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

NeMo D1.4 First Updated report on latest technological and market developments in electromobility

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2.0	08/06/2017	Sebastien ALBERTUS, Adrien CASTAGNIE	Final version after internal review for submission
3.0	06/04/2018	Adrien CASTAGNIE, Mélodie GALINAND	Initial draft of first updated report
4.0	30/09/2018	Adrien CASTAGNIÉ	Revised according to internal review comments

List of abbreviations and acronyms

Abbreviation	Meaning
B2B	Business to Business
BEV	Battery Electric Vehicle
C-ITS	Cooperative Intelligent Transport Systems
CP	Charge Point
CPO	Charge Point Operator
DSO	Distribution System Operator
eMIP	eMobility Protocol Inter-Operation
EMSP	Electromobility service Provider
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
GDC	General Data Centre
ICE	Internal Combustion Engine
ICT	Information and Communication technologies
IoT	Internet of Things
IVR	Interactive Voice Response
OBD	On-Board Diagnostics
OCPP	Open Charge Point Protocol
OEM	Original Equipment Manufacturer, refers to the Vehicle Manufacturer
PHEV	Plug-in Hybride Electric Vehicle
POD	Point Of Delivery

Abbreviation	Meaning
QC	Quck Charger
RMI	Repair and Maintenance Information
SoC	State of Charge
TCO	Total Cost of Ownership
TCU	TeleCommunication Unit
VIN	Vehicle Identification Number

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Executive Summary

With the increase of the Electric Vehicles sales worldwide, the ecosystem stakeholders have to monitor the evolution of the market, anticipate the coming trends and evaluate the impact of this new mobility on our environment. This is the goal of this document.

This document is an update of a previous deliverable, with the latest figures available regarding EV sales and EVSE installed.

With a strong rise, the electric vehicle market counted in Q1 2018 more than 310.000 new zero emission cars (BEV), which is 59% higher than Q1 2017. Several other factors, such as new car models expected to enter the market, the increase in their autonomy, urban restrictions or new CO_2 standards show that the EV market has just started.

To support this evolution, the involved actors must develop and install the needed new charging infrastructure. This year, **Europe counts more than 130.000 public charging infrastructures installed**, which is more than the objective of 120.000 set last year.

Next to that, the products, cars and charging stations, will evolve in parallel to the coming technologies. One can quote for instance the car connectivity, which permits the car manufacturers to propose new kinds of services to their customers.

Finally, in order to keep a coherence in this market, one can point out the importance of standardization, such as the coming ISO 15118, which will permit the actors to develop interoperable new services based on the same communication protocol.

1. Introduction

This Deliverable is an outcome of Task 1.2 of NeMo project which aims to monitor the latest developments in the electric vehicles (EVs) market, trends and new technologies adoption, aiming to derive requirements and specifications for the NeMo project developments.

The European Union has issued the Alternative fuel Directive in September 2014 to push the roll out of charging infrastructure and ensure its interoperability and has requested Member States to provide accurate information about the current public charging infrastructure network. The European Union has also set up an Alternative Fuel Observatory to gather information regarding the roll out of the Directive.

However, so far, no official accurate repository exists. Therefore, the methodology followed in this deliverable to capture the current status of the available charging infrastructure was based on stakeholders' interviews, including experts from:

- Vehicle manufacturers
- eRoaming platforms
- Major charge points operators
- E-mobility associations

In order to overview the global ecosystem of electric vehicles (EVs), this document is split into several parts. First, we will focus on current and expected sales of EVs and on the Electric Vehicle Supply Equipment (EVSE) roll out. Then, we will investigate the vehicle technologies which permit the EVs to be part of the ecosystem, being adaptable and connected. We will treat the EVSE features with the same logic. The deliverable concludes with a quick overview on grid intelligence and smart meters, EV standards and eRoaming platforms.

2. Market overview

2.1 Global EV sales overview

Global plug-in vehicle deliveries reached **312 400 units for Q1 2018, 59 % higher than for Q1 2017[1].** These include all BEV and PHEV passenger cars sales, light trucks in USA/Canada and light commercial vehicle in Europe.

