Hyper-**N**etwork for **e**lectro**Mo**bility

D3.2 NeMo open European Inter-Roaming protocol

Work package	WP3: NeMo Data Management
Task	Task 3.4: Design of open European Inter-Roaming protocol
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Dissemination level	Public (PU)
Status	Draft
Due date	31/10/2017
Document date	21/12/2017
Version number	1.0
	*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 713794.*

Revision and history chart

Version	Date	Main author	Summary of changes
0.1	19/06/2017	Albert Lochmüller	First Iteration of the Document, including technical interfaces, standardization and protocol details
0.9	28/06/2017	Thomas Fousse	Review including information from Gireve
0.10	09/08/2017	Sonja Pajkovska	Document Review
0.11	06/10/2017	Thomas Fousse	Document restructuring to apply with WP2.2 Requirements
0.12	22/11/2017	Sonja Pajkovska	Information added in Chapter 2 and 3
0.13	07/12/2017	Thomas Fousse, Sonja Pajkovska, Evangelia Portouli, Christina Anagnostopoulou	Restructuring and final edits. Sent for internal review
1.0	21/12/2017	Thomas Fousse, Sonja Pajkovska, Evangelia Portouli, Christina Anagnostopoulou	Final after internal review

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List of abbreviations

Abbreviation	Meaning
BS#	Business Scenario Number
CDR	Charge Detail Records
CIM	Common Information Model
CPO	Charge Point Operator
DDD	Dynamic Data Download
eMI³	eMobility ICT Interoperability Innovation
eMIP	Electro Mobility Inter-roaming Protocol
eMSP or EMP	Electro Mobility Service Provider
eRoaming	Electric Mobility Roaming
EVSE	Electronic Vehicle Supply Equipment
EVSEID	Electronic Vehicle Supply Equipment Identification
Inter-Roaming	Cross-Country Electric Mobility Roaming
OICP	Open Intercharge Protocol
POI	Point of Interest
RFID	Radio Frequency Identification
SDD	Static Data Download

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Executive Summary

The NeMo project aims to develop a Hyper-Network of tools and services, to enable the interoperable and seamless provision of electromobility services across countries and across service providers. The present document presents the open European Inter-Roaming protocol proposed by NeMo. The Inter-Roaming protocol is a functional protocol for eRoaming platforms to communicate and exchange data between themselves and to expose their data to the Nemo Hyper-Network.

The interfaces served by the Inter-Roaming protocol are the exchange of static and dynamic charge point information, authorisation data and charge detail records.

The Inter-Roaming concept greatly simplifies the inter-connection between actors (CPOs or eMSPs), regardless of their physical connection. An actor needs simply to connect to one eRoaming platform either directly or indirectly, via another platform or via NeMo, and the actor has access to all actors that are connected either to NeMo directly or to all connected eRoaming platforms. Similarly, an eRoaming platform can connect with all other already connected platforms either directly or via NeMo.

The proposed protocol is a functional one, each new eRoaming platform will have to cater for its own technical implementation. The implementation for the two eRoaming platforms that are NeMo partners is presented in this Deliverable. Any new eRoaming platform that wishes to join the NeMo Hyper-Network can follow a similar implementation of the NeMo functional open European Inter-Roaming protocol.

1. Introduction

The interoperability of electromobility services, for example to charge and pay or to find and reserve an available charging station, is expected to make electromobility more appealing to end users. One of the main aims of the NeMo project is to provide tools and create the backbone that will enable the exchange of data between electromobility actors and the provision of interoperable electromobility services across service providers and across countries.

A main category of electromobility actors are the eRoaming platforms, which are operational since some years all over the world. eRoaming platforms establish an interface between the backend systems of charging point operators (CPOs) and electromobility service providers (EMP) through a brokering system in order to enable a final user to seamlessly charge and pay at any of the interconnected charge points operated by the CPOs connected. Therefore, a specific activity of NeMo project is to develop an open protocol, the open European Inter-Roaming protocol, which will allow eRoaming platforms to exchange data between themselves and to expose their data to other stakeholders and actors via the NeMo Hyper-Network. The NeMo open European Inter-Roaming protocol, which is described in the present deliverable, is a functional protocol, describing all necessary services and interfaces to assure the interconnection between different eRoaming platforms and between an eRoaming platform and the NeMo Hyper-Network. The interfaces served by the Inter-Roaming protocol according to the specifications of WP1 of the NeMo are basically the exchange of static and dynamic charge point information, authorisation data and charge detail records.

The deliverable 3.2 is organized as follows. Chapter 2 describes the methodology followed. Chapter 3 presents the Inter-Roaming concept and functional architecture to connect eRoaming platforms directly or via the Hyper-Network. It also presents the data flows for each of the served interfaces. Chapter 4 presents how the two eRoaming platforms who are NeMo partners, Gireve and Hubject, expose their eRoaming features via the NeMo Hyper-Network via web services and how their data are matched to the NeMo Common Information Model.

2. Methodology

The work was based on the specifications that were collected in NeMo Deliverable 2.1, as regards the Business Scenario 3 “Cross-provider border booking authorization and payment management”. The data that need to be communicated, as specified in Deliverable 2.1, are shown in the following table.

#	Action, description	Request Data	Response Data
1a	Authentication (Some kind of Identification)	[Vehicle Data] [User Charging Preferences]	[Status]
4a	Booking	[Proposition Reservation Request]	[Status]
4b	Booking	[Proposition Reservation Request]	[Status]
4c	Booking	[Proposition Reservation Request]	[Status]
5	Authentication nearby or at the pole	[Vehicle Data] [Authorisation]	[Status]
6a	Notify EMP, that driver arrived and successful authentication	Request for [Authorisation]	[Status]
6b	Unlock	[Authorisation]	[Status]
7	Charge started event	[Charge Detail Record]	[Status]
8	Charge finished event	[Charge Detail Record]	[Status]

Table 1. BS3 Cross-provider border booking authorization and payment management data

An analysis of the above specifications of Deliverable 2.1 signifies that to enable the Business Scenario 3, the eRoaming platforms should exchange at least:

i) authorisation data,
ii) static charge point data,
iii) dynamic charge point data and
iv) Charge Detail Records.

For each of the above interfaces, the NeMo open European Inter-Roaming protocol proposes a functional process description.

The work was based on existing and widely used European roaming protocols (like OICP and eMIP) combined with the requirements of global standardisation norms (e.g. ISO 15118-1) and enriched by insights of international standardisation and harmonisation organisations and best practices out of the market.

Additionally, it was decided during this work that the eRoaming contracts must be propagated among eRoaming platforms. To enable roaming between them, eRoaming platforms must share information as regards roaming agreements. The logic of contract propagation is

depicted in the figure below. A CPO 1 or eMSP 1 connected to the eRoaming platform 1 should be able to do roaming with a CPO 2 or eMSP 2 connected to the eRoaming platform 2.

