

*EVS30 Symposium
Stuttgart, Germany, October 9 - 11, 2017*

Advancing eRoaming in Europe: towards a single 'language' for the European charging infrastructure

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Executive Summary

The EU market for electric vehicles is growing significantly, but the absence of accompanying EU-wide protocols and standards for interoperability hinders the development of cross-border EV travel (“eRoaming”). This paper describes best practices of 6 years of eRoaming in the Netherlands and roaming lessons learned from other sectors. It translates these into proposed next steps, such as the need for piloting eRoaming on a European level, using open standards such as OCPI. It concludes with a proposal for a comparative study of protocols to pave the way for future convergence, and thus facilitate a European market for EV products and services.

1 Introduction

In recent years the EU market for electric vehicles has grown dramatically. This has been supported by the introduction of a charging infrastructure. However, the absence of accompanying EU-wide protocols and standards for interoperability and e-roaming (e.g. the option for EV drivers to charge their vehicles at all charging stations) has severely hindered the development of cross-border EV travel within the EU. [1] Solutions for interoperability have had a national scope at best, which is primarily caused by a lack of a single (open) standard for communication between the market parties involved. Research [2] recognizes this as a serious obstacle for further uptake of electric mobility in Europe. It shows that besides range (anxiety), main obstacles for acceptance of electric mobility by consumers are:

- Poor information about location and availability of charging stations;
- Absence of information about tariffs and the total price of the session;
- Different, non-compatible ways, tools, tokens and apps to get access to charging stations;
- Non-transparent business models and potentially high cost because of the complexity of the value chain.

These obstacles can only be tackled through standardization and interoperability of the charging infrastructure, and specifically the protocols that are responsible for information exchange between the back offices of involved stakeholders (e.g. charge point operators, mobility service providers, navigation service providers). With standardization and interoperability of the charging infrastructure, European roaming (eRoaming) becomes feasible. This will make transnational EV travel far more comfortable, increases the adoption of e-mobility by consumers and is a pre-condition for more advanced solutions in order to develop future mobility as a service and innovative e-mobility service concepts.

2 Rationale for eRoaming

Currently, multiple roaming hubs for electric mobility exist in Europe, some more mature than others depending on the maturity of e-mobility in a country. All roaming hubs have developed their own proprietary protocols. This makes it almost impossible to realize roaming between hubs and between charge point operators and service providers who are not connected to a roaming hub. Therefore, an independent and broadly accepted protocol needs to be defined, developed and implemented that can both connect to hubs as well as be used for peer-to-peer connections. This development towards maturity is similar to other sectors such as Telecom (4G), Internet (TCP/IP) and the banking sector (IBAN) that have also converged to a single standard for communication between market parties. In the world of electric mobility a single protocol to connect both charge point operators and service providers via hubs and peer-to-peer has not yet been developed.

2.1 EU impact

The promotion of eRoaming has positive effects on energy efficiency and therefore on climate ambitions. The urgency is illustrated by the high ambitions for EV deployment and the hard targets to reduce CO2 levels [3].

In terms of legislation and compliancy, this project anticipates on increasingly stricter regulation towards the use of open protocols as the default way-of-working, and stricter regulation of the mobility and energy sector. It is compliant with, and supports, developments such as the EU Directive on Intelligent Transport Systems [4] (e.g. providing location of charging points, the conditions for their use and the availability) and the Alternative Fuel Directive [1] (e.g. prices for charging sessions should be easy to check and compare, a possibility to charge ‘ad-hoc’ (without a contract) should be possible).

2.2 People impact

The service for EV drivers will increase in a lot of ways: easy locating of chargers, easy access with one card, one map, transparent prices, etc.. Drivers are able to drive cross-border, to charge at every operator “like home” and using the services they know and are familiar with. It will increase and ease eMobility use and enhance comfort, travelling range and reduce charging costs. It can also facilitate innovative developments such as direct payment at chargers for example.

2.3 Products and services impact

By moving towards further harmonization of standards, we move away from suboptimal (country-specific) solutions and will create one European playground with improved connectivity between all players. It will serve as a common platform for a whole new eco-system of new service providers and apps, which has a positive impact on future employment in this sector. It is also a fertile ground for innovation, new services may even be introduced beyond eMobility and charging.