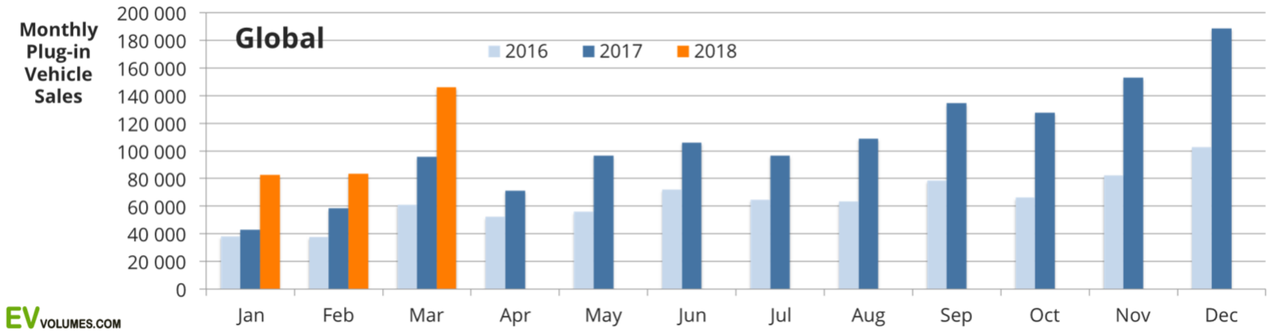


Figure 1: Global EV sales from 2015 to 2017

Growth rates is influenced by the booming Chinese EV market (+133 %), with the USA (+30 %) and Europe (+39 %) following it. In December 2018 the global plug-in share should touched the 3 % mark for the first time, following consistently strong increases during the last 5 months of the year. **The global share for the complete year of 2018 is forecasted to stands at 1,95 %.**

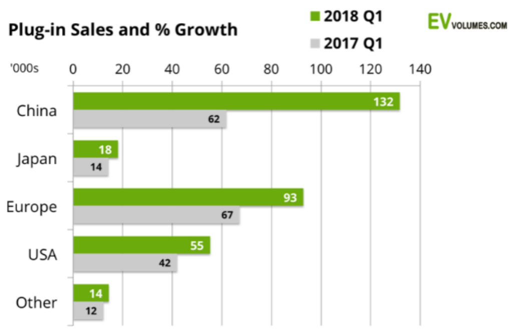


Figure 2: EV Sales and % Growth

[1] Statistics came from EV Volumes.com, a blog which gather all information on EV market development

If we go more in details in the European market, we note a 42% increase in the Plug-in sales with 195 000 units sold in H1 2018. The top 5 countries in Europe are shown in the following table:

Country	H1 2018 PEV SALES	Evolution with H1 2017
Norway	**36.500**	**+32%**
Germany	35.000	+52%
UK	30.000	+28%
France	25.000	+19%
Sweden	13.000	+59%

Figure 3: Top 5 PEV sales H1 2018 in Europe

Now if we look at the brands, this market is led by the Alliance Renault-Nissan with a market share of 38,4% on the European market, Renault is leader with a market share of 28,6%. The French car manufacturer has sold 143.627 electric cars since the beginning of the EV mass market in 2011.

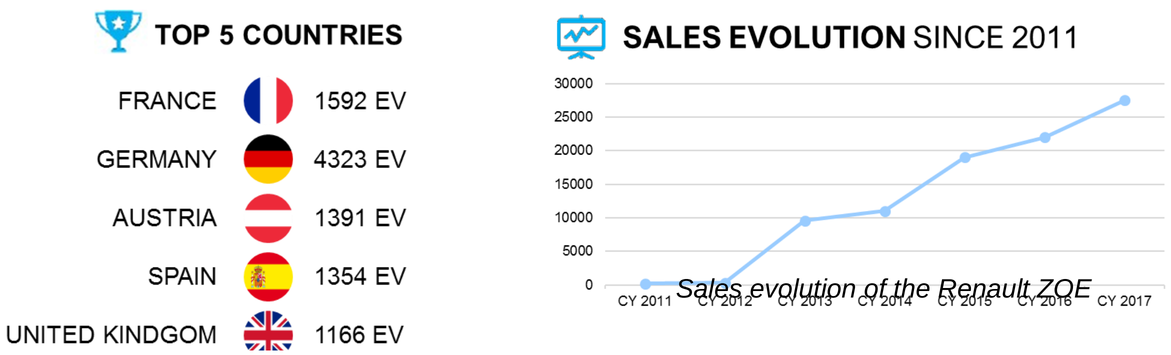


Figure 4: Top European Renault sales in 2017 and evolution since 2011

As regard as the vehicle models, Renault ZOE is the top private vehicle (PC) model sold, with more than 30.000 units in 2017. Its sales have constantly increased since its launch in 2011. France and Germany are the two top markets for the Renault ZOE. For the vehicle utility (LCV) market, the Renault Kangoo is the leader. Here is a summary of the figures.