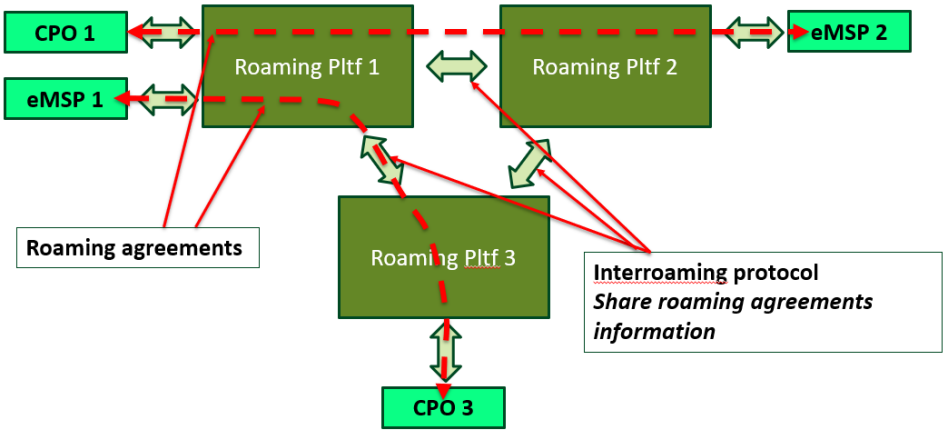

Figure 1 – eRoaming contract propagation flow between inter-connected eRoaming platforms

The need for contract propagation is described with the following example. One customer of an eMSP A wants to charge and thus tries to authenticate on a CPO's EVSE. The eMSP A and the CPO are connected to different eRoaming platforms. eMSP A is connected to eRoaming platform 2 and the CPO is connected to eRoaming platform 1.

If there is no sharing of eRoaming agreements between the platforms, the eRoaming platform 1 recognises that the CPO is in contract with eMSPs B and C. The eRoaming platform 1 processes the request for authorisation only against these eMSPs. The customer is not matched, so the authorisation request is denied and the customer cannot charge. The sequence of actions and information flow in this case is shown below.

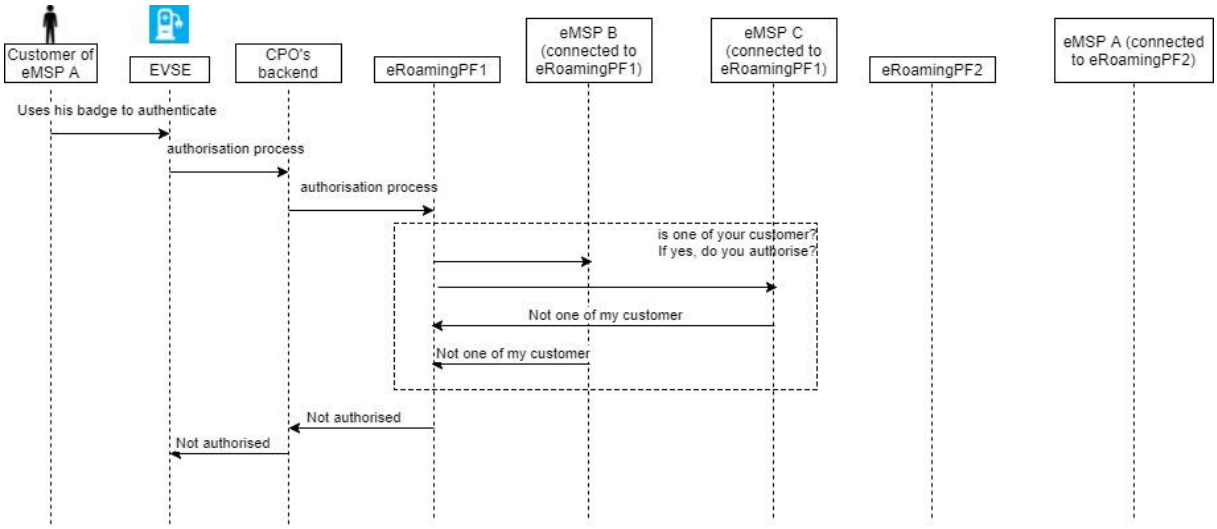

Figure 2 – Authorisation request flow chart when eRoaming contract propagation is not provisioned

When eRoaming platforms 1 and 2 have shared their roaming agreements, the eRoaming platform 1 recognises that the CPO is in contract with the eMSP A, so it processes the authorisation request against eMSP A for the customer's authorisation. In this case, the customer can charge. The sequence is depicted below.

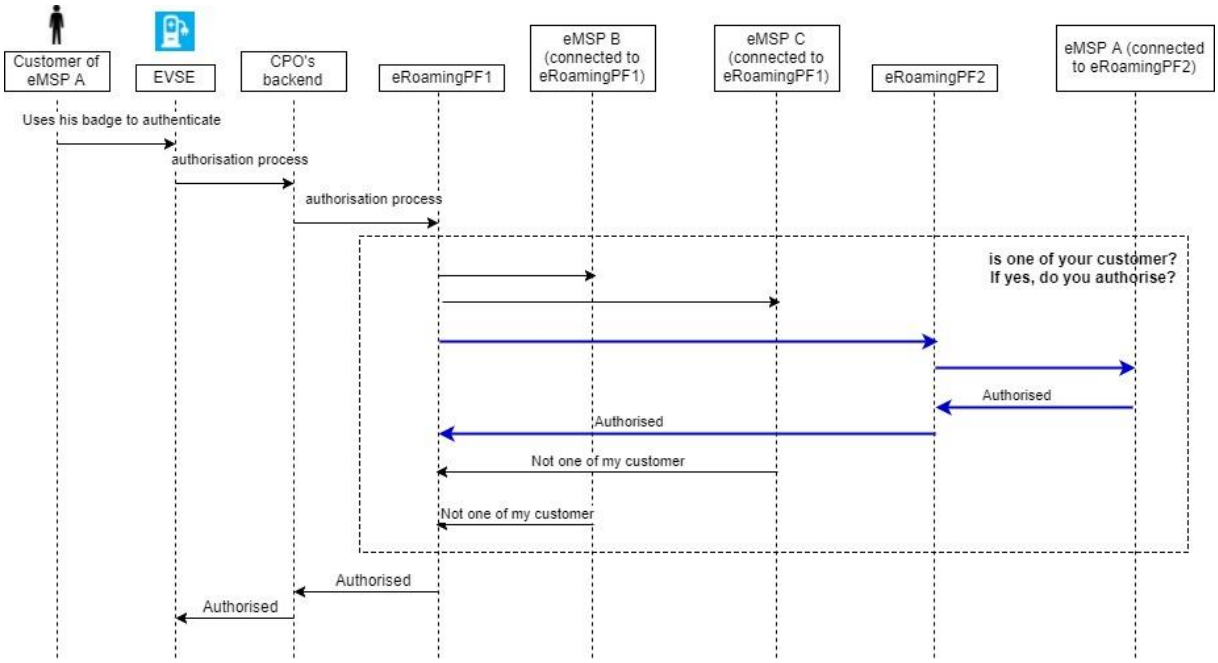

Figure 3 – Authorisation request flow chart when eRoaming contract propagation is available

Apart from authorisation, the propagation of eRoaming agreements is required for all other operations as specified by NeMo, namely to get static or dynamic charge point data and to exchange CDRs.

