

On the road towards seamless electromobility services in Europe: NeMo Hyper-Network project and challenges

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Summary

Electromobility rollout in Europe suffers from an isolated and heterogeneous charging infrastructure which seems unpractical from end-user's perspective to find charging stations, to authenticate and pay for charging service. The Green eMotion European research project (2001 – 2015) has developed and demonstrated an ICT solution which provided the foundation for further standardization needs which are being developed by eMI3 industry association group. This paper will outline the challenges and solution approach to promote easy-to-use and seamless Electromobility across all European member countries and will outline the European Horizon 2020 research project “NeMo: Hyper-Network for Electro Mobility Services” (2016 – 2019). This will enable end-users to travel across Europe with their EV, use only ONE access to find and pay for EV charging services and to enable the EV integration into the energy grid and transportation ecosystem.

Keywords: business model, digitalization, IoT, smart charging, smart grid

1 The Challenge

However, despite this high potential, the wider adoption of electromobility by motorists and road transport operators remains relatively low due to a number of reasons. One of the biggest deployment challenges for electromobility in the road sector is the limited driving range of Electric Vehicles (EVs) and the limitation to mobility and usability that this entails. This challenge faced by electromobility is the result of several obvious factors, such as the Charge Point (CP) distribution and compatibility with vehicles, but in addition of some less obvious factors as well, such as the lack of standards for electromobility data exchange, the Service Provision vendor lock-in, or even the energy grid and Charge Point Operators (CPOs) restrictive and outdated business models. In detail, the issues are listed in the following sub-sections.

1.1 EV range and charging issues

A main factor limiting EV driving range is lack of interoperability in existing infrastructure and services related to electromobility, such as charging infrastructure. Electromobility actors have currently to deal with a broad spectrum of EV charging systems hardware, service providers, standards and protocols, which can vary greatly from a technological perspective. Other aspects of this multi-dimensional problem are the sparsely scattered charging networks, specific vendor contracts which limit interoperability, EV-CP

compatibility, as well as the relatively long process of charging an EV either in conventional (several hours) or fast chargers (~1 hour), compared to refuelling an ICE vehicle (~3 minutes). All these factors force EV users to plan in detail their daily charging schedule and booking of specific infrastructure, considering vicinity from destination, compatibility with the EV, operating status and availability of the infrastructure. Sometimes, such information can be missing, incomplete or not updated, which increases even more the uncertainty and frustration of the EV users, making also possible future customers reluctant to choose EVs over ICE vehicles.

1.2 Energy and grid-related issues

Another important challenge faced by electromobility is the impact to the electric grid network, caused by increasing EV numbers but also by new charging technologies. The main issue is not coping with new electricity production needs, but defining and deploying a smart way to manage EV recharging, avoid spikes and in general manage local increased needs due to non-uniform distribution of EV charging across time and space. Additionally, fast, high-power charging and dynamic on-the-go charging both require power levels which are orders of magnitude higher than conventional static charging technologies. The proliferation of such technologies, if not coordinated, will push the supply grid to its limit. Investing in new power generation and distribution infrastructure is very costly. In conclusion, the electromobility ecosystem is not connected to the grid in a sustainable way, and yearly power subscriptions (current business model used by CPOs) lead to expensive service pricing, and thus to lose-lose situations for all actors involved.

To avoid grid over-dimensioning, many projects are currently focusing on developing ICT services to support the smooth EV integration in the energy grid by optimally using regional and global grid capabilities according to battery, local and global grid restrictions (e.g. by optimising charging schedule for each specific EV, or by Vehicle to Grid (V2G) direction of energy flow, referred to as Reverse Charging in the EU, effectively using EVs as large capacitors to smoothen supply-demand mismatch). However, such ICT services are not interoperable or standardised– with the exception of the V2G interface standard between the EV and the Recharging Spot. Each Distribution System Operator (DSO) uses proprietary software and data formats to retrieve and make available information that is necessary for such services.

1.3 Data exchange issues

The need for the provision of interoperable and seamless ICT services becomes evident if one considers that setting up a pan-European charging infrastructure involves the interlinking of more than 2100 DSOs, 1000 CPOs and 40 Services Providers (including OEMs, access service providers and navigation service providers)⁶. Nevertheless, the provision of such services on a pan-European level is now hindered i) on a technical level by the lack of a common data and information model and communication standards and ii) on the business level by the lack of common framework for commercial agreements. According to eRoaming platforms like GIREVE, there is currently no standard way of describing and referring to objects relevant to electromobility, for example to vehicles, to operators (Electromobility Service Providers - EMP, CPO) or to EV charging infrastructure elements (CPs, Charging Station, etc). This is a key concern and is highly complex in dealing with, since it requires a sequence of multiple data exchanges, it depends heavily on DSO – CPO contracts as well as on CPO – EMP contracts, and depends on time and customer requests.