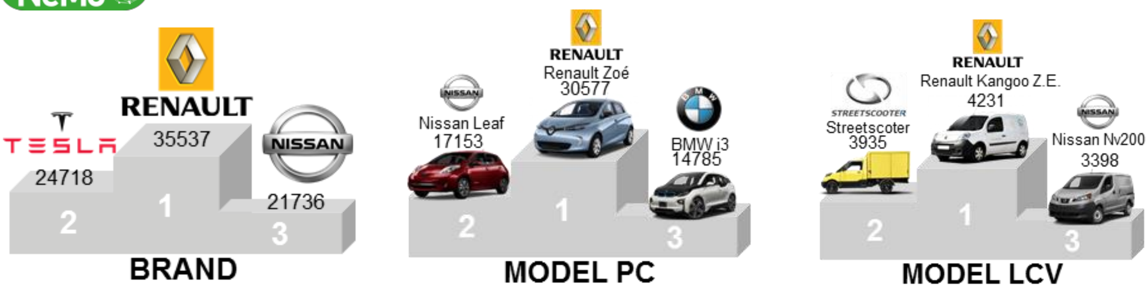


Figure 5: Top sales models in 2017

To sum up, the EV market is increasing. Even if the percentage of EV penetration is still weak compared to ICE cars, we can notice that there is more and more EV sales. This trend is expected to stay dynamic thanks to some factors explained further in section 2.3, but principally due to the development of the infrastructure network. To support this argument, here are some quotes from some OEM's and consulting firms about the EV evolution:

- "We are targeting 2m to 3m EV sales per year by 2025": *Volkswagen AG*
- "BEV to reach TCO parity by 2021": *UBS estimates*
- "BEV market share of more than 20% by 2025": *UBS Evidence Lab*
- "Global EV sales from 2.5m in 2021 to 9.7m in 2025": *J.P Morgan*

2.2 Global overview on EVSE

Europe had planned to reach 120.000 EVSEs by the end of 2017.

When we are looking to the figures provided by eRoaming platforms, from 2016 to 2017 the EVSE number went from 83.892 to 97.500. It means that there are **1,5 EVs for 1 EVSE**.

But the information from the EAFO (European Alternative Fuels Observatory) is a bit different: In 2017, Europe counts 131.794 EVSE, so there are **1,09 EVs for 1 public EVSE**.

The differences with the eRoaming platform data can be caused by different factors:

- EAFO is counting the EVSE for all Europe (EU + EFTA + Turkey) while eRoaming platform doesn't include Iceland or Turkey.
- eRoaming data include only public EVSE and mostly the connected one, while EAFO data include EVSE installed in private parking areas of companies or parking operators which are not connected.

In order to reach the ratio of 0,6 - which is considered as the optimal ratio - the number of EVSE should be equal to 180.000.

The following figure shows the repartition of EVSE in Europe based on eRoaming platforms data. We point out that the normal charging EVSE (between 7 and 22 kW) represent the majority (92,5%) of existing EVSE, compared to quick charge ones (43 kW).