According to the above, a global requirement to enable Inter-Roaming for a CPO or eMSP connected to an eRoaming platform, is that the eRoaming platform knows all eRoaming agreements contracted between:

- this CPO and eMSPs or this eMSP and CPOs connected to the eRoaming platform
- AND those contracted with eMSPs or CPOs connected to any other eRoaming platform

3. The NeMo open European Inter-Roaming protocol

3.1 Concept and functional architecture

A communication protocol is a system of rules that allows two or more entities to exchange information. The NeMo Inter-Roaming protocol is a functional protocol that enables the direct communication between eRoaming platforms, as regards the four interfaces of authorisation, static and dynamic information about charge infrastructure and CDRs. Additionally, an eRoaming platform may publish its services to the NeMo Hyper-Network, providing eRoaming features, like any other NeMo service. Therefore, an eRoaming platform can exchange data in two ways:

- Exchange of data directly with another eRoaming platform. In this case, their connected CPOs and EMPs become inter-connected using the Inter-Roaming protocol.
- Exchange of data with the NeMo Hyper Network. In this case, the eRoaming platform publishes its services to the NeMo Hyper-Network via the NeMo service registry using the service brokerage. Consequently, all connected EMPs and CPOs of the eRoaming platform and of all other platforms connected via Inter-Roaming with it, are directly part of the Hyper-Network using the eRoaming services of the platform.

The concept and functional architecture of the Inter-Roaming protocol is shown in the following figure.

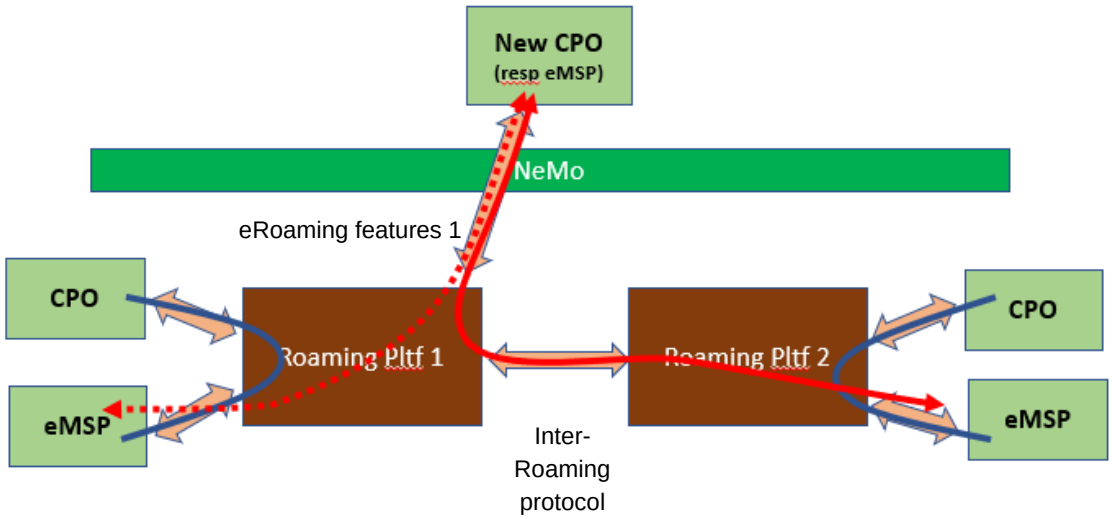

Figure 4 – Functional architecture of the Inter-Roaming protocol

The Inter-Roaming concept greatly simplifies the access of any CPO or eMSP to all other connected actors' services, because it allows any connected actor to easily make business with any other actor. Additionally, by implementing the eRoaming features of one platform

provided via NeMo, the connection of one actor (for example the new CPO in the figure above) with all other connected actors is feasible, no matter where the other actor's physical connection is, for example connection in Roaming platform 1 or 2. Supposedly, a new CPO (or eMSP) is connected to NeMo and wants to exchange services with any other CPO (or eMSP) connected either to Roaming Platform 1 or to Roaming Platform 2. Without the Inter-Roaming protocol, the new CPO (or eMSP) should implement the eRoaming features published in NeMo by both eRoaming platforms 1 and 2 in order to be able to connect with the actors of both. With the Inter-Roaming protocol, the new CPO (or eMSP) needs to implement only one of the eRoaming features provided through NeMo, choosing between the eRoaming features from Roaming Platform 1 or from Roaming Platform 2. This simplifies the connection of the new CPO (or eMSP) to all other connected actors.

It must be noted that the Inter-Roaming protocol allows two ways of connection of a new eRoaming platform to other platforms. A new e Roaming platform that connects to NeMo Hyper-Network can connect with the other already connected platforms either directly or via NeMo. For connection via NeMo, the new platform can provide its eRoaming features through NeMo making itself visible to all other connected actors. For direct connection to a connected platform, the new platform has to implement the Inter-Roaming protocol, as a generic functional protocol, and it is only needed to further specify the exact technical implementation. It must be noted that the new platform does not need to connect to all other platforms, it is enough if it only connects to one of them.

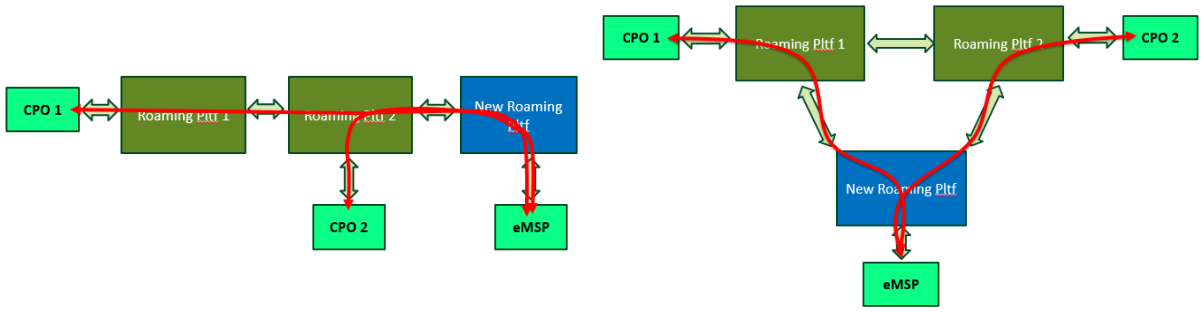

Figure 5 – Single versus multiple connections of a new eRoaming platform to other platforms via Inter-Roaming

3.2 Interface 1: Static Charge Point Data

The first interface of the NeMo Inter-Roaming protocol delivers the connection process for the exchange of static charge point data. The static charge point data are owned by CPOs. The CPO is responsible for the distribution, including creation, update and deletion of operations as well as ensuring data quality. The data flow for this interface is depicted in the following figure:

