaming agreements and protocols employed by the telecommunications industry.

5.4 Support future decisions

Another objective of Task 3.8 is to create a strong platform for future decisions. It is the objective to identify likely challenges and issues with relation to ICT standards and protocols in the future. The partners of Work Package 3 will seek to establish a set of "Guiding Principles" and recommendations in this deliverable to provide a clear and strong point of reference for future decisions.

To avoid dilution in the specifying Guiding Principles, Task 3.8 contributors have recognised that it is important to prioritise the efforts by the Green eMotion partners around the most critical areas of concern.

5.5 Potential stakeholder overlaps

A lot of different stakeholders are currently involved in the electric mobility business. This means there is a lot of activity from different angles about this topic. But each player only has a limited view, partly because the know-how is not available at the specific stakeholder and partly because it is not possible to have all aspects researched.

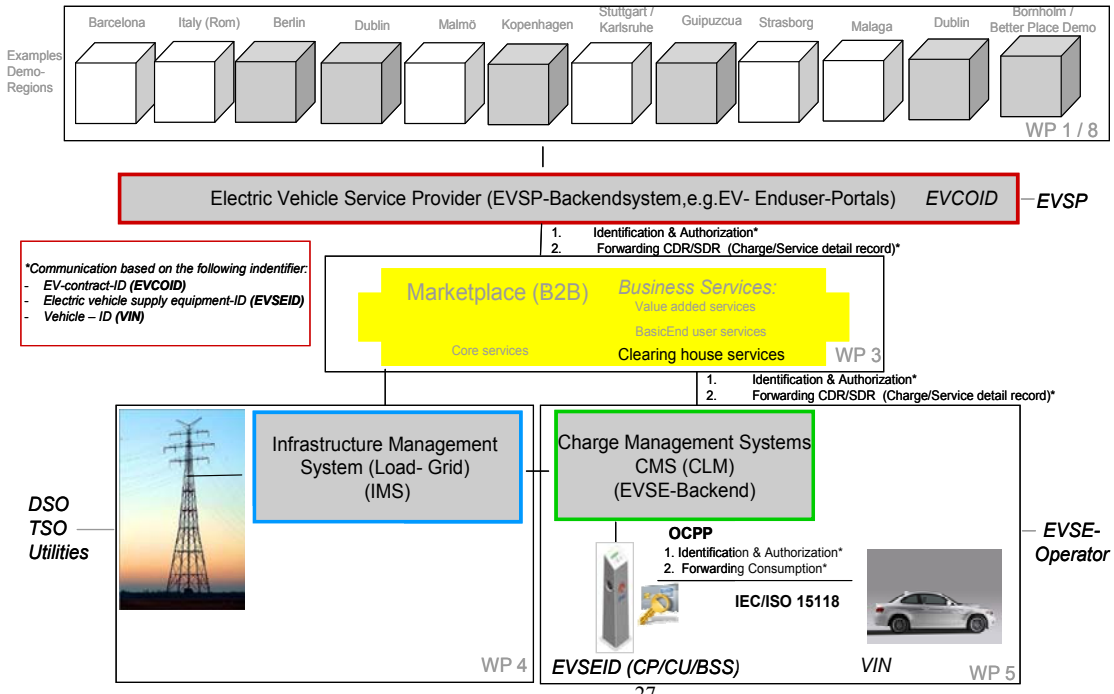


Fig 5-D: Different stakeholders of the GeM EV ecosystem[27]

[27] Graphic supplied by Siemens

Figure 5-D shows the different stakeholders and their involvement in the GeM work packages:

- Energy suppliers (WP4)
- Infrastructure providers (DSO and TSO) (WP3,4)
- Intermediaries & Aggregators (Marketplace) (WP3)
- End-user portals of Automotive OEMs or EVSPs (WP1,8)
- Demo regions (WP8)
- EVSE operators (WP3,5)
- Automotive OEMs (WP3,8)

Classic energy producers want their power plants to run at a constant level with no big ups and downs in power delivery. This is the most cost effective way to produce energy, e.g. in nuclear plants. On the other hand the owner of a wind park is very much interested to sell their peak energy whenever it is produced. Consequently it would be reasonable to have slow charging vehicles (constant network load) which can be made to charge more if necessary.

A grid operator's interest is to have a network which is balanced. He has to make sure that there is no overload on the network and that there is enough energy at any point at the same time. Green energy makes this an even harder goal. The EV seems to be an interesting option to get the network balanced out. The car can charge at a high level if there is enough energy in the grid. The car could stop charging or even feed back energy to the grid if there are energy deficiencies. For this reason a close look needs to be given to standards and development in the Smart Grid world.

The IT operators want to provide services to the other players. This can be done by a centralized marketplace or via bilateral agreements between involved parties. Services can be basic end user services like searching for EVSEs in the region. Other services may be clearing house services, value added service, transaction support, contract management or authentication. This marketplace can be a centralized communication and commerce platform between all the other players; defined as the GeM B2B Marketplace.

End user portals are often run by a specific energy supplier or DSO. The portals are often already in place for other topics, like managing local energy contracts, phone services, selling tickets for public transportation etc. The e-mobility aspect has to be brought into existing systems. Those existing systems have to interface mainly with the GeM Marketplace services.

Demo regions often represent several of the players from above. Demo regions are often driven by political agenda or by the interest of a local authority. A Demo region

often brings in expertise on a certain topic e.g. producing energy and operating a grid, but has to integrate all the other parts.

Charge network operators build and run a network of public, semi-public, and home chargers. They make sure that the system is operating fine and offer services if there are issues with the chargers. They install and maintain the EVSEs. They use the marketplace for billing, authorization etc. They also provide information about the status of the EVSEs and support services like reservation.

The OEMs main interest is that a car can be charged without any problems. In the interest of the driver the car will try to be fully charged by the time the driver comes back to the car. An extra requirement might be the cost and CO2 efficient way to charge the EV. The EVSE needs to know things like price and CO2 per kWh and perhaps any end-user SLA in delivering power fast enough. Furthermore an OEM is interested in the status of the car so he possibly wants to read out information about the car whenever it is possible e.g. via a digital connection while the EV is charging.

As the IT operators seem to be the central communication point in the complete system it seems to be best to address the different interest of the players here. The GeM Marketplace has to offer interfaces to all the players, so all the demands have to be put here.

5.6 Identify standards bodies relevant to this effort

Currently there are no standards on how to communicate between several components such as, for example, the proposed ICT System for the EV Services Market including the GeM Marketplace and portal, GeM Marketplace and grid operator, GeM Marketplace and the charge network operator's charge management system.

In defining specifications for the interfaces for authentication, charge detail records, EVSE search clearing house services, roaming, etc. the ISO and IEC standardization bodies would be among the first candidate external bodies to approach with a proposal for standardisation. There are few standards which have to be watched and should be updated with the knowledge coming out of Green eMotion. These are: IEC 61850 for grid management, IEC 61851 and ISO/IEC 15118 for the communication between the EV and the EVSE.