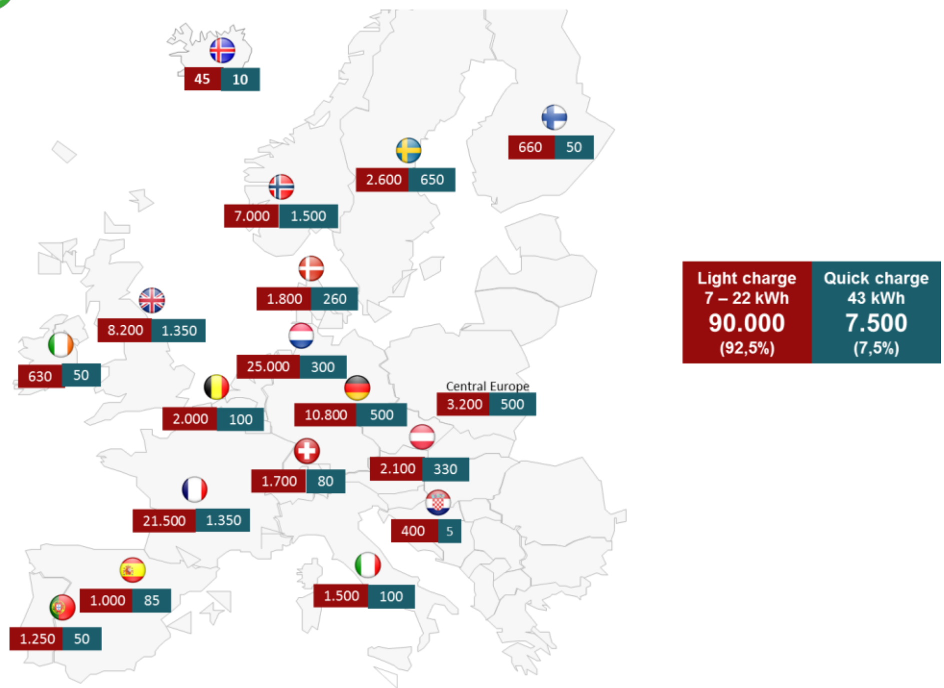


Figure 6: EVSE in Europe in 2017

To conclude, if the EV market remains this successful and continue its rise, the number of EVSE must follow its development and keep an acceptable ratio[2] in order to allow each EV driver to charge easily, without being in trouble with unavailable EVSE due to not enough charging points. There will be a focus on EVSE a little further in this document to explain the technology.

2.3 Factors accelerating EV market

Some factors will boost the EV market. We have identified 4 factors that will have a positive impact on EV sales.

Line Up:

Within 2022, 30 new electric car models will come on the EV market, which equals an increase of 150% of the models available compared to 2017. As the offer of EV models will increase, the sales will go up too.

[2] This acceptable ration is defined by the European Commission. It is 1 charging point for 10 EVs.

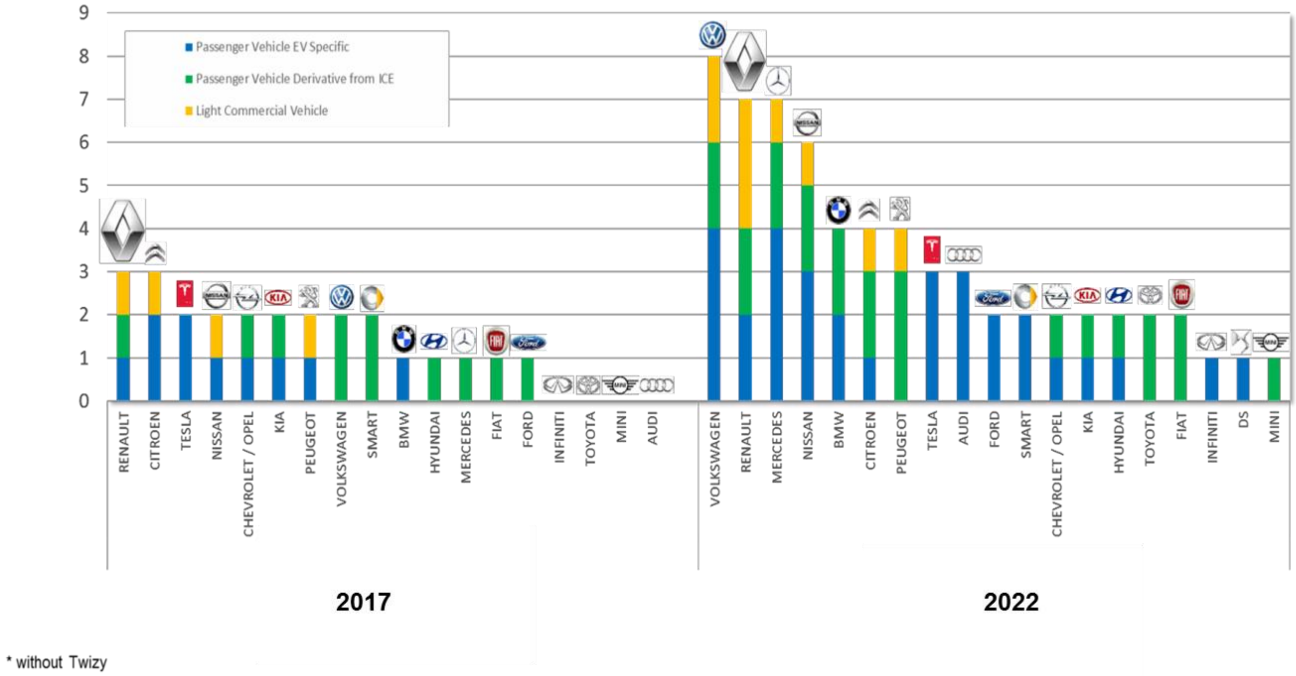


Figure 7: EV models' availability in 2022

Autonomy:

Currently, the maximum autonomy is offered by Tesla with 550km. However, in 2022, Audi and Renault have planned to go beyond this, with a battery offering 650km autonomy. Moreover, in 2016, the average autonomy available on the EV market is 270km. In 2022, the average autonomy planned is 377km.