1.4 Diverse eRoaming platforms

The lack of interoperability gave rise to the recent concept of electromobility eRoaming platforms, which started their commercial operations in Europe in 2013. Such eRoaming platforms establish an interface between the backend of the CPO and EMP through a brokering system in order to enable the EV user to seamlessly charge and pay at any of the interconnected charge points operated by the CPOs connected. All existing eRoaming Platforms run a very critical business and are faced with similar difficulties such as the slow ramp-up of the electromobility market, and the complex environment due to national differences,

involving both regulated and open market. Now, there are several of such eRoaming platforms, and the problem of interoperability between platforms still remains.

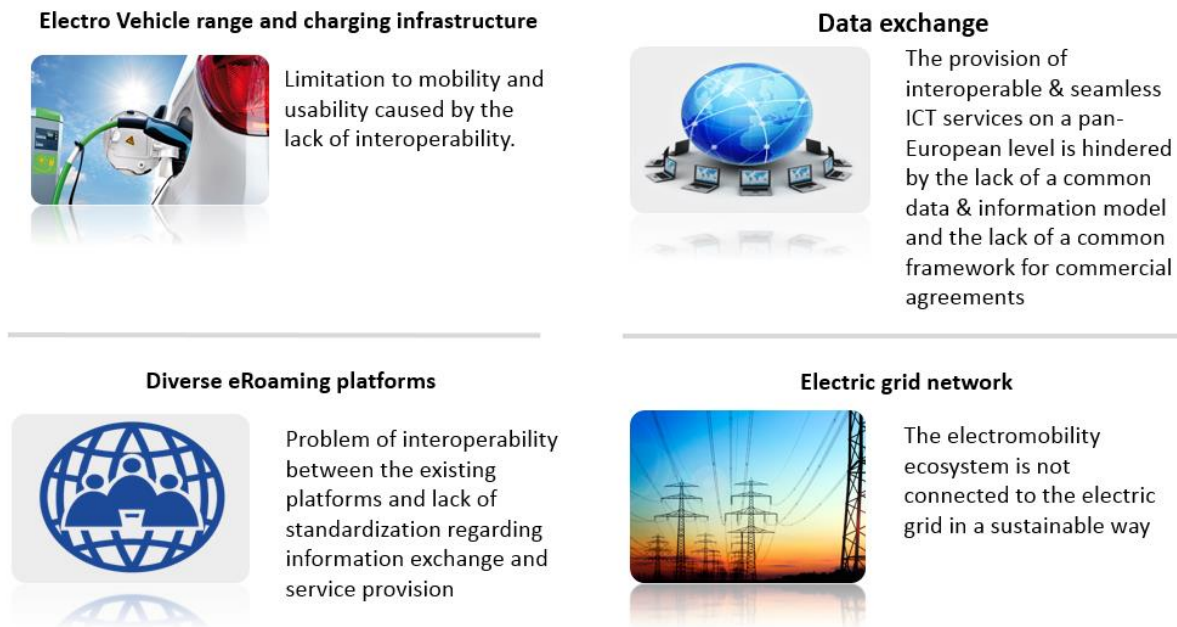


Figure 1: Challenges of electro mobility in Europe

1.5 Why past attempts fail to answer the problem

Several ICT services have already been developed to address some of the bottlenecks, including the eco-efficient navigation to the most appropriate CP, advance booking of a CP, remote monitoring of the charging process to minimise waiting time, EV sharing schemes, interconnections with alternative means of transport while charging the EV, etc. The main reason is that such solutions are normally built for, and based on specific proprietary systems and use cases.

As a conclusion, the lack of standardisation regarding information exchange and services provision for electromobility makes communication among involved actors very difficult. This limits the potential for interoperable and seamless electromobility services to a wider public, a wider range of actors, and a wider geographic area, thus hindering wider EV market introduction. Electromobility is a novel and fast-growing technology, and as such, it opens new horizons for ICT services (since EV connectivity is a pre-requisite).