Criteria for selecting an appropriate standardisation body will be applied such as:

- Existence of current standards to interlink with
- Existence of suitable TC
- Suitability of project specification maturity with standards update cycle time
- Representation and influence of project partners

A few topics are already addressed by consortia groups which are no official standardization bodies. Those are e.g. CHAdeMO for the communication of the EV with the EVSE for DC charging or OCPP for the communication of the EVSEs with an infrastructure management system.

The efforts in task 3.8 will be directed to be both inclusive and flexible – given the number of different perspectives involved.

5.7 Define communications interlocks

The Green eMotion Work Package 3 is only concerned with the GeM Marketplace as part of the GeM EV Services Market. This means that there are several interlocks with the other work packages.

Work package 4 looks at the effects the EVs have can have on the grid and ways to manage the issues. To manage these effects the grid has to have a way to communicate necessary steps to EVs and the EVSEs. Those communication paths have to be enabled by ICT infrastructure.

Work package 5 provides different EVSEs to the demo regions and a management solution for EVSEs. This management software has to communicate both to the ICT infrastructure and to the EVSEs. Defining a common interface between work package 5's management software and the ICT infrastructure must be a definite goal.

There are a several demonstration regions within Green eMotion Work Package 8. Most of the demo regions already have an IT infrastructure with customer portals, billing systems etc. Demonstration regions like Barcelona, Denmark or Dublin will provide demands for integrating the ICT infrastructure into the existing systems. A common interface needs to be designed and used in the other demonstration regions.

As a starting point, a strong connection has been established with Work package 7 and this is expected to continue so that the synergies between the two groups can be maximised.

6 Guiding principles

These are the underlying general rules which an organization (the EU via its legislative body for instance) will use to utilise and deploy all business and IT resources and assets, across the EV landscape. In stating the principles, the motivation and implication statements have been considered:

- The benefit statements highlight the value to the organisation of implementing the principle - and therefore provide a basis for justifying all related activities, for example, the implementation of an Enterprise Architecture, or the implementation of a Security Framework
- The implication statements provide an outline of the key tasks, resources and potential costs to the business of implementing the principle. They also provide valuable inputs to future transition initiative and planning activities.

6.1 Retrospective support of EV pilot programmes

Possible e-mobility-services have been identified, developed and tested in numerous international pilot projects. Not only the basic-services, but as well value-add services have been realised. It shall now be the objective to utilize the experience gained from those projects and make the already developed, proprietary services accessible to the public, using the GeM-marketplace. Therefore, further developments will be necessary from the EV-pilot projects: necessary services need to be identified and analysed - experiences made within the projects shall be considered. Re-programming and adaption to the marketplace is required.

Since the GeM Marketplace follows the approach of a service-oriented architecture (see D3.2), the analysed services mentioned above, can be encapsulated in web services, which again can be aggregated to value-add services. By using those web services, bidirectional interaction with the respective systems can be ensured. When choosing the services that are to be implemented, it is of high importance to consider customer-orientation and ease of EV-implementation/ -usage to improve acceptance of EVs. User from the regional pilot-projects can still access the services they are used to via the marketplace. Services that haven't been available before can easily be integrated from other projects and add value for the user.

6.2 Security

To achieve a high security level based on best practises, the following guidelines should be considered:

- Build and maintain a secure network and regularly monitor it
- Maintain instructional documentation and training programs for users, service providers and integrators
- Maintain a marketplace-wide information security policy and make sure that users read, understand and accept it.

- Access to the marketplace needs to be regulated. A service-provider handling sensitive data needs to be certificated. His compliance to the security-policy must be audited by an external auditor on a regular basis.
- Implement strong access control measures. Information is only distributed within users that need to deal with it. Implementation of a role-based security- and access-model
- Provide secure authentication features. Whenever a service-provider registers at the marketplace, his Identity needs to be checked by an external entity (e.g." post-indent").
- Facilitate secure network implementation. It must be ensured that the system, communicating with the marketplace is the system it pretends to be (e.g. server certificate).
- Identify and protect sensitive Data and store only if necessary
- Financial and operational penalties are in place whenever the information security policy is violated and/or sensitive data is compromised.
- Protect wireless transmissions (e.g. EV to EVSP).
- Facilitate secure remote software updates
- Encrypt sensitive traffic over networks

6.3 Resiliency

In a multi stakeholder transaction environment (such as the marketplace is) integrity of basic operations needs to be maintained in the presence of partial failure.

In every large scale system some parts can become inoperative. Planning for network scarcity is the way in which telecommunication systems worldwide have gathered benefits from technology advances; industry pioneers in the smart grid field actively promote technology for smart management of scarcity in the electricity grid, foreseeing a future made up of de-localized energy flow in to the grid, with high volatility. Resiliency will thus be a key consideration for smart-grid systems deployment and for EV integration into the grid. One way to keep the system running is to have backup capacity in place to replace the broken parts. If that is not possible for some reason, it should be at least ensured that the most important functions are still available. In order to achieve that, the first step is to identify the most important functions. If it is possible, a prioritisation in more than two clusters should be done to be more flexible. For this reason, resiliency needs the displacement of smartness up to the charging point.

A dispatcher, which receives all the messages of third-party systems, can forward the requests based on the given prioritization to working systems. Should a working system be unavailable, the dispatcher could find another working system that is capable of handling the request. Should the broken system be the only system that can handle requests from a specific type, the dispatcher can store the request in a queue and wait until the system is back online again. Additionally, the dispatcher can

inform the requestor system of the problem. The dispatcher should also be built as logical entity so that multiple systems can fulfil the dispatcher function.

6.4 Adequacy

Due to their (currently) restricted range, EVs are most suitable for commuting to the workplace in the morning and returning home in the evening. As a result, EV-users will mostly charge their cars whilst being at work or when arriving home in the evening. Based on this behaviour, peaks are most likely to occur. Those can be between 7:00 and 9:00 in the morning and from 16:00 to 20:00 in the evening. From a marketplace-view, not only the charging-process (the charging itself) is important, but especially setting up the connection between EV and EVSP and the following authorization. Charging itself could possibly be delayed, regarding the grid load or the costs of energy.

As already described in section 5.3, (Resiliency), requests will be prioritised. In order to ensure that the most important requests will be handled at all times, the system must be able to focus on the execution of those. Less relevant requests can be postponed and should be executed at a later point in time or discarded if they are no longer relevant.

6.5 Interoperability and Cost-Effectiveness

As far as interoperability is concerned, the GeM-marketplace shouldn't "re-invent the wheel". Existing standards and protocols should be reused. One of the advantages of interoperability is in the fast electronic transfer of information between two entities, avoiding failures. This makes business processes highly efficient and cost-effective.

For example, the interoperability which has been achieved in electronic financial transactions (as shown, for example, in figure 6-A) should be explored and lessons-learned – or, best practices – should be adopted in the GeM Marketplace implementation and operation.