2.4 technological/ICT impact

Using open protocols reduce the cost of access for market parties to enter the market and develop new services. The focus on protocol harmonization acknowledges today’s diverse landscape of protocols which shows the innovation capability of the market. At the same time it addresses the necessity to converge towards a fully interoperable future with all advantages of scalability and customer focus. eMobility will be promoted by offering e-mobility infrastructure access at a uniform way throughout the EU.

3 Roaming initiatives in Europe

3.1 Overview roaming platforms & protocols

Currently, multiple roaming hubs for electric mobility exist in Europe. Some of these are more mature than others depending on the maturity of e-mobility in a country. All roaming hubs have developed their own protocols. This makes it almost impossible to implement roaming between hubs and between charge point operators and service providers who are not connected to the same roaming hub, although some protocols now also offer direct connection possibilities.

For roaming, the following protocols currently exist in Europe:

Table1: Roaming protocols in Europe

Protocol	Proprietary / independent	Usage via Hubs/ central platform	Usage via peer 2 peer connection/decentral (without contract with hub)
Open Clearing House Protocol (OCHP)	Proprietary (e-Clearing.net)	YES	NO
Open InterCharge Protocol (OICP)	Proprietary (Hsubject)	YES	NO
eMobility Inter-Operation Protocol (eMIP)	Proprietary (Gireve)	YES	NO
Open Charge Point Interface Protocol (OCPI)	Independent	YES	YES

In essence, all roaming protocols have the same goal: to offer roaming to EV drivers across Europe. However, the hubs that use their own proprietary protocol do not communicate with each other and do not exchange data. A service provider or charge point operator who wants to achieve maximum roaming will need to reach an agreement with all major hubs. OCPI can change this. In an ideal situation the different protocols should be united and converged into one independent and open protocol that can connect both via hubs as well as peer to peer. This will reduce the need to connect to every hub as OCPI offers alternative ways to connect (e.g. peer to peer)

OCPI can easily be compared with the EU “Campaign for the introduction of the voluntary agreement (MoU) for a common charger for mobile phones.”, promoting the use of similar connectors (USB-C) instead of each manufacturer promoting their own connector, resulting in additional cost and electronic waste, preventing customers to choose between products and hindering the development towards a mature marketplace.

3.2 Current market situation vs future market situation

The following figures give an overview of the current situation described in two scenario’s and the future situation using a single protocol.

3.2.1 Current situation (scenario 1)

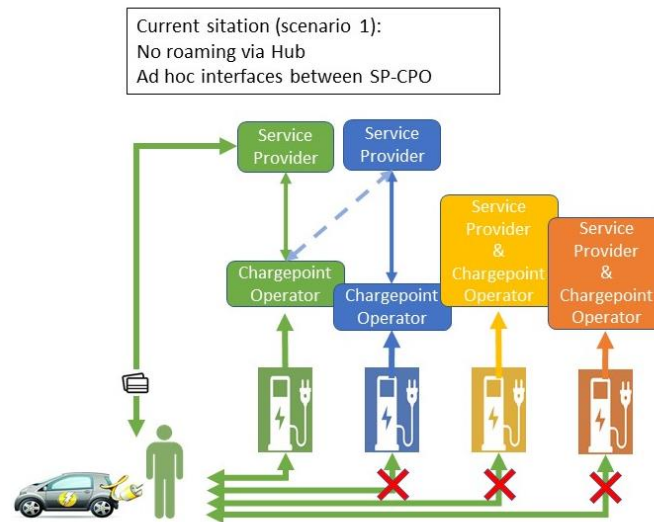


Figure 1: Current market situation (scenario 1)

Currently, not all charge point operators and service providers are connected to roaming hubs. In this situation they connect peer-to-peer via custom made protocols. This results in a situation where they need to support multiple custom made protocols from their partners.