2 NeMo Project – Objectives and Solution Approach

The vision of NeMo is to create a Hyper-Network of new and existing tools, models and services which will provide seamless interoperability of electromobility services, creating an open, distributed and widely accepted ecosystem for electromobility. NeMo aims at bringing the successful interoperability paradigm of seamless roaming (as in mobile telecommunications) into the domain of electromobility services, paving the way for a Pan-European eRoaming framework.

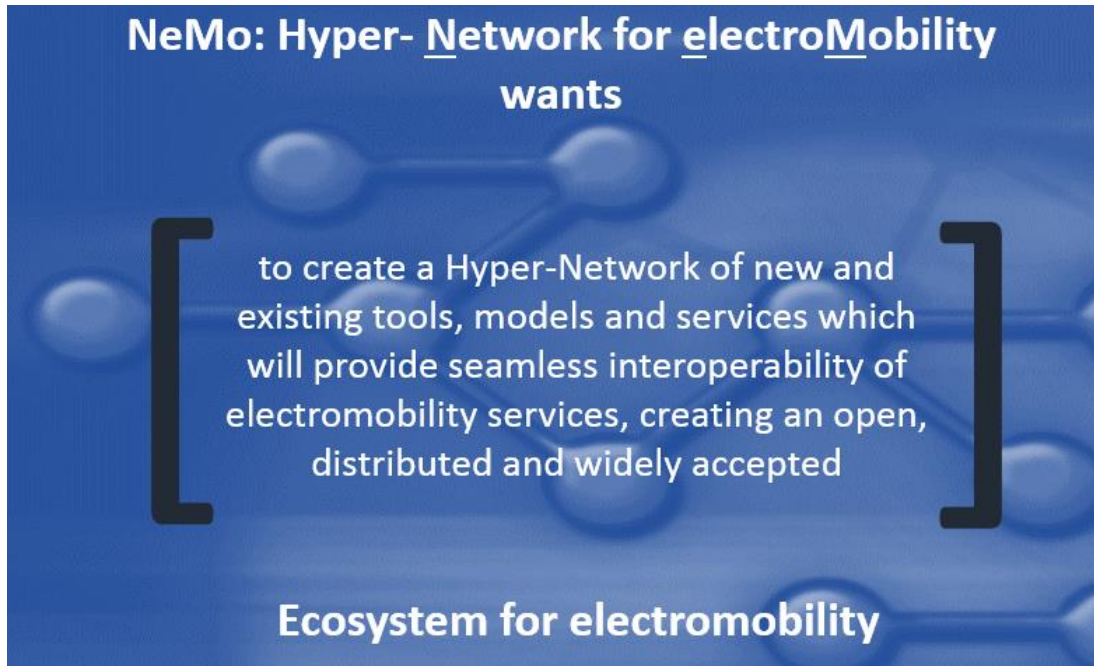


Figure 2: NeMo EU Project Vision: Ecosystem for electroMobility

The NeMo Hyper-Network is a distributed environment with open architecture based on standardised interfaces, in which all electromobility actors, physical (i.e. CPs, electricity grid, EVs) or digital (i.e. CPOs, DSOs, EMPs, EV owners, etc.), can connect and interact seamlessly, to exchange data and to provide more elaborate electromobility ICT services in a fully integrated and interoperable way both B2B and B2C. The connection will be based on dynamic translation of data and services interfaces according to the needs of the specific local scenario and the involved stakeholders. This way existing services and data repositories will be elaborated in the most cost efficient and seamless way. NeMo is not just another proprietary platform for electromobility but a full open eco-system allowing continuous and uninterrupted provision of data and services.



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EC funding: 7.836.827 €

Duration: October 2016 – September 2019

5 test sites

1 cross-country demonstration

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Figure 3: NeMo EU project at a glance