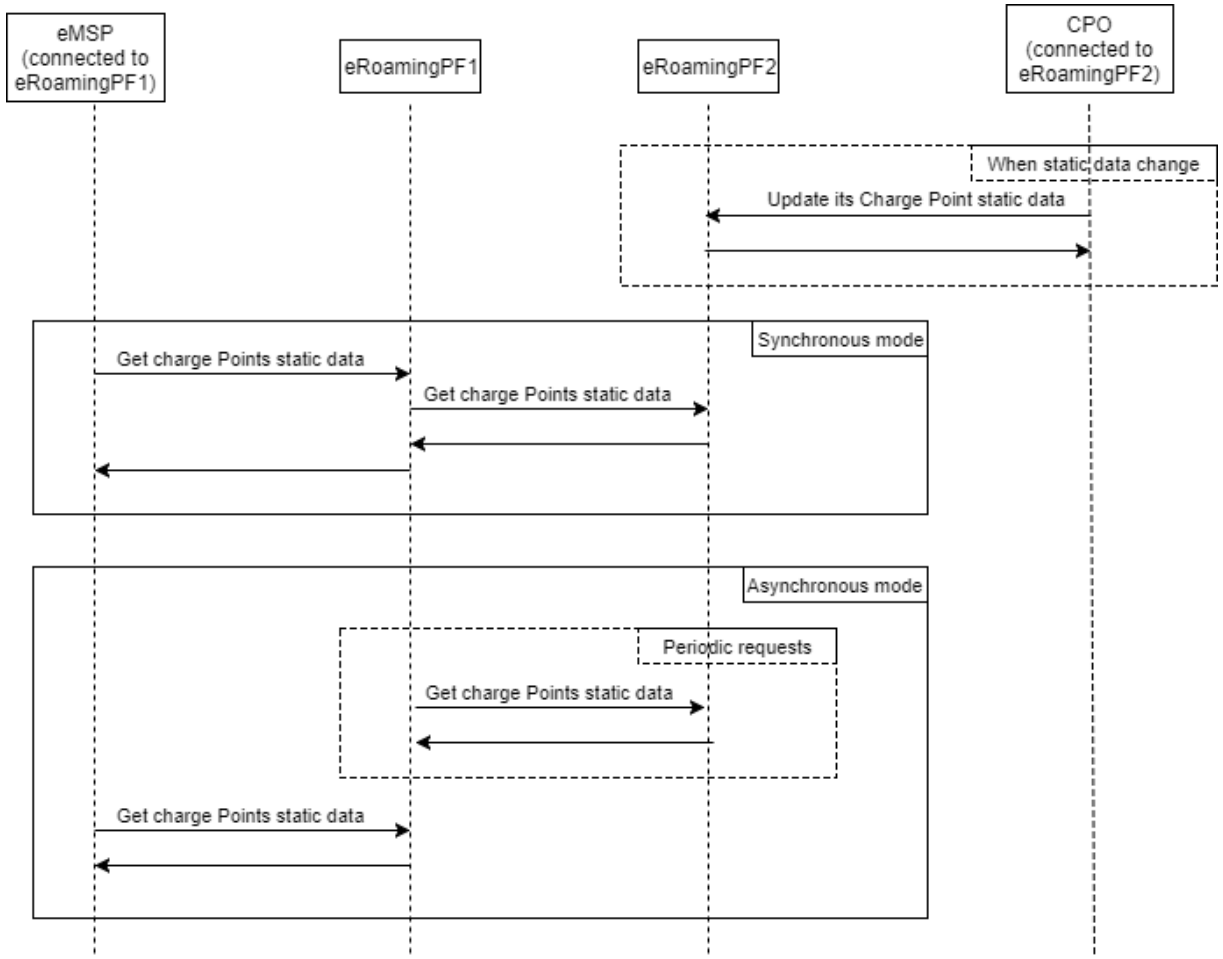

Figure 6 – Static Charge Point interface data flow

This interface aims at making the static data of a CPO available to any actor who needs them, wherever they are connected. There are several ways to achieve this. The two main options, as depicted in Figure 6, are: get static data from other eRoaming platforms synchronously when an actor requests them; or get and store static data periodically in order to have them available in the platform's system for all.

3.3 Interface 2: Dynamic Charge Point Data

This interface relates to the aggregation of dynamic charge point data, which may include for example the EVSEs real-time availability. The dynamic charge point data are owned by their respective CPOs. The data gets updated by the CPOs on every change related to a single EVSEID. The Inter-Roaming dataflow for this interface is described in the figure below.

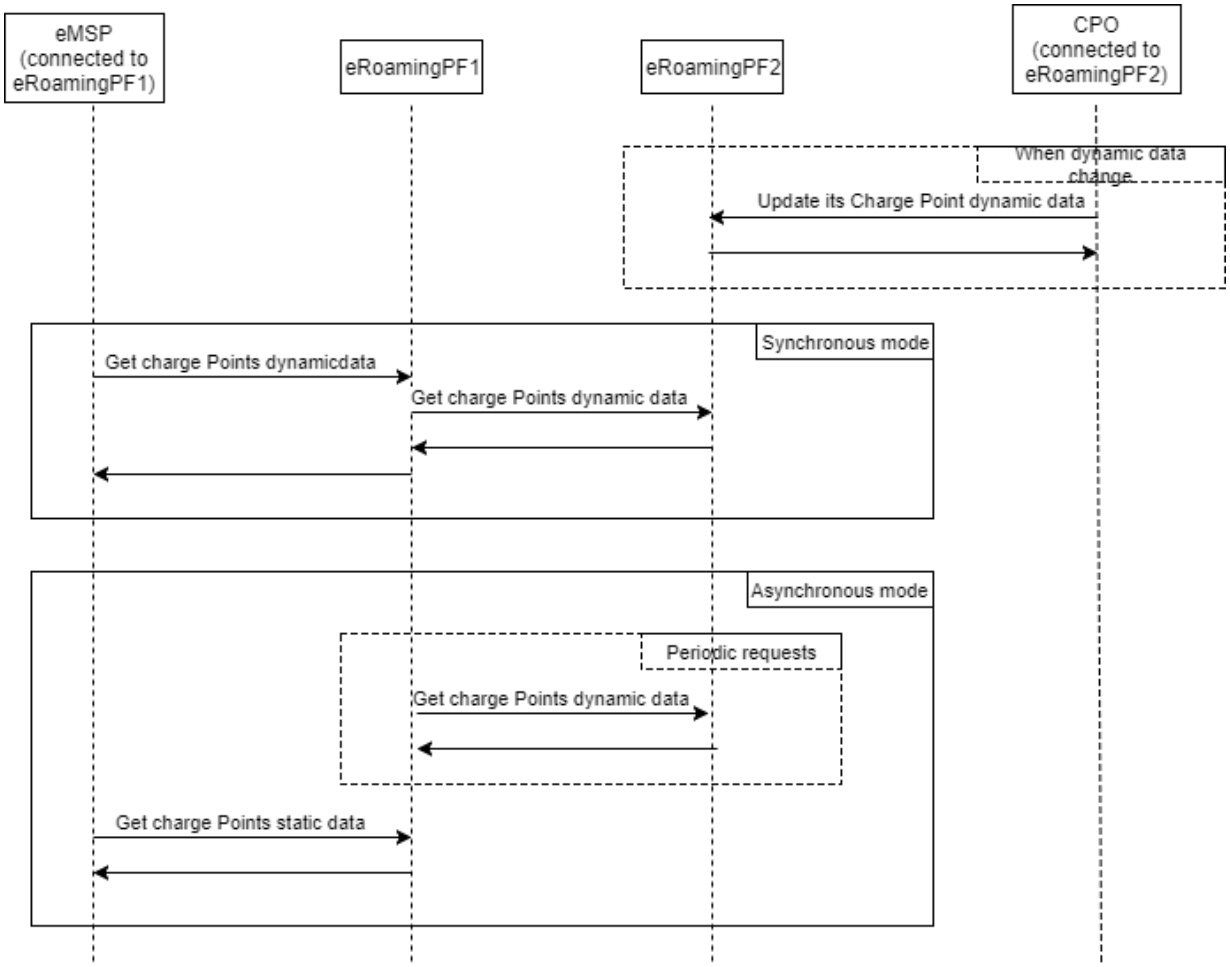

Figure 7 – Dynamic Charge Point interface data flow

Whenever an EVSE identified by a specific EVSEID indicates a status change (e.g. start of a charging event), the CPOs backend gets notified and forwards this information to the corresponding eRoaming platform. After this process is completed, the stored information can be retrieved by data consumers. As is the case for the exchange of static data, there are also two main options for the exchange of dynamic data: either get dynamic data from other eRoaming platforms synchronously when an actor requests them, or get and store them periodically in order to have them available in the platform's system for all.