Without a connection between the two involved parties, the EV driver cannot charge at the specific charge point. This scenario results in many different custom connections without a single communication standard and with corresponding additional implementation cost. It results in an unequal playing field, reduces competition, and ultimately reduces freedom of choice and transparency for the EV-driver

3.2.2 Current situation (scenario 2)

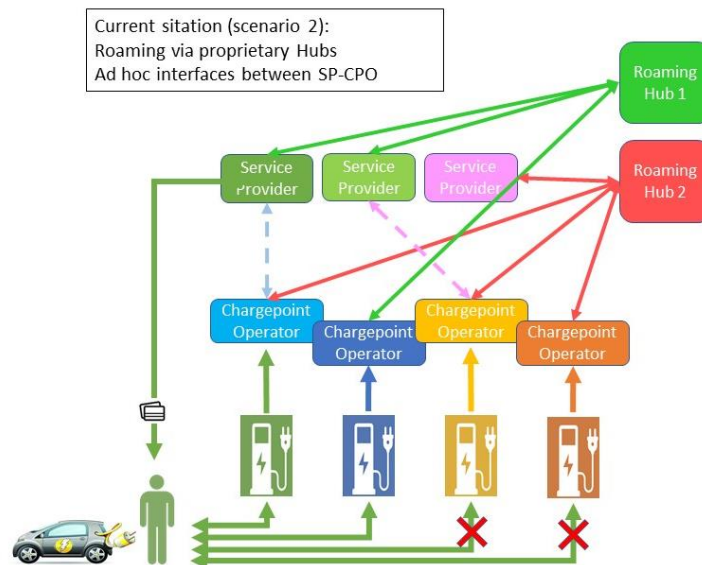


Figure 2: Current market situation (scenario 2)

In a second scenario, charge point operators are connected to a central roaming hub, using the hub's own protocol. The hubs currently have a somewhat geographical focus; if a charge point operator or service provider wants to offer maximum charge possibilities to EV drivers, it must connect to multiple hubs (including membership, membership fees, and implementation of the hub's specific protocol). This is a costly situation and does not assure price transparency and services for EV drivers according to a single standard.

3.2.3 Future situation

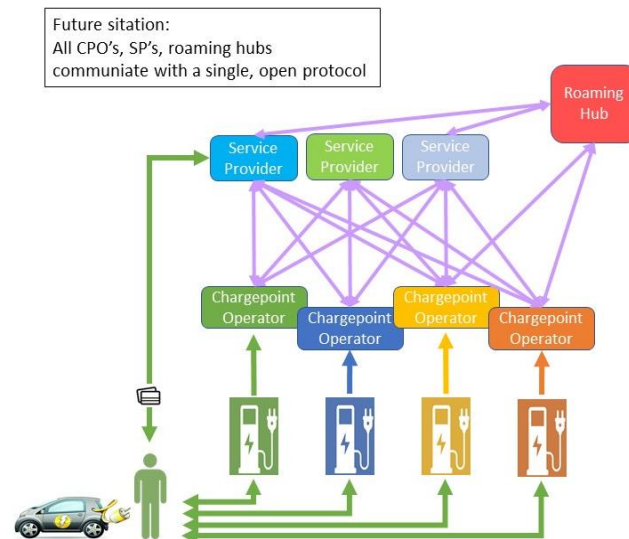


Figure 3: Future situation

In the future situation only one protocol is needed for connecting both charge point operators and service providers peer to peer (decentral) as well as via a roaming hub (central). There may still be different roaming scenarios present: the charge point operators can choose to connect with one or more hubs and/or peer to peer with another market player.

What is of crucial importance, is that they do not need to implement and maintain different protocols anymore. Secondly, whichever connection is chosen, the end user can be supplied with all necessary information and services using a single communication standard. This will reduce the cost of operations significantly, and will make it easier to roll out roaming-related services on a European scale. It will also result in a more level playing field with more competition and lower cost: Instead of competition on protocols, the focus will move to competing services for the EV driver.