6.6 Ease of implementation

Finally, to ensure that the recommendations made by green eMotion as whole are realistic, the EV charging "system" has to be easy to implement and introduce to the public. So the questions which need to be addressed as part of the ICT System implementation (and, which will also be enshrined in recommendations made by Task 3.8 or Work Package 3) are:

- What set of technologies, standards, etc. would give the marketplace a "quick start"
- What aspects of the standards specification would lower the barriers to entry
- How can 'de-facto monopolies' be prevented

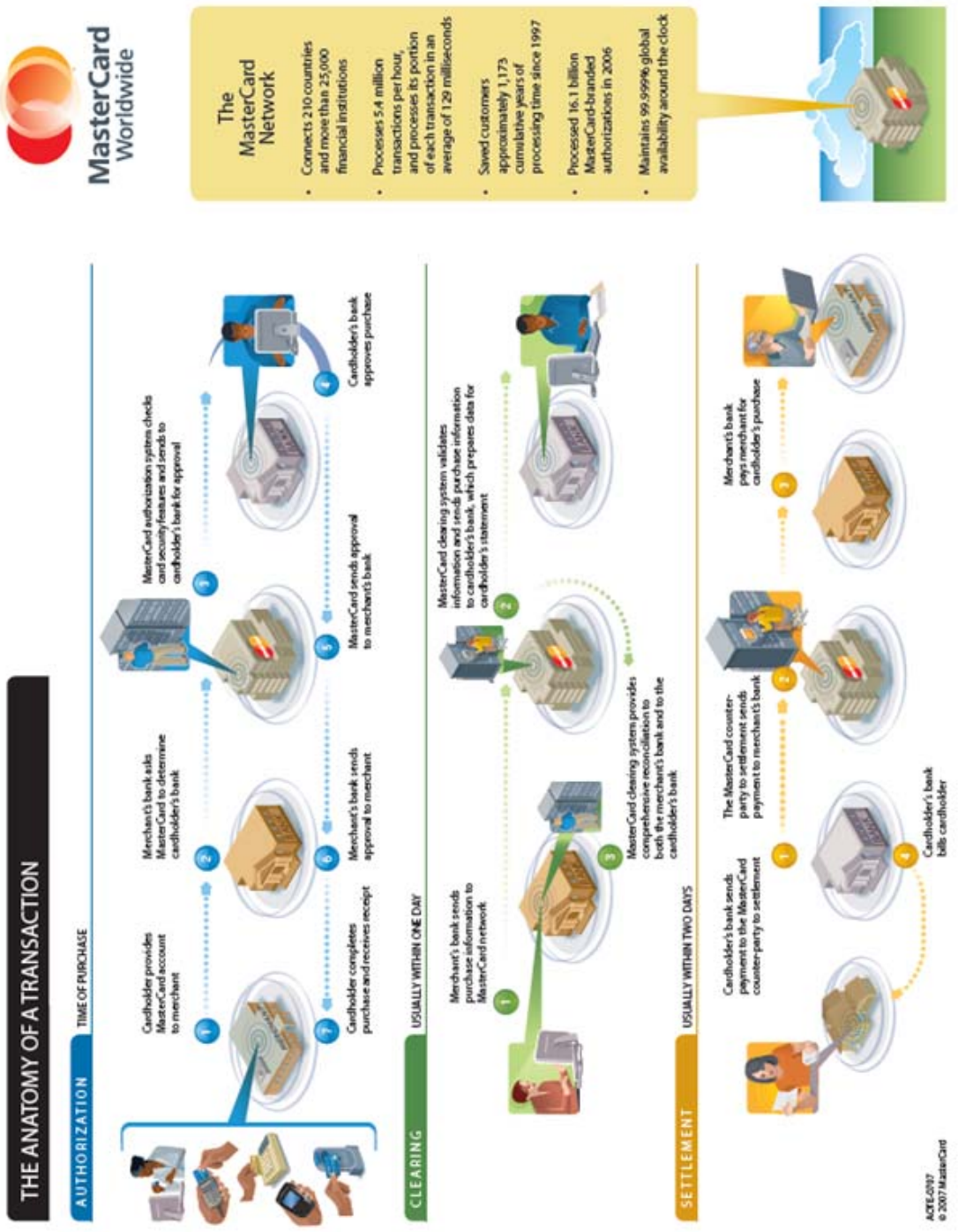


Fig 6-A: Example[28] of interoperability in a financial transaction

[28] Sourced from: MC Anatomy of a transaction – Jan 2006 – MasterCard found at: http://www.mastercard.com/us/company/en/docs/TheAnatomyOfATransaction.2007.pdf

6.7 The implications of Guiding Principles

A number of these principles will drive the definition of the Non-Functional requirements for the ICT architecture. Furthermore, these Guiding Principles – in their entirety – will provide some of the criteria based upon which some of the Architectural Decisions are going to be made as concerns meeting the requirements identified in the use case scenarios.

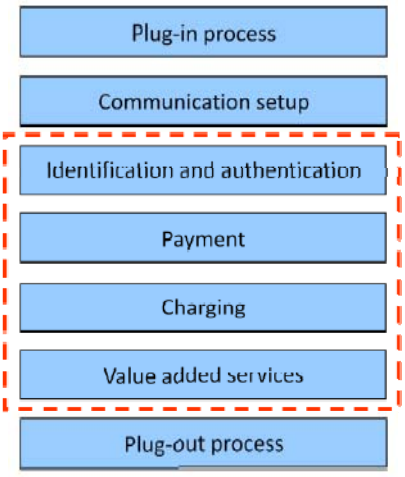
In stating these principles, the experience gained from pilot programmes cannot be underestimated and needs to be harnessed.

Finally, a great deal of interlock within and outside of Work Package 3 will ensure an effective, realistic and pragmatic set of guiding principles.

7 Standards & Protocols – Initial Content

The decision to focus the emphasis in Task 3.8 on transaction support introduces a set of specific characteristics and guidelines. These define, at this point in time, the initial content (one could say the "manifesto") of the ICT Standards and Protocols. This can be summarised in the following statements:

- The focus is to provide a specification to describe, fully, the set of necessary transactions
- The specification allows for future extensions and maintenance of transactions
- Information to enable traceability is built into the specification (the information model)
- The specification allows the "nesting" of transactions – and, therefore, it is not prescriptive in terms of B2B or B2C scope:
  - Therefore, it can support either a "marketplace" or "peer to peer" operations
  - A "transaction cost" can be established for each component – therefore, choice is augmented
  - Encompasses the description of existing interactions as employed in current EV pilots
- Security can be applied at varying degrees/levels – as necessary for each transaction type
- Identification & Authentication becomes a critical topic – and 3.8 needs to make suitable recommendations (and, possibly, align with or influence the STORK[29] activities)



This approach also means that for the communication phases (marked red):

- Transport Layer protocols (e.g. TCP/IP, etc.)
- Application Layer protocols (e.g. HTTP, SNMP, FTP, etc.)
- Structure Information Communication protocols (e.g. SOAP, REST, etc.)
- Synchronous or Asynchronous (and, even bureau) modes of operation become implementation-specific (and can even be proprietary) without a significant bearing on the EV operations.