3.4 Interface 3: Authorisation process

This is a process by which an eMSP grants or does not grant authorisation for a charging session of one of its customers on one EVSE of a CPO. According to the requirements of Deliverable 1.1, there are two possible ways of authorisation, direct and remote. Due to the different options available to invoke this event, the interface splits into two separate processes.

When the process starts at a certain physical EVSEID, for example when the user initializes the process with an RFID card, the data flow is as shown in the following figure.

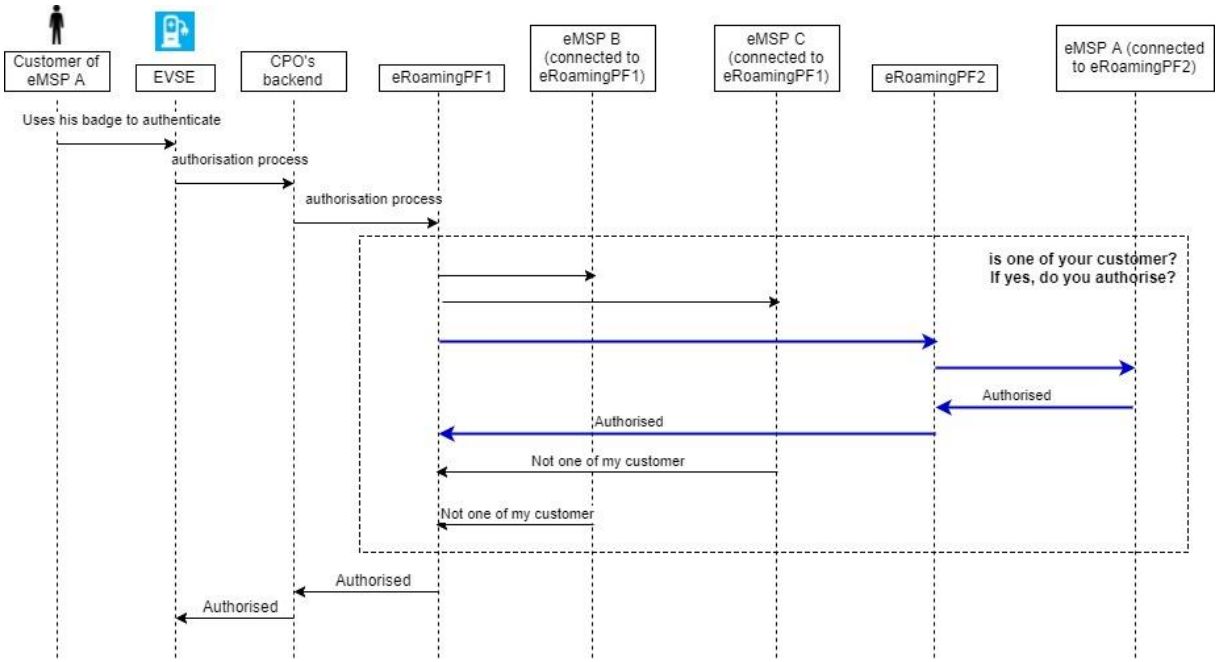

Figure 8 – Direct authentication process at the EVSEID

As depicted above, the CPO forwards the user ID to the connected eRoaming platform 1. The eRoaming platform 1 asks its connected eMSPs and eRoaming platform 2 and requests for authorization.

Any new eRoaming platform that connects to NeMo Hyper-Network, either directly to the already connected platforms or via NeMo by publishing its eRoaming features, automatically makes itself visible to all other connected actors by sharing authorisation data via its web interfaces, allowing for the authorisation of its clients to any EVSE, the eMSP of which is a client of any other connected platform. When the authorization process is invoked remotely, by an application, the process is being reversed and invoked by an eMSP, as shown in the following figure.

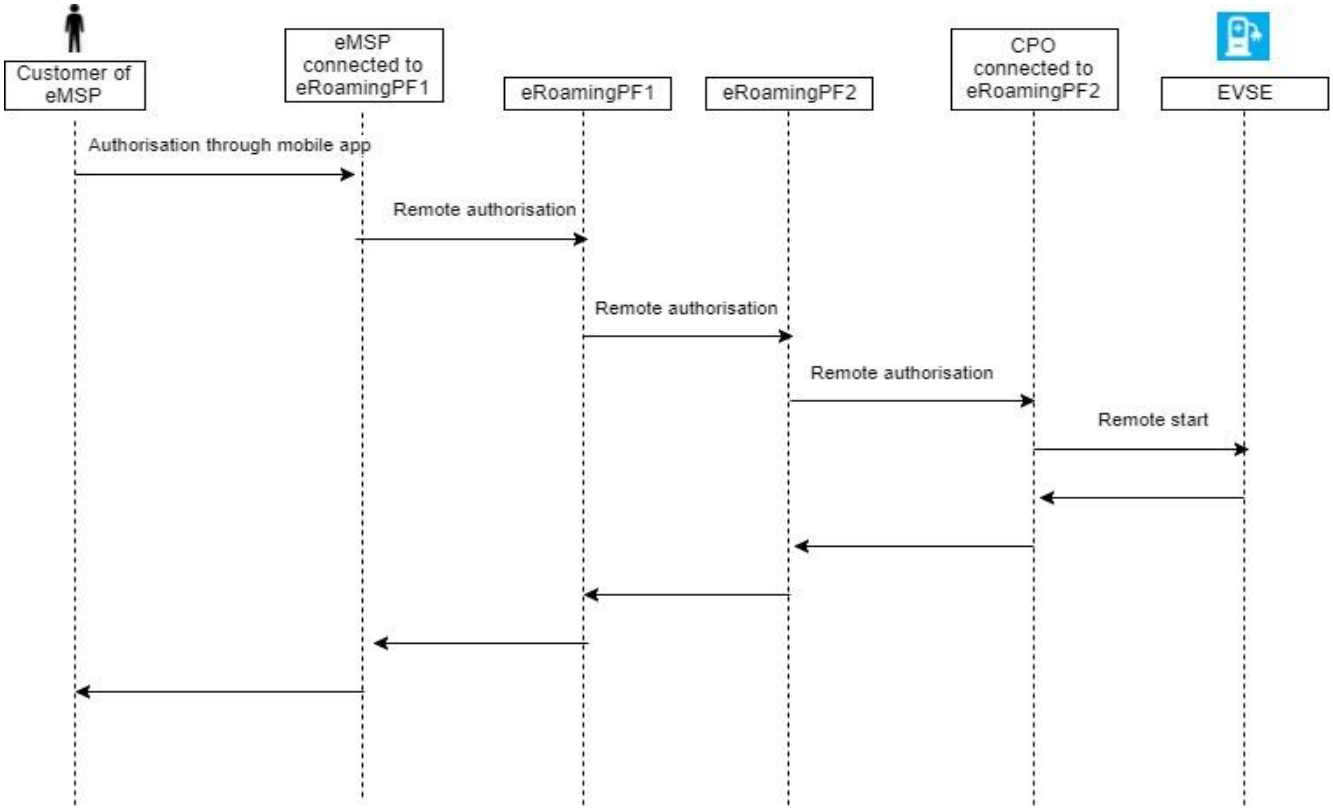

Figure 9 – Remote authentication process by an app

3.5 Interface 4: Charge Detail Records

This interface relates to the transmission of Charge Detail Records (CDRs) of an eMSP's customer recharge session by a CPO to an eMSP, on a CPO's EVSE. Charge detail records contain all billing relevant information to issue the invoice for the end customer, including the B2B clearance. They are provided by CPOs to be forwarded to the end user's associated EMP. Usually CDRs carry information about charging times, power consumption and possible additional information like smart meter ids. In general, CDRs are created when a charging event is concluded. The relevant data flow is shown in the following figure.

