



Hyper-Network for electroMobility

Horizon 2020 Programme

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NeMo Stakeholder Forum Conference and Technical Developer session

IBM offices, Ehningen, Stuttgart
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Event summary report



Prepared by Andrew Winder (ERTICO), November 2017



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Introduction

NeMo is a 3-year project which addresses the issue of lack of interoperability in electromobility services. It aims to make electromobility more attractive, focusing on seamless interoperability of charging and other electromobility services. It will apply to electromobility services the concept of inter-operator and international roaming (as in mobile telecommunications).

Specifically, NeMo is creating a **Hyper-network of tools, models and services** to create an open, distributed and widely accepted ecosystem for electromobility. This will allow charging points, roaming operators, the electricity grid, system operators and service providers, vehicles and their owners/drivers to connect with each other in order to exchange data and to provide electromobility ICT services in a fully integrated and interoperable way.

NeMo will facilitate increased service availability, better planning and more secure electric grid operation, by making backend data and services accessible to the right actors and bringing down barriers. An Open Cloud Marketplace will enable service providers to reach more users and provide more seamless services. NeMo will boost the market share of electric vehicles through better accessibility to charging infrastructure, ICT services and wider B2B interconnectivity.

The project started in October 2016 and runs for 3 years, until September 2019. It includes 19 partners representing the automotive, research, software, operator, public authority and energy sectors. NeMo is co-funded by the Horizon 2020 Research and Innovation Programme of the European Union (grant agreement no. 713794).

Annual stakeholder events are planned in NeMo, in addition to participation in external events and other communication and stakeholder engagement activities. NeMo seeks to engage a wide range of external bodies in order to ensure the success of the Hyper-Network in achieving its objective of transforming electromobility in Europe. Potentially interested organisations include providers of electromobility and related services (navigation, payment, etc.), charging station manufacturers and operators, public authorities, electric vehicle manufacturers, application developers, researchers and academia, infrastructure owners (roads, car parks, service stations), energy providers and distribution operators, electric vehicle fleet operators (cars, buses, e-bikes, logistics), consultants, media, associations, etc.

The **NeMo Stakeholder Forum** is open to all by signing up at <http://nemo-emobility.eu/nemo-forum> and/or by joining the LinkedIn group at www.linkedin.com/groups/12012387. It enables members to engage with the project in terms of providing feedback on project outputs as well as to be informed of project developments and to be invited to NeMo events.

This public report summarises the outcomes of the first annual project event, the **NeMo Stakeholder Forum Conference**, which took place on 12th October 2017 at the premises of NeMo partner IBM Deutschland at Ehningen, near Stuttgart. This conference included a parallel **Developer Session** aimed at technical stakeholders and focusing on electromobility service creation. This event took place following the EVS30 (Electric Vehicle Symposium) event which was held nearby at Stuttgart Messe on the three preceding days; it was separate to EVS30 but successfully capitalised it by attracting key stakeholders who were already in the Stuttgart area for this major annual electric vehicle event.

Participation

A total of 75 persons registered for the event (60 for the Stakeholder Forum Conference and 15 for the Developer Session), NeMo partners included. Actual attendance was 62 (48 for the Stakeholder Forum Conference and 14 for the Developer Session).

External stakeholders came from 24 different organisations including charge point operators, a vehicle manufacturer, IT companies, service providers, an energy provider, associations, universities and research organisations. They came from seven different countries (Germany, France, the Netherlands, Belgium, the UK, Spain and Korea).

Event Report

Please note that the presentations made at this event are available on the NeMo website at <http://nemo-emobility.eu/presentations>

Plenary introductory session: 09:00 – 09:35

Chaired by: Dr. Angelos Amditis, Research Director, Institute of Communication and Computer Systems – ICCS / NeMo Project Coordinator

Dr. Amditis opened the Conference and a welcome address by the host organisation was given by **Mr. Axel Rogaischus**, Vice President Industrial Sales, IBM. He noted that it was appropriate that this event was being held in Stuttgart with its key vehicle manufacturing industry, as the development of electromobility has recently moved to the first position in terms of priorities of the automotive sector.