7.1 The transaction model – Request and Response data structure

The transaction in the EV space can be represented as a structure and helps to identify the "layers of concern" and focus efforts:

[29] EU project aiming to establish a European eID Interoperability Platform that will allow citizens to establish new e-relations across borders, just by presenting their national eID

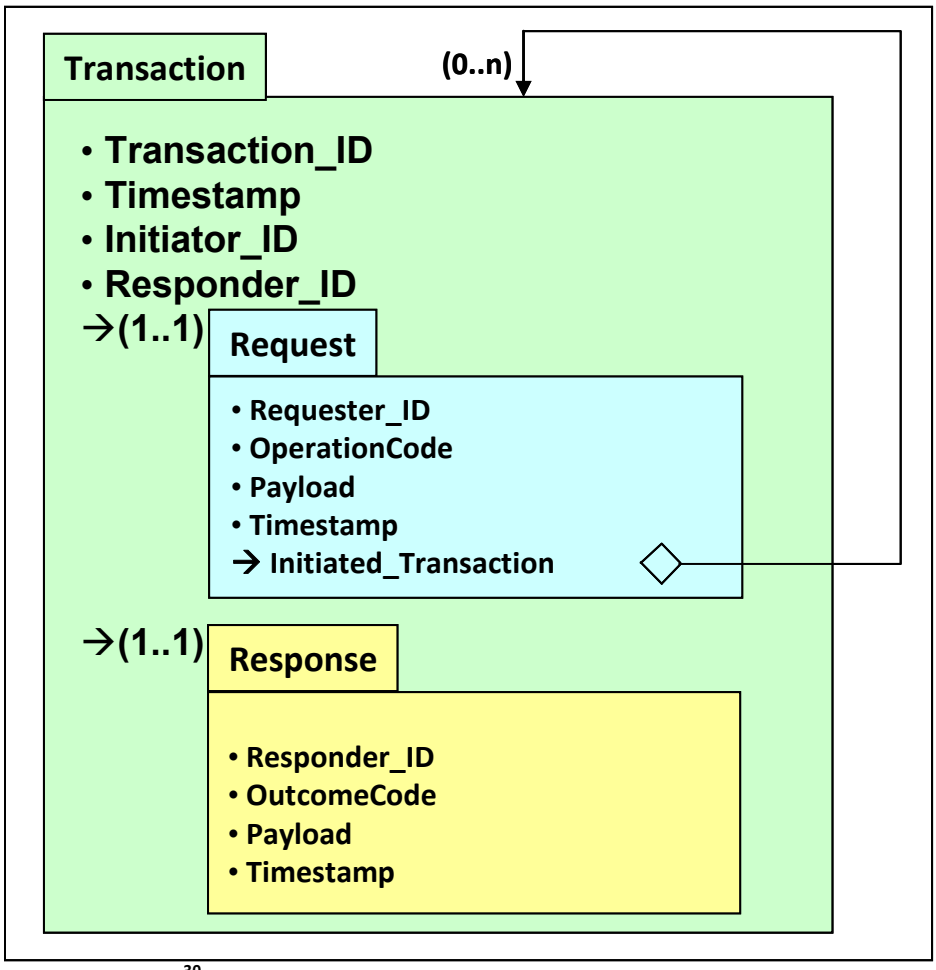


Fig 7-A: Possible[30] Transaction mode

The transaction paradigm quickly leads to a consideration of the following:

- Traceability requires unique transaction Identifiers (IDs)
- Requesters and responders require unique identification
- Time stamping is necessary – and acts as a guard against cross-system inconsistencies
- The operation codes of each transaction type need to be formalised and, preferably, proposed as a standardised list
- The payload for each transaction needs to be clearly and unambiguously specified

It follows that there is a need to consider the semantic description for describing the payload – and how this might be standardised. Hence, early consideration and specification needs to be directed to:

[30] NB: This is not the definitive transaction structure – just an example to illustrate the principle. There are relevant standards/specifications such as for example the BTP specification from OASIS

- The transaction information model
- The semantics for the model (e.g. XML Schema)
- The syntax for the actual data contents in the model (e.g. XML)

Similar approaches have been taken by, for example, the US healthcare industry (e.g. HIPAA & HCPCS); the NAESB is in the process of adopting the same approach – all these are supported by the ANSI Accredited Standards Committee X12. It would be imprudent to ignore these examples of best practice – especially since they have been shown to be working very well in practice.

7.2 The working method to define the specification

In the specification, we seek to identify the codes (operations) and the messages (payload or content or information). This can be illustrated using the example scenario from earlier: the annotations in figure 7-B show which parts of the transaction would be subject to formal specification.

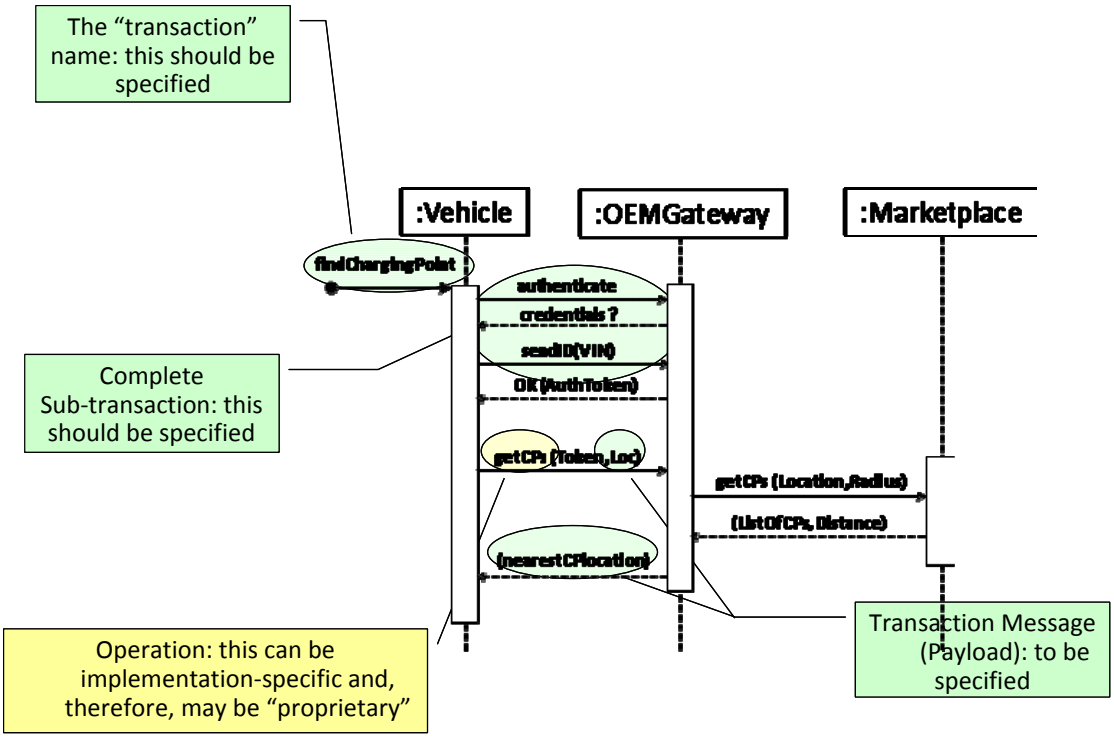


Fig 7-B: An Illustration of what to specify

Note, of course, that the specification applies to "public" transactions – "private" or "proprietary" transactions (i.e. those which are invisible to the end-points of the transaction) – do not need to be specified. However, sufficient visibility needs to be imparted from the "proprietary" to the "public" view of the transaction to enable the end-to-end functionality (i.e. this resembles a "concertina effect" on the information).