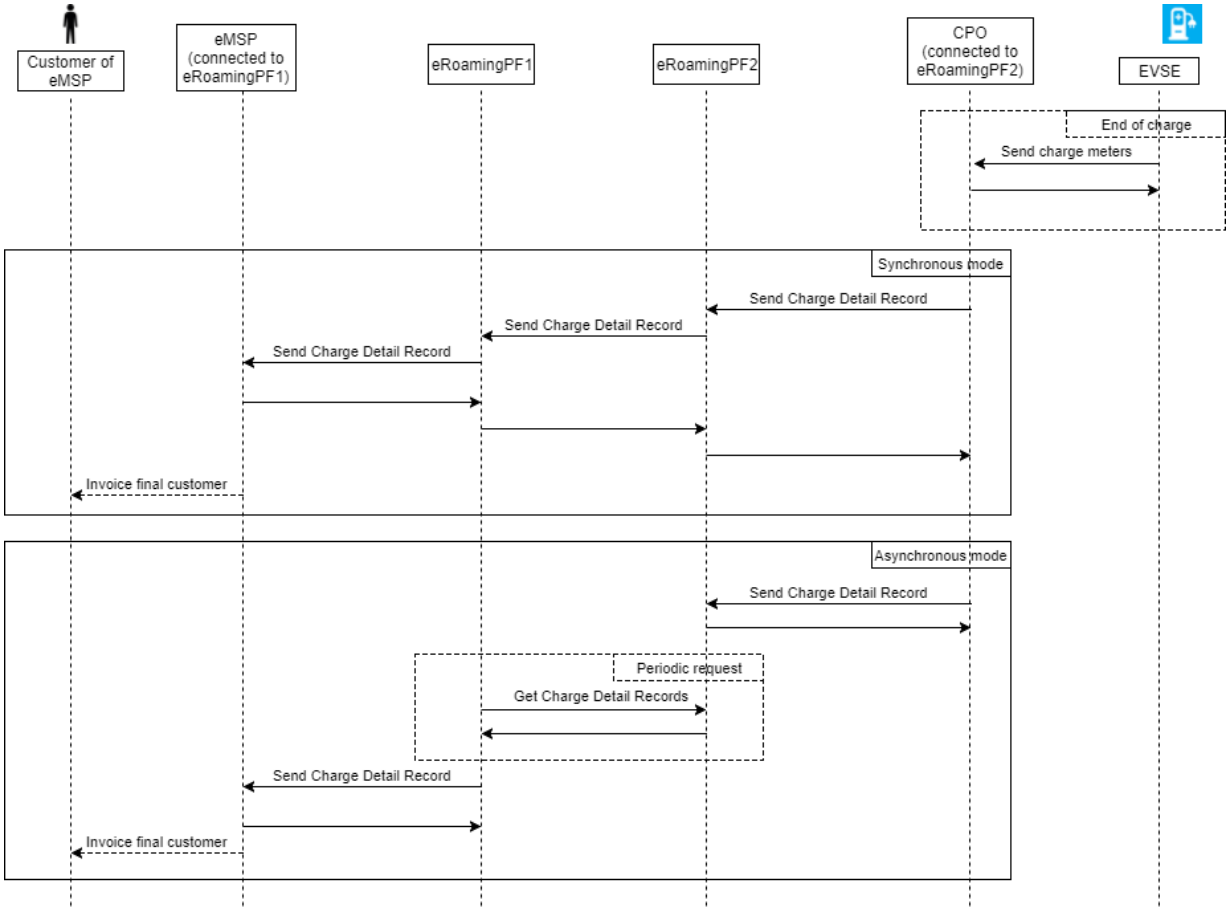

Figure 10 – CDR interface data flow

The CDR can be pushed directly from the CPO to the eMSP going through the eRoaming platforms, on the synchronous mode, or the CRD transfer can be performed asynchronously. The choice depends on the agreement between the two connected eRoaming platforms.

3.6 eMobility Service Providers and Charge Point Operators IDs

As agreed by European regulation, eMSPs and CPOs need to be identified by a unique identifier. These identifiers are a composition of a country code in 2 characters, a separator (mostly '*') followed by a three-digit code. The country codes have been appended to the IDs in order to guarantee doubtless cross-national partner identification. When one entity has both roles of EMP and CPO, two IDs will be assigned to it. The assignment of IDs should be specifically defined by a respective national institution. Still, today only 4 countries have defined a specific association responsible for these IDs assignments, which are:

- France with AFIREV (http://www.afirev.fr/)
- Germany with BDEW (https://www.bdew.de/)
- Netherlands with eViolin (http://www.eviolin.nl/)
- Austria with AMP (http://www.austrian-mobile-power.at/)

In other countries, CPOs and eMSPs assign themselves their operator IDs. This creates a risk, as there is no central entity ensuring the uniqueness of the identifiers. For these reasons, the above mentioned entities try, via the eMI3 working group, to address this topic. Some options are proposed, for example giving this responsibility to the entity of another country or creating a European-wide authorities. As operator aggregators, the eRoaming platforms reduce the risks related to IDs conflicts.

4. Implementation of the NeMo Inter-Roaming protocol

4.1 Introduction

As explained previously, the NeMo Inter-Roaming protocol can be applied by any other eRoaming platform as a generic functional protocol, and it is only needed to further specify the exact technical implementation in each case. The Inter-Roaming protocol allows the direct exchange of data between eRoaming platforms and the exchange of data between an eRoaming platform and the NeMo Hyper-Network.

The next sections present how this implementation was done within the NeMo project, as regards the interconnection of the Hubject and Gireve's platforms and the provision of eRoaming features to the Hyper-Network.

For each of the four interfaces, web services by each platform, Gireve (eMIP) and Hubject (OICP) have been defined. These eRoaming features are based in the Common Information Model (CIM) as it is described in D3.3. For this, a mapping of the Common Information Model attributes against the Gireve's eMIP protocol and the Hubject's OICP protocol is presented in the tables below per eRoaming feature. Consequently, these tables are equivalent to the data translators to be configured for the publishing of the eRoaming features to NeMo Hyper-Network. Translators as data handling tools of the Hyper-Network take into account privacy and security policies of respective translated data, to secure proper data management/ sharing.

4.2 Static Charge Point data

4.2.1 WebServices

Protocol	WebService	Description
eMIP	eMIP_ToIOP_GetEVSEData_FullList	This request belongs to the "Data Download" (SDD and DDD) services, and allows an eMSP to get EVCI description data. The requestor will get EVSE description, for each EVSE managed by a CPO with which the eMSP is in contract. For each EVSE, this request will give a set of attributes, attached • to the Charging-Pool and the Charging-Station that contain the EVSE (upper hierarchy), • to the EVSE itself

		• to the Charging-Connectors contained by the EVSE (lower hierarchy). This service has to be used in an initialisation phase, i.e. only one time.
	eMIP_ToIOP_GetEVSEStaticDataChanges	This request belongs to the "Static Data Download" (SDD) services, and allows an eMSP to get EVCI description data. The requestor will get EVSE description, for each EVSE managed by a CPO with which the eMSP is in contract, and that has changed since the last requestor call. For each EVSE, this request will give a set of attributes, attached • to the Charging-Pool, and the Charging-Station that contains the EVSE (upper hierarchy), • to the EVSE itself • to the Charging-Connectors contained by the EVSE (lower hierarchy).
OICP	eRoamingPullEvseData	The EVSE-Mapping table contains the information necessary for the mapping of static POI data. These data contain essential information about the properties of an EVSE, including its ID, geocoordinates, authorisation modes and supported plug-types. Due to the full static address of an EVSE being an object including multiple data sets on its own, it is separated into a distinct table for EVSE address mapping.