Opening and Welcome, Axel Rogaischus (IBM Deutschland)

Dr. Amditis then introduced the NeMo project, its **vision, objectives and expected impact**. Its vision is 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.

As well as building the Hyper-Network, objectives include creating Common Information Models for objects, data and services, a set of ICT interfaces and a core system. With these there will be horizontal services to facilitate the creation of innovative and smart services, open APIs that will enable an open B2B marketplace for electromobility, a self-certification mechanism and new business models.

Overall, NeMo is expected to improve the attractiveness of EVs, to unify charging infrastructures for all connected operators, to allow easy creation and delivery to a wide audience of innovative, interoperable electromobility services via an open cloud marketplace, to facilitate information exchange and to integrate smart-grid applications and services.



NeMo Strategic Objectives, Angelos Amditis (ICCS)

Dr. Volker Fricke, Technical Relations Executive of IBM explained in more depth what the NeMo Hyper-Network will really be and how it will work. This focused on the Blockchain for business, featuring a shared ledger, smart contract, privacy and consensus. He also covered the main building blocks of the Hyper-Network, linked by Distributed Ledger Technology.

Parallel session 1: Stakeholder Forum Conference: 09:35 – 12:55

Chaired by:

Dr. Angelos Amditis, Research Director, ICCS / NeMo Project Coordinator

Mr. Andrew Winder, Manager, ERTICO – ITS Europe / NeMo Dissemination Manager

This session commenced with a presentation on Scenarios and Use Cases, as well as their implementation in the test sites. **Dr. Selini Hadjidimitriou**, Research Fellow at the Interuniversity Consortium for Optimization and Operation Research (ICOOR) presented this first phase of NeMo's work. The focus was the seven Business Scenarios developed:

- BS1: Smart Charging
- BS2: Itinerary planning
- BS3: Cross-Provider/Border booking, authorisation and payment management
- BS4: NeMo Network Service
- BS5: Horizontal Services
- BS6: E-Mobility Report
- BS7: Vehicle Preparation for Drive Off.

A number of use cases are associated with these Business Scenarios and the aim was to validate or improve the scenarios through discussions with the stakeholders present.



Scenarios and use cases: implementation in the test sites, Selini Hadjidimitriou (ICOOR)

Ms. Sonja Pajkovska, responsible for Research, Development and Innovation at electromobility roaming provider Hubject then presented the work on Interoperability and Regulatory requirements. In electromobility, interoperability means that the user of an EV should be able to charge their car at any charging point using their usual choice of authorisation and payment method. Work to date has identified a large number of initiatives, projects and regulations at national level across Europe, but few nationwide interoperability schemes. There are commercial initiatives from private operators which have achieved interoperability through e-roaming platform protocols but there is still a huge gap between different European countries.



Interoperability and Regulatory requirements, Sonja Pajkovska (Hubject)

Parallel discussion sessions were then held covering these two topics, with two groups alternating between discussion areas. A summary of the main points follows:

Discussion session on scenarios and use cases:

Roaming:

- Discussion on NeMo's focus: e-roaming or inter-roaming? Inter-roaming is a major goal. The end user will experience that by being able to seamlessly use his EMPS account in roaming situations, so both cases should be covered.
- Roaming is always about drivers (considered as OEM customers) being able to drive anywhere, anytime, and being able to use charging infrastructure seamlessly. A core concern of roaming is pricing.
- Even though it is a major concern, the project is not limited to e-roaming.