7.3 From use case to specification

Figure 7-C shows a more elaborate example of what needs to be considered in driving the specification. The example is kindly supplied by one of the Green eMotion partners[31].

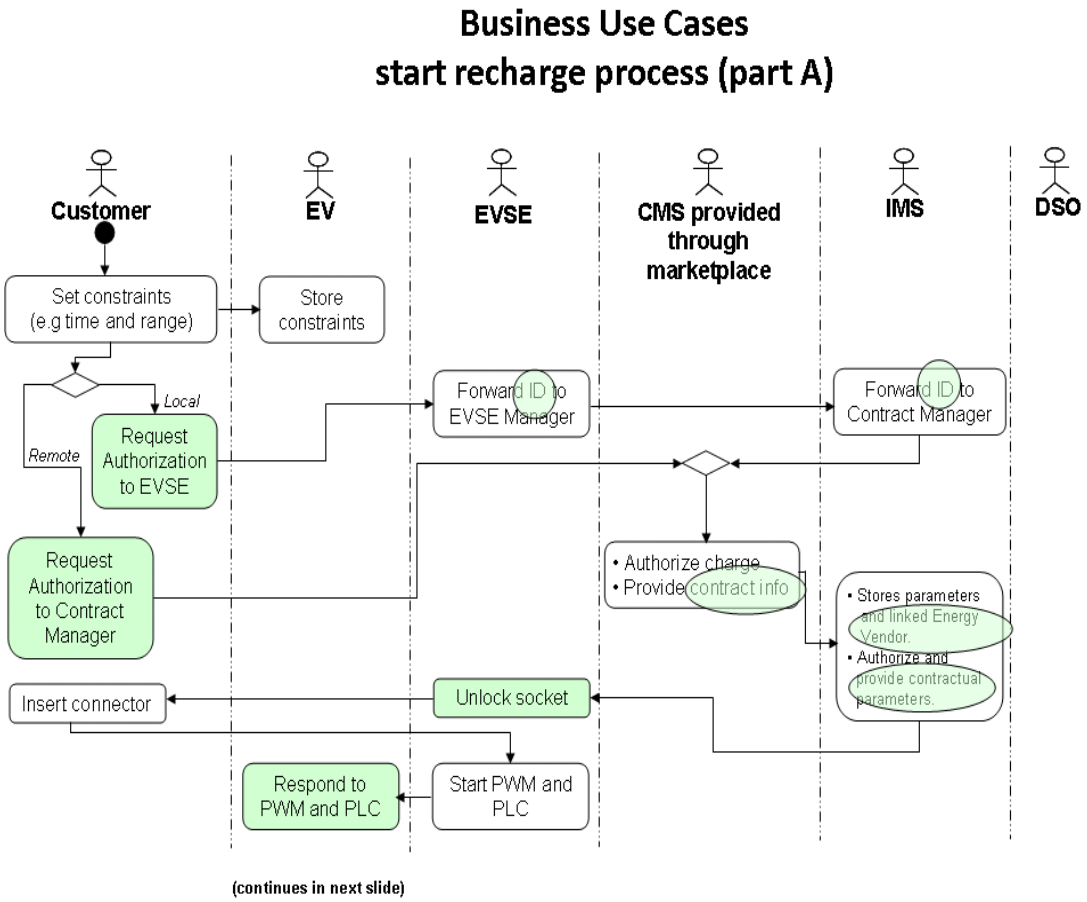


Fig 7-C: Using the use case to drive the specification

This illustrates the use of the business (use case) scenario to identify the parties in the transaction and the interactions between them. The elements in the picture which are highlighted in green represent the elements which will be used in the specification. To extract the necessary codes the use case diagram can be used directly or, if a more complex interaction map is required, then a detailed interaction diagram can be constructed and used instead. For clarification purposes, the IMS acronym identifies the Infrastructure Management System already described in this deliverable and other proceedings of Work Package 3, while CMS stands for the Commercial Management System that deals with B2C relationships (out of GeM B2B Marketplace scope at this first round of requirements).

[31] Courtesy of ENEL

7.4 Specification evolution

In the next phase of Task 3.8, the focus is going to be in engaging the Priority 1 areas (as per section 2.2 of this document), generating or obtaining the interaction diagrams and then using these to define the specification for codes (operations) and content (messages). These will be documented in detail in Deliverable 3.9 releases 2a and 2b (and, possibly, 2c).

The specification will provide:

- Operation or Service codes – code listing, description & explanation
- Operation or Service Payload – information structure descriptions
- Referenced standards – where these may exist
- Allowances or Concessions to be made – why, where and for how long
- Gaps & Overlaps to be resolved

The specification should be presented in a form analogous to that used by the ANSI X12 committee. This will not only ensure a consistent style – it will also result in a format which is familiar to the international standards community with, potentially, favourable consequences in the speed of processing or approval by external bodies.

An additional guideline to be followed in subsequent efforts in Task 3.8 may be:

The W3C XML Schema (XSD 1.1 Recommendation) will be used to define the information structures and content. By implication, the message or information instances will follow the XML Language specification.

8 Recommendations & Guidelines

This section identifies some additional topics – which are either developing or which are outside of the immediate scope of Task 3.8

Care will be required in the GeM Marketplace as regards identification and, particularly, the "trusting" of parties (i.e. being certain that a party which sent a request / response is truly the right party rather than an impostor) – this US paper on strategy for identification and authentication should be analysed[32] to draw recommendations.

SPI (sensitive private information) is a minefield of individual EU country legislation – we need an approach which transcends country boundaries and is not in conflict to legislative restrictions and/or relaxations.

Telecoms developments should not be forgotten – even though the specification of the ICT standards does not directly depend upon them - changes in Telecoms can make the "transactions" much more granular and we ought to anticipate service versioning and evolution (of the services).

Finally, the specification of User Interfaces (either as generic guidelines or more specific user interfaces / dialogues) could be a relevant viewpoint for Task 3.8 to contribute.

[32] Also relevant for further analysis are the activities on EU level around Smart Grid Information Security under Mandate 490.

9 Maintenance Policy (Governance)

The recommendations and specifications developed within this deliverable focus on a set of systems to be developed within electric mobility business that are rapidly changing and far away from general harmonization.

Specific conflicts in standards adopted have been highlighted in several phases of the transaction process, from the customer to the marketplace, throughout the currently deployed pilot projects in all Europe. Therefore, recommendations and specifications delivered in this document and in other proceedings of Green eMotion WP3 will be updated beginning from the first release of the GeM B2B Marketplace until the end of the project, and needed from the end of specifications phase.