4 Best Practices

4.1 eRoaming in The Netherlands with international connection

In the Netherlands, eRoaming in its basic form - allowing EV drivers to charge at every charging station - is already possible since 6 years. eViolin is the entity that brings the stakeholders together and currently manages roaming for over 210.000 EV cards/tokens, 90.000 charge stations and 22 charge point operators and mobility service providers. eViolin is also responsible for the issuing of IDs for these organizations, which makes eViolin crucial in the EV ecosystem to support exchange of data and roaming. In the coming months, roaming and information sharing will be offered via the Open Charge Point Information protocol OCPI. Currently, roaming hubs are not yet connected to each other, therefore a combination of peer to peer roaming and roaming via the Germany based e-Clearing.net platform has been chosen. By using the open OCPI protocol mobility service providers, navigation service providers and charge point operators are free to choose their preferred connection and can connect to other hubs as well as connect via peer to peer connections. When roaming hubs work together and can roam between them, everyone will be free to choose their preferred roaming hub, do it only peer to peer or a combination. The chosen open OCPI

protocol is supported by all main roaming hubs, so switching to another roaming hub will be relative easy in the future.

OCPI not only supports roaming but also exchange information about tariffs for charging, location and availability of charge stations, exchange of billing information and supports remote usage of charge stations. Future versions will support smart charging, ISO 15118 functions, data collection functions, and better connection to other market roles.

A group of fast charging operators, led by Fastned, recently agreed to join the roaming initiative and implement OCPI to enable interoperability of fast chargers across Europe for all involved service providers. This is a step change from the current situation where fast charging networks are closed systems and chargers can only be used with proprietary apps and tokens.

The Netherlands Knowledge Platform for Public Charging Infrastructure (NKL) is an independent, not-for-profit organisation that currently owns OCPI and ensures the development, maintenance and continuity of it, together with many charge point operators and service providers across Europe who support this process.

4.2 Roaming in other sectors

An adjacent sector such as the telecom sector has already introduced roaming since 2007 [5], which has proven successful for the further introduction of services and products on a European scale. In addition, the decision has been made to eliminate roaming tariffs, which will result in a mature European market that no longer introduces barriers per country [6]. These developments and lessons learned, when transferred to the E-mobility sector, underline the need for interoperability between market parties such as charge point operators and mobility service providers, without additional (financial) barriers. Open protocols such as OCPI could well fulfil this function.

5 European eRoaming pilot

5.1 Transnational pilot

OCPI is already prototyped and first implementations are currently taking place, showing a commitment by the market to support and invest in this protocol. Current TRL (Technology Readiness Level) is estimated at 6/7.

By setting up a corridor with several adjoining countries (Austria, Germany, Denmark, Netherlands) within this project the impact of the protocol will be demonstrated. The protocol will interface with existing hubs like e-clearing.net, which is an already proven roaming hub serving multiple European countries. During the project important new functionalities will be added, collected via consulting a large group of key users in Europe. Finally a maintenance organization will be setup which gives the protocol the needed level to scale up to a largely adopted protocol.

Therefore, during the project the development of the protocol will shift to level 8 and finally reach Level 9 (System ready for full scale deployment) as the project objectives support commercial deployment across Europe of numerous business models that rely on standardized information exchange.

5.2 Harmonization of protocols

Currently, several protocols are being used or developed to support roaming. Developments in other sectors have learned that, over time, these will converge to a single roaming standard. Therefore, it is proposed to start working on a theoretical framework in order to make a comparative analysis between the different protocols and provide recommendations for harmonization and future convergence.

Research will be done on how the different existing proprietary protocols can be further harmonized: recognizing their current existence and value, but at the same time providing a roadmap towards a converging future, based on an optimal business-ecosystem. This requires different ways of working and thinking of the existing roaming hubs.

The above illustrates the ambition of the project in terms of interoperability, solutions, ICT and collaboration, and its potential to support the breakthrough and widespread uptake of electric mobility.

References

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Authors



Roland Ferwerda is the Programme director of NKL - The Netherlands Knowledge Platform for Public Charging Infrastructure - since the beginning of 2016. Managing a programme to improve the business case for public charging infrastructure, Project leader for development of open roaming protocol OCPI. Over 10 years of experience in the energy sector - Production, Trading, Retail, Grid - his last function being the director of Risk Management for Essent/RWE. Experienced project and programme manager in ICT and Energy. Teacher in Financial Decision Making and Strategic Risk Magement in several MSc programmes. Owns a MSc degree in Theoretical Physics.



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