Business Scenarios:

- Discussion on the value of having vehicle drive-off preparation as a core business scenario in a project where the focus is on interoperability and inter-roaming. It seems like a very minor point that should be the driver's responsibility instead of a core NeMo concern. However drive-off preparation might be considered a precondition for smart charging. But most stakeholders saw smart charging related to pricing and infrastructure usage optimisation, not about drive-off preparation (or driver services in general). Drive-off preparation should be a support activity around itinerary planning, not a core business scenario.
- Business Scenario 2 on itinerary planning is a core concern for OEMs to offer a valuable EV proposition to drivers, especially real time charge point availability. This should include dynamic data propositions to be useful (roaming, real time availability for charge points, seamless authorisation and payments).
- Charge point operators (CPOs) present considered all the presented business scenarios to be interesting but especially the smart charging and e-roaming/itinerary planning scenarios. But is the communication between DSOs and CPOs considered in the project? It is an interesting concern for power-grid load balancing, but most stakeholders do not see power-grid balancing as a major concern for NeMo.
- Common information models are important for the project but a minor business concern.
- Long distance itinerary planning should be a major concern in the project, especially dynamic services. Static map information is usually lacking (EV POI data) and that makes it hard to provide reliable information for drivers (e.g. charge point compatibility information). It is not clear how will

drivers see inter-roaming in different connected service providers. The quality and completeness of data is the most important part, to ensure drivers can rely on the services NeMo provides. This is most important when it comes to relying on dynamic services such as availability and payments.

- Stakeholders showed interest in horizontal services related to smart charging.

Use cases:

- E-mobility as a service would be an interesting use case not considered in NeMo.

Standards:

- Suggestion to consider ETSI standards as a starting point for standardisation.

Smart charging, energy and pricing:

- There will be new market opportunities based on the connection between electric vehicles, the grid and the private infrastructure. This includes solar panels, battery storage and reverse charging, private infrastructure sharing, P2P charging, etc. It is not clear how or if NeMo is addressing those.
- Is there a consideration for dynamic energy supplier choice? (Choosing the energy supplier providing energy to a particular charge point).
- Is it possible to achieve a similar process for charging infrastructure as works now for mobile phones, where there is a default provider that can always offer roaming services?
- It usually takes over 30 days to change the energy supplier for a charge point.
- Understanding and accurately predicting EV energy requirements is also a core service for OEMs.
- Smart charging will become a lot more complex once off-grid charging services become an option for private charge points. This is not entirely feasible today for regulatory reasons (for example: solar powered off-grid private charge point sharing).
- Smart charging is usually very limited by incomplete or unavailable charge point compatibility information. This can be improved by the itinerary planning services.
- Smart charging was of high interest. There was also interest in connection capabilities between an EV and a charge point. NeMo selected three scenarios related to smart charging, one of those explores the usage of ISO 15118 in connected vehicles.
- OEMs present pointed to privacy and security considerations in this respect. No identifying information may be shared outside of the secure systems of a vehicle. This would prevent any kind of infrastructure equipment from requesting services from a vehicle (e.g.: reverse charging).
- Smart charging is explained in too many different ways in different projects and standards. It might be useful for NeMo to provide a consolidated view which could be based on eMI³ (electromobility ICT interoperability innovation platform) protocols.
- CPOs should be able to know or predict in advance the energy needs of an EV.
- Predicting energy needs on a generalised way implies predicting driving behaviour. It has been tried before with ICEs and found to be quite difficult and very unreliable.

Data exchange:

- There is a lot of interest in accessing project data to further other research activities. What data from NeMo can be considered open and which data is private to the consortium? Open data is increasingly important in European projects.
- There are technical and business implications in the open exchange of data.
- Will GDPR affect NeMo? It is unclear at the moment, however NeMo does not own any data as it is not a legal entity - it simply facilitates the exchange of data between private parties.

Perspective from South Korea:

- A Korean team is working on charge point infrastructure. Stakeholders are working on charging infrastructure research, including smart charging. The current team's interest is getting an overview of the state of the art of standardisation and new development efforts in Europe regarding charging infrastructure for EVs. They are very interested in standardisation efforts around e-roaming and interoperability. They are interested in connecting different e-mobility platforms and see business scenarios one and three as the most relevant for the project. They would also like to see efforts on integrating private charging infrastructure into EV services network. Private charge point sharing is a major business opportunity. It is not clear yet how booking and payments could work on private infrastructure. They are also interested in wireless authentication solutions (included in NeMo as a general service).