Whatever change will be required to the recommendations and specifications on standards, it will be published by following a maintenance policy to be defined by the involved partners, especially the ones more keen on ICT system development and maintenance (IBM, Siemens, SAP, etc.) together with the partners more used to standard definitions, development and updating processes (Enel, BMW, Daimler) that will gather experience on similar duties accomplished within international standard bodies.

Maintenance policy is also needed to gather broad consensus from all involved partners in order to let the project deliver significant guidelines from a joint industry partnership to the external audience and standard bodies.

The hereby proposed model is intended to be a draft attempt in describing such a maintenance policy that will be needed later on during the project. Therefore the expectation is that this policy will be heavily updated after the kick-off of framework demonstration phase and the initial feedback gathered from GeM demo regions.

9.1 Structure and membership

The structure of the proposed maintenance policy is described below. Two groups of GeM members are included in order to deploy the governance process:

Maintenance Board: IBM, Enel.
Maintenance Committee: Better Place, Daimler, BMW, Siemens, SAP, RWE.

The Maintenance Board is both responsible of proposing changes to specifications or evaluating change requests coming from the other partners involved in the governance process, which are enrolled in the Maintenance Committee.

The maintenance timeline will eventually follow up future releases of this deliverable document. However, the updating process could also be required on-demand from one of the Maintenance Board members, even without correlation with deliverable

releases. The Maintenance Board thus defines a set of Public Review Period(s) in order to monitor effectiveness of recommendations and specifications and leads needed modifications. Change requests could be stated outside of PRPs only by either the Maintenance Board or the Maintenance Committee, while during PRPs instances could be raised by demo regions through the Regional Board leader.

9.2 Process and timeline

The maintenance policy could be deployed following the process depicted below.

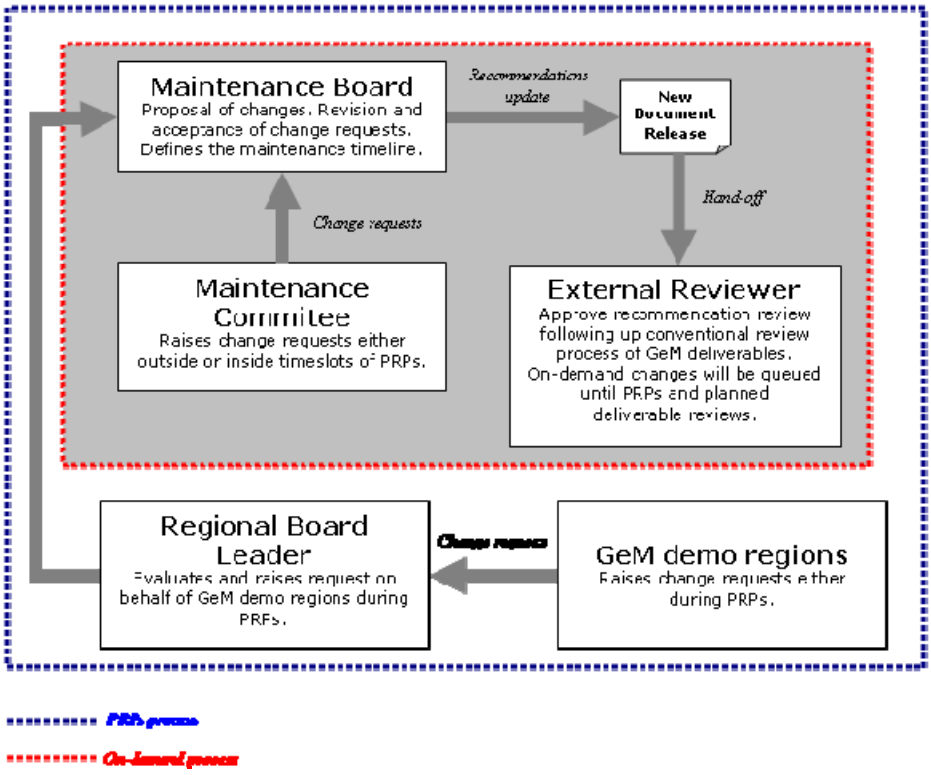


Fig 9-A: Maintenance policy & process

An expected first-guess timeline for maintenance to happen is envisioned below.

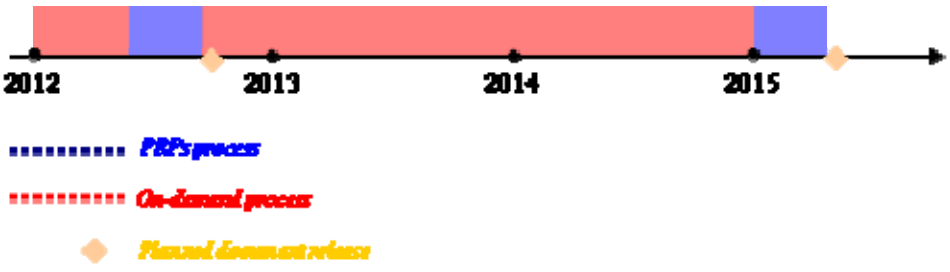


Fig 9-B: Timeline for maintenance

10 Conclusion

This deliverable analysed the situation for ICT standardisation and described the strategy to go forward adapting the DOW to the current situation. After the completion of the deliverables D3.5 and D3.6 the next steps will be to:

- Workout and agree on a roadmap for specification releases 2a and 2b ensuring good synchronisation with the other WP3 task and work packages 4,5, and 7.
- Continuously communicate standardisation issues to the work packages 4,5 and 7
- Cooperate with WP7, specifically with T7.3 to get specific transaction inputs
- Seek cooperation with other EV projects in the EU to raise the standardization need for basic identifiers like EVCOID and EVSEID to ease future integration and to motivate upcoming projects to implement a “future proof” specification and update current systems.
- Develop the releases as stand alone documents based on this deliverable and decide on the appropriate distribution and way to cope with feedback received

Appendices

A1 - Standards & protocols used for EV pilots

The purpose of this section is to present an early review of the ICT standards used in pilot projects running in Europe within the electro-mobility framework. The review is made up of the contributions coming from the Green eMotion partners who are participating in the demonstrations and pioneering both the EV charging infrastructure deployment and the service delivering to the customers.

Having briefly reviewed the ICT infrastructure, the areas of concern regarding the communication that enables interoperable charging process have been split into three subsystems: the EV-EVSE and EVSE-EVSE Op. and the EVSE Op. back-end – Marketplace communication. Due to lack of harmonization in the EVSE Op. back-end deployed in Europe, EVSE – CH communication seems not feasible, while EV-CH communication may be subject of further developments within the GeM project.