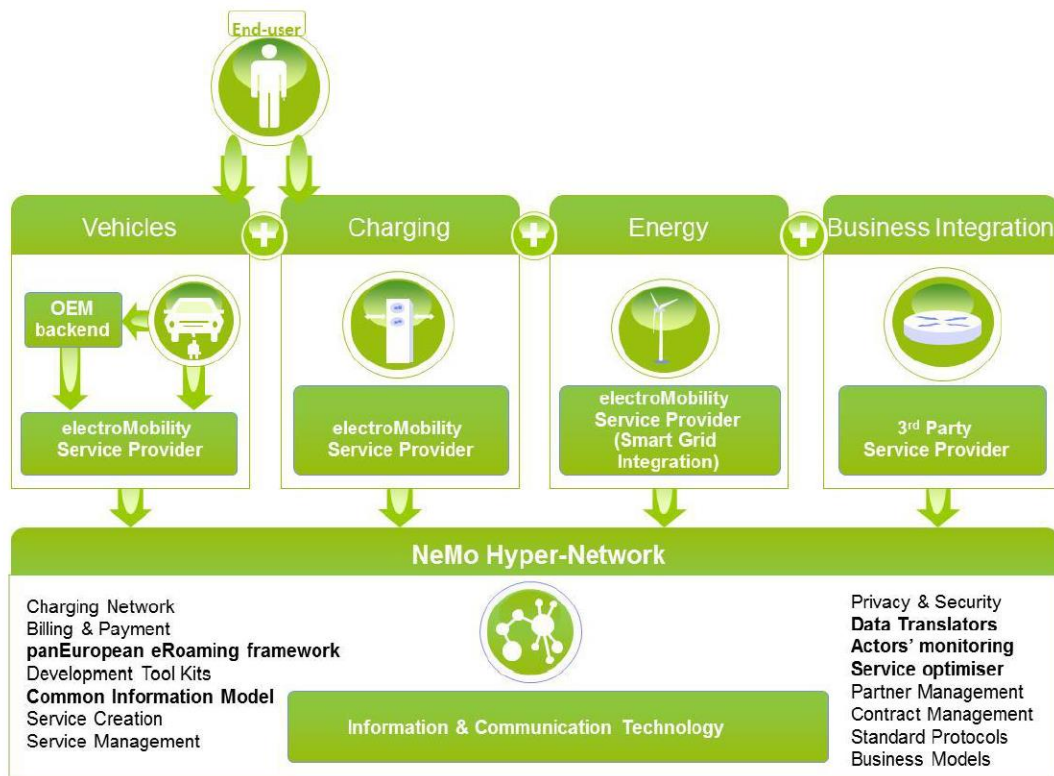


Figure 4: Electromobility actors integrated within the NeMo Hyper-Network

The main strategic objectives of NeMo are to:

1. Design and develop a Hyper-Network of electromobility services, which enables the provision of seamless and interoperable ICT services, to all users and actors relevant to electromobility (including smart charging and grid/energy-oriented services) throughout Europe, thus enabling the integration of the overall cycle of EV energy management, including ICT-based on-board charge system management.
2. Develop the backbone of this Hyper-Network by
 - a. creating common information models for objects, data and services, incorporating current standards, where such exist,
 - b. introducing a set of ICT interfaces, which will facilitate the communication and data access for all electromobility related actors,
 - c. developing a Core system capable of providing ICT services,
 - d. developing a set of horizontal services to facilitate the creation of innovative and smart services, and e) creating a set of open APIs that will enable an open B2B Marketplace for electromobility. This enables third parties, and especially SMEs, to integrate their services in the Hyper-Network in the future, and make them available to the NeMo's user base.
3. Develop a self-certification mechanism through conformity tools and processes to establish the quality and integrity of both data and services, enabling an efficient and affordable integration of new and multiple partners (especially DSOs or utilities companies) and services within the Hyper-Network, thus strengthening and promoting an open and innovative European electromobility market.
4. Develop a pan European eRoaming framework, by linking existing eRoaming platforms and by designing a common and open European Inter-Roaming protocol, instead of just dealing with the current protocol diversity. This will reduce the complexity of using an EV, enabling the EV owner / driver to use a complex technology in a very simple and transparent way, similar to mobile phone roaming.

5. Address and successfully resolve any operational and organisational issue arising from the increased B2B connectivity that eRoaming will bring, developing new business models and scenarios for all involved actors aiming at increased user base and new revenue opportunities.

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Volker Fricke works at IBM Germany as Technical Relations Executive, Europe. He represents IBM in international and national standardization bodies, such as ISO, W3C, DIN, DKE in the domain of „Connected Vehicle, eMobility and Co-operative Intelligent Transport Systems (C-ITS) for autonomous vehicles. He leads IBM involvement in European Horizon 2020 research projects in the domain of electric and green vehicles. He was the Lead IT Architect from IBM in the European Research project „Green eMotion“ and he is the technical lead for the “Green Vehicle” NeMo EU project. He holds various patents and publications in the domain of Internet-Of-Things together with other IBM colleagues. He is contributing and participating at conferences about “Connected Vehicle”.