Discussion session Interoperability and Regulatory requirements:

Obstacles identified:

- Cross-border taxes result in complex billing, one single bill is currently not possible.

- Open standards / protocols
- Liberation of energy
- EU directives are not specified enough and each country implements them differently. Countries should agree to implement them similarly.

Measurement issues and pricing:

- One single bill. Payment should be interoperable; currently interoperability of payment does not exist.
- It should be possible to bill for kWh delivered and not for time. It should be allowed to sell energy, not time. Currently it is not allowed to sell energy, it needs to be transformed to time; this should change.
- It should be allowed to sell energy at a different price than it what it costs, otherwise there is no added value and motive to invest on infrastructure.
- There should be more conformity between the price models in different European countries.

Electrical requirements:

- Electrical requirements for charging stations should be unified.
- Further integration of EVs with energy infrastructure is needed; the current regulation is outdated.
- Open standards / protocols are needed.
- The 15118 protocol should be extended to transfer the information needed for eRoaming.

Business models:

- Operators are trying to find how to offer smart charging; they will need to change their business models.
- More flexibility should be given by regulation on business models, giving room for innovation. Currently no best practices are available.
- The role of energy supplier should be separated from DSO (Distribution Supply Operator).
- There should be incentives for infrastructure owners to make their charging stations available to others. These may include public funding for private entities or incentive models for DSOs if they own a charging station. One solution is that the charging infrastructure is installed and belongs to the same organisation that is currently responsible for the energy infrastructure.
- One idea is the creation of local energy communities, in which the DSO may opt in and energy can be consumed by local renewable energy sources.



Discussion session

After the first discussion sessions, the presentations continued with **Dr. Evangelia Portouli**, Senior Researcher at ICCS, presenting the NeMo Common Information Models. She explained that one of the pillars of NeMo Hyper-Network is the possibility to exchange data using a common NeMo

meta-language, which will comprise Common Information Models (CIM), Data translators and common interfaces, and Smart Processing/Data Management algorithms. The CIM (for physical objects and data structures) is based on previous relevant work (e.g. specifications from the eMI³ platform) and integrates existing standards on information modelling related to electromobility in order to create a consistent format for data.

Business objects were presented, which comprise EV charging infrastructure, the final user, the charge session, smart charging functionalities, a marketplace for service creation and delivery, grid loads, and vehicle preparation for drive-off. These are complemented by a range of support objects. The proposed CIMs will form the basis for the service creation and provision within the NeMo Hyper-Network and to build translators so as to translate data from proprietary formats to the NeMo language. It is expected that this common language will promote the interoperability of electromobility services and will enable the better user's experience. During the project developments and the low level design, some changes may be necessary in the CIM proposals, in which case the proposed models will be updated accordingly.



NeMo Common Information Models, Evangelia Portouli (ICCS)

Mr. Jean-Marc Rives, Technical Director at French-based roaming provider Gireve, then presented the Open European Inter-Roaming Protocol (OEIP). After introducing the concept of cross-border (or inter-operator) roaming and the two main current topologies (peer-to-peer and hub), the latter now including multi-hub topologies involving different e-roaming platforms. This opens the scope for inter-roaming between hubs. This requires data exchange between actors, additional features to transport business information, and integration with the NeMo Hyper-Network.



Open European Inter-Roaming Protocol (OEIP), Jean-Marc Rives (Gireve)

The final technical presentation was given by **Mr. Stefano Persi**, CEO of Mosaic Factor, a consultancy based in Barcelona focusing on IT solutions for mobility and transport. He gave an overview of the Hyper-Network Services, which will comprise horizontal services, EV driver/owner services, as well as grid, vehicle and battery services. Services can be developed in NeMo to showcase the potentiality of added value services and to test the flexibility and robustness offered by the Hyper-Network to (external) service developers.