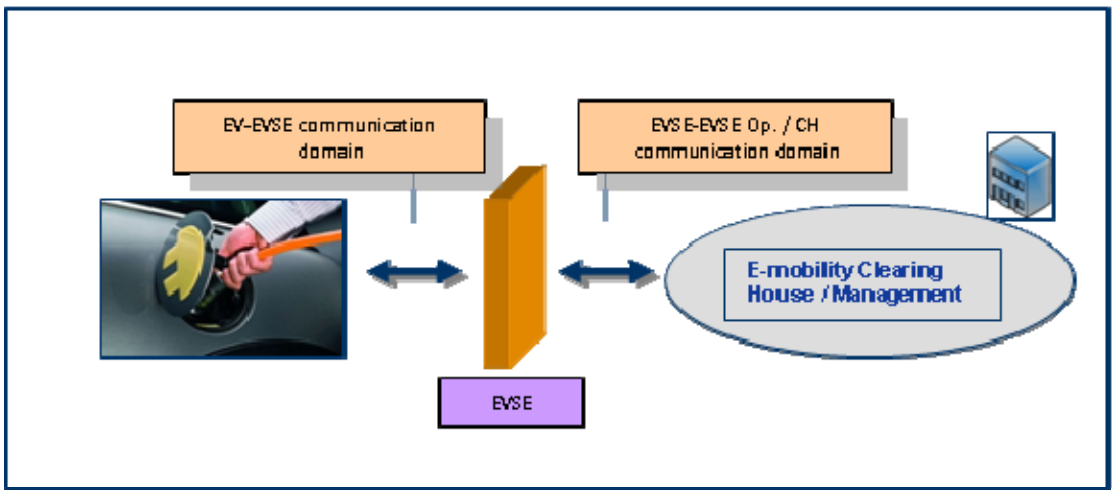


Fig A1-A: Communication domains in electric mobility framework

Each partner has been invited to provide an account of the ICT standards they are referencing and explain where they are used and how the overall system leverages them. Further details over standards can be found in the work ongoing in Work Package 7 – Standardisation.

The Italian Demo Region and Enel experience

Demo Region:	**Italy – IT1**
GeM Partner:	**Enel SpA**
Projects:	**E-Mobility Italy** (data collected and merged into GeM project)

Communication EV-EVSE

ISO 15118 compliance to be achieved within GeM project timeline.

Communication EVSE – EVSE Op.

In order to manage the recharging infrastructure installed, Enel has developed and is still improving a central control system, called (EMM – Electro Mobility Management). It allows a real time remote control and management of CUs installed by EVSE operators, both on private and public areas.

EMM system allows several functionalities, such as:

- Infrastructure configuration and management.
- Customer contracts configuration and management.
- Association between contracts and RFID card to activate recharging sessions.
- B2B relationships management.
- Interfacing with billing systems.
- In progress, the deployment of an innovative electric grid management thanks to interaction with DSO SCADA System.

The management process and recharging process between CUs and EMM are established on a proprietary protocol. Recharging process management allows to authorize and to start the recharging process. The system management allows:

- EVSEs configuration.
- EVSEs Polling.
- Forwarding commands to EVSEs (i.e. reboot, update software).
- EVSEs electric and software settings.
- Unlocking the plug if necessary.
- Diagnostic on EVSEs.

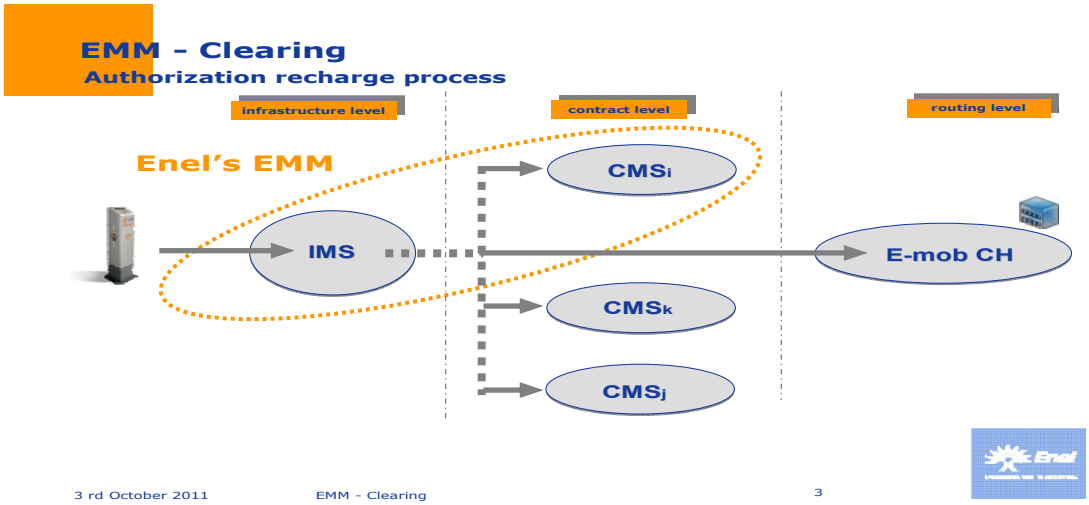


Fig A1-B: Functional layers within Enel's EV mobility management system

Currently the communication between CUs and the centralized management system that takes care of CUs management, recharging processes authorization and energy info routing towards other market actors (i.e. TSO, DSO, energy traders and so on) is established on a custom architecture due to the experimental phase of electro-mobility framework, which is basically in the early-adopters section of the technology curve. A general overview of the ICT

EVSE-EVSE Op. architecture deployed in Italy is pictured in fig. A1-B, as it is currently planned in order to meet the clearing house interoperability functionalities.

The ICT standards currently established within Enel's Electric Mobility Management system are mainly within the first sub-system, which is the Infrastructure Management System (fig. A1-C).