4.2.2 Charging pool data mapping

Common Information Model	eMIP	OICP
PoolId	{attributeId "1003", attributeValue} or PooleMI3Id	

Name			{attributeId "1006", attributeValue} or Name	
Description			-	
LocationInfo	Name		-	
	Description		-	
	AddressInfo	StreetName	{attributeId "1045", attributeValue} or StreetName	Street (string)
		BuildingIdentifier	{attributeId "1044", attributeValue} or StreetNumber	HouseNum (string)
		BuildingIdentifierAddition	{attributeId "1046", attributeValue} or AddrComplement	-
		Storey	{attributeId "1050", attributeValue} or FloorNumber	Floor (string)
		PostalCode	{attributeId "1042", attributeValue} or PostalCode	PostalCode (string)
		PostalCodeAddition	{attributeId "1046", attributeValue} or AddrComplement	-
		City	{attributeId "1043", attributeValue} or City	City (string)
		Country	{attributeId "1041", attributeValue} or Country code	Country (CountryCodeType)
	GeoCoordinate	Latitude	{attributeId "1047", attributeValue} or PoolLatitude	Latitude (GeoCoordinatesDecimalDegreeFormatType)
		Longitude	{attributeId "1048", attributeValue} or	Longitude (GeoCoordinatesDecim

			PoolLongitude	alDegreeFormatType)
		Altitude	{attributeId "1049", attributeValue} or PoolAltitude	-
		CoordinateSystem	-	-
	ParkingEntranceGeoCoordinate	Latitude	{attributeId "1062", attributeValue} or PoolEntryLatitude	Latitude (GeoCoordinatesDecimalDegreeFormatType)
		Longitude	{attributeId "1063", attributeValue} or PoolEntryLongitude	Longitude (GeoCoordinatesDecimalDegreeFormatType)
		Altitude	{attributeId "1064", attributeValue} or PoolEntryAltitude	-
		CoordinateSystem	-	-
OpenHours			{attributeId "1101/1102/1103/1104", attributeValue} or OpeningHoursList*(if not 24x7)/ OpeningHoursList-NbItem/ OpeningHoursList/ InfoOuvertureZone	OpeningTime (String)
Accessibility			{attributeId "1061", attributeValue} or AccessibilityType	AccessibilityType
TimeZoneOffset			-	-
TimeZoneName			-	Timezone (string)
CPO	CPOID		{attributeId "1252", attributeValue} or eMI3Id - TechOperator	OperatorID {OperatorIDType}
	CPOName		{attributeId "1253",	OperatorName (String)

		attributeValue}	
	CPOContact	-	-
	ChargingPools	-	-
AdminState	AdminState	{attributeId "1082", attributeValue} or AvailabilityStatus	OperatorEVSEStatus
	EventTime	-	
LastUpdate		{attributeId "1298", attributeValue}	lastUpdate (Date/ Time)

4.2.3 Charging Station data mapping

Common Information Model		eMIP	OICP
StationID		{attributeId "2003", attributeValue} or StationeMI3Id	ChargingStationId (String)
Label		{attributeId "2005", attributeValue} or VisualId	ChargingStationName (String)
AuthorisationMethods		{attributeId "2063", attributeValue} or StationAuthentMode	AuthenticationModeType (AuthenticationModeType List)
PaymentMethods		{attributeId "2064", attributeValue} or StationPaymentMode	PaymentOptions (No Payment, Direct, Contract)
UserInterfaceFeatures		-	-
LanguageSupported		{attributeId "2070", attributeValue}	-
LocationInf	Name	-	-

o	Description		-	-
	AddressInfo	StreetName	-	Street (string)
		BuildingIdentifier	-	HouseNum (string)
		BuildingIdentifierAddition	-	-
		Storey	-	Floor (string)
		PostalCode	-	PostalCode (string)
		PostalCodeAddition	-	
		City		City (string)
		Country	-	Country (CountryCodeType)
	GeoCoordinate	Latitude	{attributeId “2041”, attributeValue} or PoolLatitude	Latitude (GeoCoordinatesDecimalDegreeFormatType)
		Longitude	{attributeId “2042”, attributeValue} or PoolLongitude	Longitude (GeoCoordinatesDecimalDegreeFormatType)
	ParkingEntrance GeoCoordinate	Latitude	-	Latitude (GeoCoordinatesDecimalDegreeFormatType)
		Longitude	-	Longitude (GeoCoordinatesDecimalDegreeFormatType)
Manufacturer			{attributeId “2121”, attributeValue} or StationMaker	-
Model			{attributeId “2122”, attributeValue} or StationProductId	-

StationType		-	ChargingFacilityType
EVSE		-	-
Admin State	AdminState	{attributeId "2061", attributeValue} or StationAccessibility	
	EventTime		
UserComments	Submitter	-	
	DateTime	-	
	Comment	-	
ServiceProviderComments		-	
LastUpdate		{attributeId "2298", attributeValue}	lastUpdate (Date/Time)

4.2.4 EVSE data mapping

Common Information Model		eMIP	OICP
EVSEID		{attributeId "3003", attributeValue} or EVSEeMI3Id	EVSEID (EVSEIDType)
Label		{attributeId "3005", attributeValue} or VisualId	
LastUsedTime		{attributeId "3043", attributeValue} or LastUseDateTime	
ChargingSolutions	ChargingMode		{ChargingModeType} ChargingModes
	RatedPowerLevel	{attributeId "3049", attributeValue} or EVSEAvailablePower	

VoltageRating		-	
Admin State	AdminState	{attributeId "3046", attributeValue} Or AvailabilityStatus	EVSEAdminType
	EventTime	statusEventDate	
OperationalState	OperState	{attributeId "3041", attributeValue} Or BusyStatus	EVSEStatusType
	EventTime	statusEventDate	
ChargingConnectors		-	-
ParkingInfo		-	
PoDID			
EnergyMeterID		{attributeId "3048", attributeValue} or MeterType	
LastUpdate		{attributeId "3298", attributeValue}	

4.2.5 Charging Connector data mapping

Common Information Model	eMIP	OICP
ChargingConnectorId	{attributeId "4003", attributeValue} or ConnectoreMI3Id	-
Label	{attributeId "4005", attributeValue} or VisualId	-
TypeOfConnector	{attributeId "4021", attributeValue} or ConnectorType	List (PlugType)

MaxPower	{attributeId “4043”, attributeValue} or ConnectorMaxPower	MaxCapacity (Integer)
CableLength	-	
LastUpdate	{attributeId “4298”, attributeValue}	