Hyper-Network Services, Stefano Persi (Mosaic Factor)

NeMo aims to develop a set of specific smart and horizontal services on top of its Hyper-Network, as well as to allow new and existing (adapted) electromobility services to be offered through the Open Cloud Marketplace. These could include booking and prediction of demand for charging points, brokerage, pricing (static and dynamic), smart navigation for EVs, EV authentication, grid load management and forecasting, battery load management, improved state-of-charge information, etc.

Parallel discussion sessions were then held covering these three topics, with three groups alternating between discussion areas. These are summarised below.

Discussion session on Common Information Models (CIM):

In general it was proposed that the CIM should be flexible and expandable in the future, to support new needs as they arise. There is a need to provide interactive environment in order to dynamically create attributes/data translation for new objects that are not currently described. The discussion focused on the Charge Session, Smart Charge and e-mobility reporting Business Objects.

Charge Session Business Objects:

- It must be clear that the “ChargeDetailRecord” Business Object is exchanged between the Charge Point Operator and the entity that issues the bill to the final customer. In the “ChargeDetailRecord” the attribute “NumPhases” should be renamed to “TypeOfCharge” (AC,DC, 3-phased, inductive, etc.)
- It was noted that currently the price is calculated after the Charge Detail Record is issued, therefore the “GlobalTransactionCost” attribute, which refers to the B2B cost, should be optional. It should be separated to “EnergyCost”, “ParkingCost”, “BookingCost”, “OtherCost”, with the possibility to have other categories. A “Tariff” attribute should be added. (Prices differ between CPOs and EMPs). Price models to include occupation time vs connection time pricing.

Smart Charge Business Objects:

- Objects relevant to smart charging while parked for long should be added (mentioned case of charging at work over a long period). Currently the objects rather refer to mobility needs, i.e. in view of preparing a trip. Occupation time of space is different than charging/connecting time. Sometimes booked charge point could not have available parking space.
- It will be a challenge to collect all information needed for the “UserMobilityNeed” Business Object, maybe data from the vehicle and the user’s smartphone should be combined.
- An “Updated” attribute should be added, to distinguish if this is an original request or a need after a rerouting of the itinerary. Consider updating due to traffic (maybe relevant info could be provided by a service) or change of plans during trip.
- Aggregation of other energy sources, renewables, etc. and local mapping of those should be beneficial. Aggregators will be grouping these types of alternative to connecting to the grid resources.

E-mobility reporting Business Objects:

- Business Objects should not include complete charge detail records due to sensitive personal information, rather they should target anonymised energy transfer data. The power/consumption profiles should be requested instead, and consider that the energy consumption of the charge points as a whole does not only include the EV charging. (DSOs, cities or charge point operators have this data, and prediction of energy is usually done by DSOs).
- In general, the energy players are not interested in the energy delivered to vehicles but in the energy that has passed at the AC connection, and such consumption data are or will soon be available by smart meters at the charge points.
- The Business Objects in this area could be interesting for third parties that wish to develop prediction and forecast services for planning authorities.

Discussion session on Open European Inter-Roaming Protocol (OEIP):

Role for roaming platforms:

- Discussion regarding why roaming platforms are still needed despite the NeMo connection. Also the scope of the inter-roaming, that is to say, which functionalities of different roaming platforms do they cover.
- There is a need for roaming transparency and to deal with a combined multi-hub / peer-to-peer topology.
- Users and charge point operators need to be informed of the roaming possibilities.
- There is a need for notification of new roaming actor (roaming platform / electromobility platform / charge point operator).
- Roaming platforms should have an aggregation role, not only aggregating status but also speaking on behalf of actors (clearing house).
- Concern was expressed regarding how far collaboration between the platforms goes. Will the roaming platforms share data with the rest of the network, when there is no inter-roaming? If yes, how much data?
- Question regarding the subset of services provided by the inter-roaming, on how it will allow the roaming platforms to differentiate.