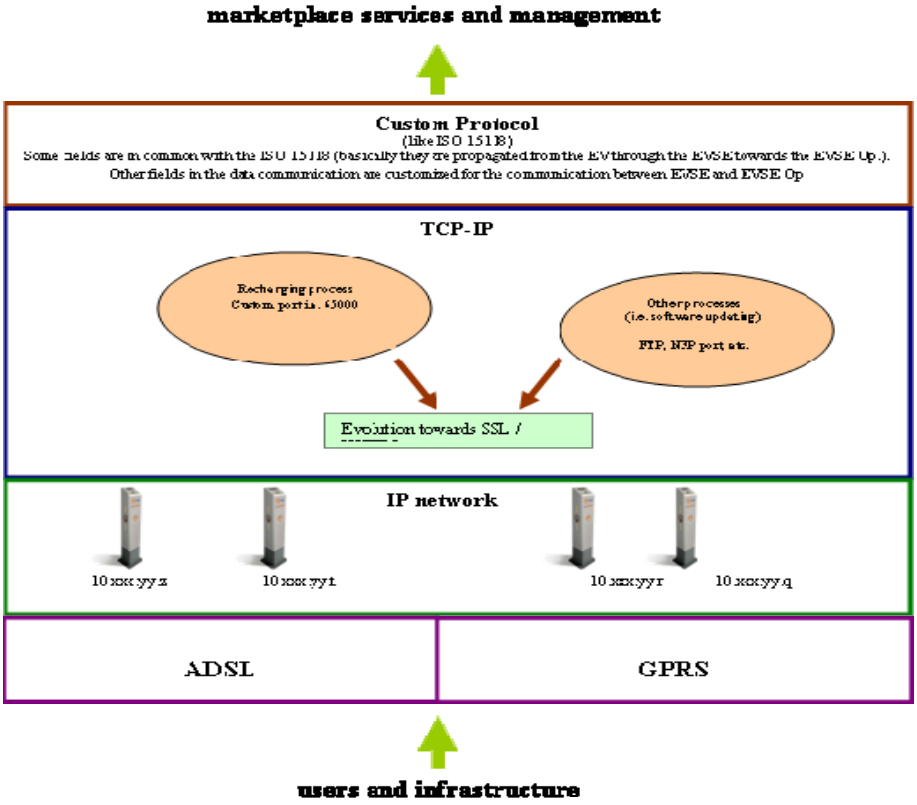


Fig A1-C: OSI of the EMM system for infrastructure and service management

The protocol used on top of the architectural stack is a custom one, designed in a similar fashion to the V2G ISO 15118 but with significant differences. Currently no management protocol has been chosen (i.e. SNMP) as custom approach was considered the most flexible in dealing with the early-adopters phase of EV service market. Further improvements towards a granular standardization (from the physical layer up to the data packets content) are under design, and will gather inputs from GeM project as well.

Further details on the custom solution adopted for the Italian pilot project

Each message exchanged between the CU and the CH is composed by two parts:

- A header, that is the same for every message
- A payload, that is particular for each message

The format adopted in order to specify messages is based on a wide usage of sockets in order to send/receive messages. General format consists of a set of variable length fields:

each message has a fully defined structure described in the following. In order to specify messages we adopted some conventions accordingly to the ISO 8583 standard.

Each field of a message can be of three different types, namely:

- **an**: alphanumeric field, each byte in the field is an ASCII character.
- **n**: binary coded field (thus used for numeric values). As a default this value has no decimal digits unless differently specified in the single field description of each message. All the bytes of the field are used to compose the number.
- **XVAR**: variable length field, with a preceding "X" bytes specifying the actual field length (without the length specification part, therefore the total field length will be X + number of bytes defined in the X field). The X length bytes has a numeric code (is a 'n' field as specified above). The content of the field is generally alphanumeric, anyway is defined for every single field.

The padding character for alphanumeric fields is a space ' '.

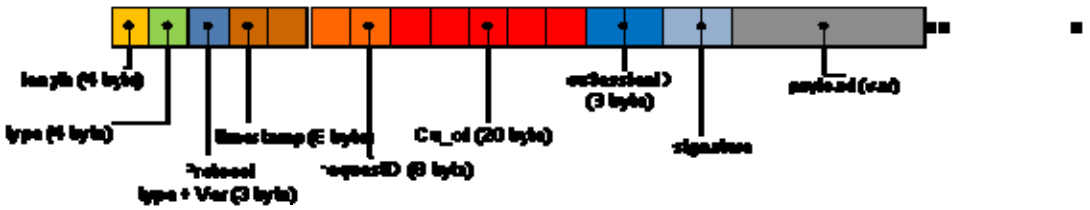


Fig A1-D: Structure of the message

A2 - Standards relevant to ICT scope

This is a primary contribution of task 3.8. It has been agreed that for each scenario identified for the GeM Marketplace, we will identify:

- The transaction (including any sub-transactions)
- The operations (request / response)
- The message content (payloads to go with request / response) – and, also, any "events"

In principle, the "interaction diagram" (which realises a use case scenario) can be used to extract the relevant transactions – then "normalise" (i.e. make sure there is no duplication) and build the appropriate standard specification. Part of this process is to check the existing coverage for an example look here: http://datatrans-inc.com and here:
http://www.1edisource.com/learn-about-edi/transaction-sets/x12)

The table of scenarios identified in Tasks 3.1 and 3.3 to 3.7 can be used to define a starter set of what needs to be specified. It is anticipated that the following concepts or existing specifications (or initiatives) will be relevant:

- For financial transactions: 3D-Secure/SecureCode, EMV (Europay, MasterCard and VISA)
- For Smart Card technology: ISO/IEC 7810, ISO/IEC 7816, ISO/IEC 14443-4, etc.
- For Business Transactions: X12 EDI Transaction Sets, X12 CICA Messages, OASIS BTP and HIPAA.
- For privacy: http://www.hhs.gov/ocr/privacy/hipaa/understanding/summary/index.html
- For communications: ETSI M2M and Intelligent Transport efforts
- For Information Security: ISO/IEC 27000-series, ISO 17799, etc.

Specifications will be re-used and adopted as extensively as possible. The selection process will be concurrent with the use case scenario to transaction elements process.

A3 - Standards analysis criteria used

For this document the transaction is used as a central method of information exchange. ANSI interprets the term transactions in the following way: “transactions are electronic exchanges or, interactions, involving the transfer of information between two parties for specific purposes”.

The types of transaction can be divided in three groups.

- Mandatory
- Optional
- Desirable

A mandatory transaction must be considered. The system will not work without this transaction. Any partner willing to work with the system has to implement the transaction. The goal must be to provide a clear and unambiguous specification. An example might be basic charging functionality.

An optional transaction should be considered. The system will work without this transaction, but providing the transaction will add extra value to the partners and fuel the delivering of value added services to the customers, that quite often happen to be the trigger for killer applications in a broad variety of businesses. The goal must be to provide a standard specification on guiding principle. An example might be search functionality for the nearest EVSE, or aggregating EV energy in order to deliver ancillary services to the DSO / TSO in a certain load area.

A desirable transaction could be considered. The system will work fine in the current state without this transaction, but for future purposes it might be worthwhile implementing it. The goal must be to provide a reference standard and make recommendations. An example might be CO2 reporting or V2G functionality.

The criteria for selecting a transaction to be mandatory, optional, or desirable can change during the project as the priorities shift. The evaluation of the transactions must be repeated on a regular basis according to the latest findings. A priority list is therefore at the very heart of PRP to be held within the maintenance process.

A4 - Review of Standards & Protocols versus GeM Marketplace Use Cases

In Deliverable 3.1 (Business Analysis), we identified different Business scenarios. Those can be rated according to their relevance as mandatory, optional and desirable.

Mandatory Business scenarios would be:

- Charging at home or in public
- Mono-directional control of charging
- Service detail records for accounting and billing
- Standardization of interfaces and messages (for remote customer service)
- Roaming between EVSPs in one country
- OEM Basic charging

Optional Business scenarios:

- Differentiation of customer contracts, check of SLA
- Bi-directional control of charging (vehicle-to-grid)
- Marketplace: buying, selling, routing
- B2B contract-management
- Service provisioning, registration and lifecycle-management
- B2B partner management
- Roaming between countries (contractual clearing)
- Financial clearing
- Enhanced charging
- CO2- and other legislation-based reporting
- Grid related services (centralized congestion management)

Desirable Business scenarios:

- Value-added services (analytics, reporting, eco-routing…)
- Aggregator grid services, energy trading
- Monitoring of EVSE

The relevance of the Business Scenarios listed above might change over the duration of the project - considering the needs and issues raised from GeM partners in order to follow up the development of the electric mobility market.

End of Document