4.3 Dynamic Charge Point data

4.3.1 WebServices

Protocol	WebService	Description
eMIP	eMIP_ToIOP_GetEVSEData_FullList	This request belongs to the “Data Download” (SDD and DDD) services, and allows an eMSP to get EVCI description data. The requestor will get EVSE description, for each EVSE managed by a CPO with which the eMSP is in contract. For each EVSE, this request will give a set of attributes, attached • to the Charging-Pool and the Charging-Station that contain the EVSE (upper hierarchy), • to the EVSE itself • to the Charging-Connectors contained by the EVSE (lower hierarchy). This service has to be used in an initialisation phase, i.e. only one time.
	eMIP_ToIOP_GetEVSEDynamicDataChanges	This request belongs to the “Dynamic Data Download” (SDD) services, and allows an eMSP to get EVCI description data. The requestor will get EVSE description, for each EVSE managed by a CPO with which the eMSP is in contract, and that has changed since the last requestor call. For each EVSE, this request will give a set of

		attributes, attached o to the Charging-Pool, or the Charging-Station that contains the EVSE (upper hierarchy), • to the EVSE itself • to the Charging-Connectors contained by the EVSE (lower hierarchy).
OICP	eRoamingPullEVSEStatus	Whenever an EVSE identified by a specific EVSEID indicates a status change (e.g. start of a charging event), the CPOs backend gets notified and forwards this information to the corresponding platform. After this process is completed, the stored information can be pulled by data consumers. Due to the information being dynamic status changes, all dynamic EVSE data are being pulled at least every 5 minutes. The results are mapped by the Hubject protocol adapter mechanism, which relies on the standardisation implemented by the remote platform provider and updates all status changes on the Hubject platform as well.

4.3.2 Data mapping

Common Information Model		**eMIP**	**OICP**
AdminState (for EVSE)	AdminState	{attributeId "3046", attributeValue} Or AvailabilityStatus	EVSEAdminType
	EventTime	statusEventDate	
OperationalState (for EVSE)	OperState	{attributeId "3041", attributeValue} Or BusyStatus	EVSEStatusType
	EventTime	statusEventDate	

4.4 Authorisation

4.4.1 WebServices

Protocol	WebService	Description
eMIP	eMIP_ToIOP_GetService Authorisation	Request an authorisation for a given user contract id. The GIREVE's Platform will contact the related eMSP to check the authentication and authorisation of this user.
	eMIP_ToIOP_SetService Authorisation	Request a remote authorisation for a given Charging Point. The GIREVE's Platform will contact the related CPO to enable the authorisation. The eMSP can use this request to start a charging process (AuthorisationValue OK).
OICP	eRoamingAuthorizeStart	Authorization describes the process of an EV-Driver wanting to start the respective charging process at a specific EVSEID. The CPO forwards the UID to the connected roaming platform. The Interoperability Platform tries to lookup the UID within their own UID storage and asks the corresponding eMSP for authorization.
	eRoamingAuthorizeRem oteStart	Authorization describes the process of an EV-Driver wanting to start the respective charging process at a specific EVSEID. The eMSP receives (e.g. by an App) or invokes a remote start request and forwards it to the Hubject platform. From there the request gets forwarded to the respective relevant CPO by the Hubject platform .

4.4.2 Data mapping

Common Information Model	eMIP	OICP
CPOSessionId	execPartnerSessionId	PartnerSessionID
eMSPSessionId	salePartnerSessionId	PartnerSessionID

sessionId	serviceSessionId	SessionIDType
CPOID	{execPartnerIdType, execPartnerId}	OperatorID (1) *OperatorIDType*
eMSPId	{salePartnerIdType, salePartnerId}	OperatorID (1) *OperatorIDType*
EVSEID	{EVSEIdType, EVSEId}	EVSEID (EVSEIDType)
eMAID	{userIdType, userId}	Identification (1)
ServiceId	requestedServiceId	
Status	authorisationValue	EVSEStatus (EVSEStatusType)

4.5 Charge Detail Records

4.5.1 WebServices

Protocol	WebService	Description
eMIP	eMIP_ToIOP_setChargeDetailRecord	This request allows a CPO to send a charging session record to the GIREVE Interoperability Platform.
OICP	eRoamingChargeDetailRecord	The charge detail record mapping contains EVSE information as well as specific data from the charging session which are necessary in order to enable a billing process between the respective CPO and eMSP. Specific data consist of the timestamps of the start/end of the charging process as well as meta data from the charging meter.

4.5.2 Data mapping

Common Information Model	eMIP	OICP
CPOSessionId	execPartnerSessionId	PartnerSessionID
CDRID	-	-
EVSEID	{EVSEIdType, EVSEId}	EVSEID (EVSEIDType)
eMAID	{userIdType, userId}	Identification (1)
EnergyMeterID	-	MeteringSignature
NumPhases	-	
GlobalBeginSession	startTime	ChargingStart
GlobalEndSession	endTime	ChargingEnd
TotalEnergy	{meterTypeId "2", meterValue, meterUnit}	ConsumedEnergy
GlobalTransactionCost	{meterTypeId "3", meterValue, meterUnit}	
Currency	-	-
ChargingPeriodRecords	-	

4.6 Adding new services

The tables above describe in a consistent and common format (the NeMo Common Information Model) the four basic interfaces, as regards thee exchanges of authorisation data, static and dynamic charge point data and CDRs, which the eRoaming platforms should initially implement in order to satisfy the NeMo Business Scenario 3 "Cross-provider border booking authorization and payment management". Under the scope of NeMo, and the Business Scenarios planned, the list of web services to be published to the Hyper-Network will be enriched for allowing the proposed functionalities such as itinerary planning, smart charging, booking of a CP, etc.

5. Conclusions

eRoaming platforms are a significant category of electromobility actors, therefore one of the main NeMo objectives is to develop an open protocol, the open European Inter-Roaming protocol, which will allow eRoaming platforms to exchange data between themselves and to expose their data to other stakeholders and actors via the NeMo Hyper-Network. The NeMo Inter-Roaming protocol is a functional protocol that enables the direct communication between eRoaming platforms, as regards exchange of data relevant to authorisation, static and dynamic information about charge infrastructure and CDRs. Additionally, an eRoaming platform may publish its services to the NeMo Hyper-Network, providing eRoaming features, like any other NeMo service.

The Inter-Roaming concept greatly simplifies the inter-connection between actors (CPOs or eMSPs), irrelevant of their physical connection. An actor has simply to connect to one eRoaming platform either directly or indirectly, via another platform or via NeMo, and the actor has access to all actors that are connected either to NeMo directly or to all connected eRoaming platforms. Similarly, an eRoaming platform can connect with all other already connected platforms either directly or via NeMo.

The proposed protocol is a functional one, each new eRoaming platform will have to cater for its own technical implementation. The implementation for the two eRoaming platforms that are NeMo partners is presented in this Deliverable.

It must be noted that the protocol will benefit from unique identifiers of actors, like CPOS and EMPs. For the moment, there are organisations issuing such identifiers in some countries, for example Germany and France, that can be also used for other countries, but risk may definitely arise. NeMo should explore in WP7 how the issuing of unique identifiers all over Europe can be ensured, possibly by the establishment of a Europe-wide responsible entity for the coordination of those unique identifiers.

References

NeMo Deliverable 1.1 “Consolidated Version of the Use Cases and Actors’ Requirements”, June 2017

NeMo Deliverable 2.1, “Consolidated Version of Technical Specifications for NeMo development and integration”, August 2017

NeMo Deliverable 3.3, “Common Information Models”, September 2017

OICP 2.1 CPO Protocol and OICP 2.1 EMP Protocol

eMIP 0.74 Protocol

DIN EN ISO 15118-1, vehicle to grid communication interface

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