Performance:

- There is a need to optimise response timing and avoid infinite loops. Charge point operators need a very fast response time and electromobility platforms need near real time information.
- There are concerns about performance if data needs to flow through the network. We need to balance the performance needs of the actors.

Privacy:

- GDPR related issues are a real concern; this is difficult to integrate into NeMo.

Pricing:

- There is a real interest regarding how energy tariffs can evolve, especially as this is challenging in the face of regulations.
- There is an interest regarding billing: is it B2B? B2C? Does it give the information for billing or does it do the actual billing? Especially for roaming platforms.

Other services:

- There is a need for the integration of other services that are not necessarily directly related to EVs or energy.

Discussion session on Hyper-Network Services:

Four main questions were posed by NeMo consortium partners to the stakeholders present, with a summary of responses as follows:

Which service would you (or other entities) be interested in using?

- Local energy management taking Dynamic pricing, real time pricing, user acceptance and HMI aspects into consideration.
- Smart Navigation with a clear user interface.
- No battery data can be transmitted outside the vehicle unless defined within a strictly governed private ecosystem. Therefore such services would not be interesting from the OEM perspective.

Which other service would you suggest that NeMo addresses?

- Peer-to-peer energy markets. Focus on contracting mechanisms.
- Battery health.

How should trust in services hosted by NeMo be developed?

- High quality of service, especially during the initial stages of deployment. Sharing of energy data according to corresponding standards (MyEnergyData).
- Leaving testing at the client side is OK as long as basic testing tools are available.
- Service ranking is highly advisable but OEM would still run intensive tests before including a third parties service.

How do we increase re-usability of e-mobility services and patterns?

- By following a micro-services approach in software development. By enabling service contracting as an incentive and by using data as a means of connecting business actors.
- By ensuring fine detailed information service abstraction.

Parallel session 2: Developer Session: 09:35 – 12:55

Chaired by:

Dr. Volker Fricke, Technical Relations Executive, IBM Deutschland

This session, presented by **Mr. Johannes Fährdrich** of the Technical University of Berlin, first described the NeMo Architecture and practical challenges for efficient service integration into networks. It then focused on developing and utilising NeMo services. NeMo will provide a service development environment that allows for the specification of service processes, integrates service search at design-time based on semantic service descriptions, enables the composition of services to value-added services, is itself running within the cloud infrastructure, and which comes with testing features.

It then gave use cases of different service developments, including with VSDT (Visual Service Design Tool), service description and search with SSM (Semantic Service Description), and the service execution environment.



Developer Session: Service development and integration for the NeMo Hyper-Network, Johannes Fährdrich (TU Berlin)

Conclusions: 12 October, 14:00 – 14:15

Dr. Angelos Amditis provided an overview of the morning's sessions, which presented the main findings of the first year of the NeMo project: use cases and business scenarios, requirements, Common Information Models, Inter-roaming protocol and specifications of services. It collected very useful feedback, opinions and suggestions which will allow the NeMo partners to refine and update their findings and improved the development of the Hyper-Network.

NeMo's evaluation activities include deployment in each site (five countries) where different scenarios will demonstrate full operational capabilities. A final test drive will take place with the

same EVs travelling across different European countries, with real users in real charging and transportation conditions, to demonstrate the seamless usage of electromobility services. As a preparation for this (and to measure the baseline and current issues facing long distance drivers using EVs) a first test drive took place using two Renault ZOE electric cars from Turin to Barcelona at the beginning of October 2017 (this trip is summarised on the NeMo website, here: <http://nemo-emobility.eu/nemo-cross-country-test-drive-maps-challenges>).

Finally he urged the participants to stay connected with the project via the website, Twitter (@NeMo_electro) and LinkedIn (www.linkedin.com/groups/12012387), and highlighted that NeMo will participate in future external events as well as holding a second Stakeholder Forum Conference in 2018. He ended by thanking the participants for their active engagement and IBM for hosting the event.