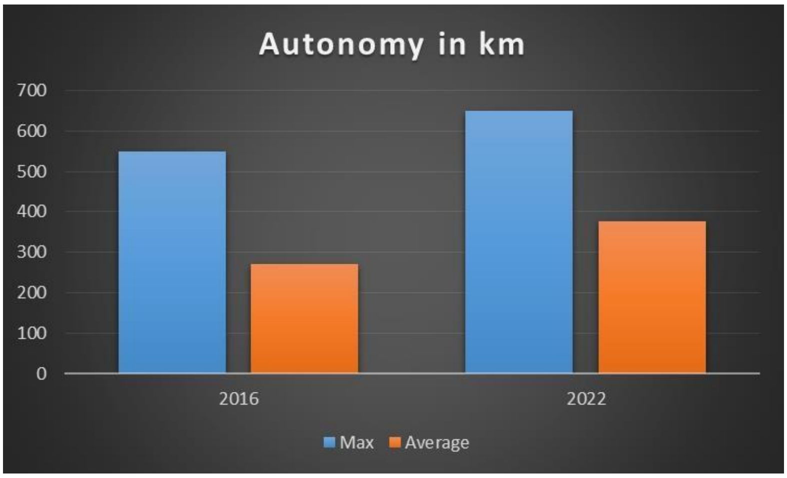


Figure 8: EV current and planned autonomy

As we can see, the autonomy is going to increase and the number of different models too. Each manufacturer is going to launch its own EV model due to the demand. Therefore, the offer to the consumers will be larger and their needs will be better satisfied.

Moreover, concerning Renault, the new Zoe with the LR (Long Range) battery competes a lot with Clio, another Renault car. Indeed, their price positioning is the same, while the cost of electricity is much cheaper than the oil cost. Moreover, Zoe and Clio are used in the same way by the consumers, they are small vehicles destined for an urban environment and daily trips such as home-work trips. The cannibalization effect has already started between Zoe and Clio and will get wider.

Urban restrictions:

In Europe, several cities have already taken measures restraining the usage for ICE cars and this trend will raise in order to provide a better air quality to the urban population. The map below gives an overview of all cities which have enforced some restrictions, like LEZ (Low Emission Zone) or a fee to reach the city centre.

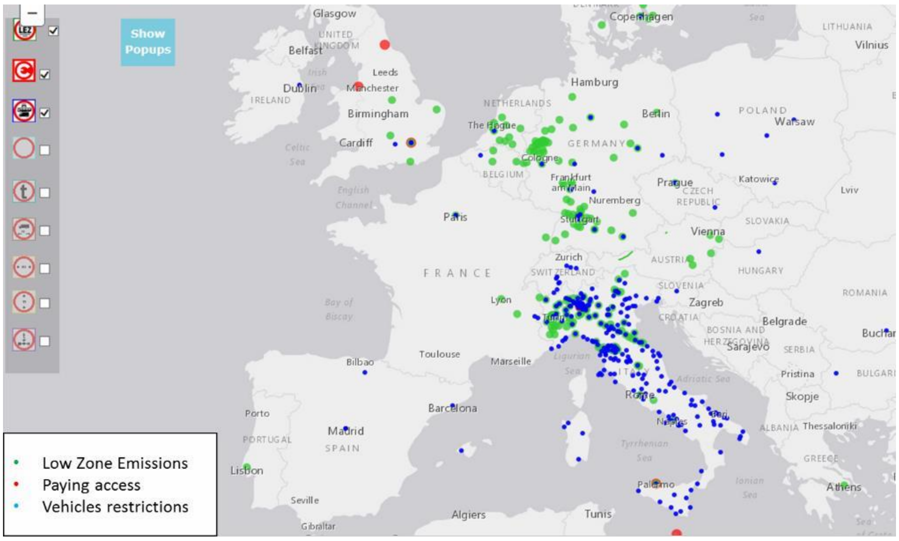


Figure 9: European cities with restrictions for cars

In most cases, EV are not included in such restrictive measures. This is another reason to switch from ICE to electric vehicles.

CO2 standard (CAFE) linked to global warming:

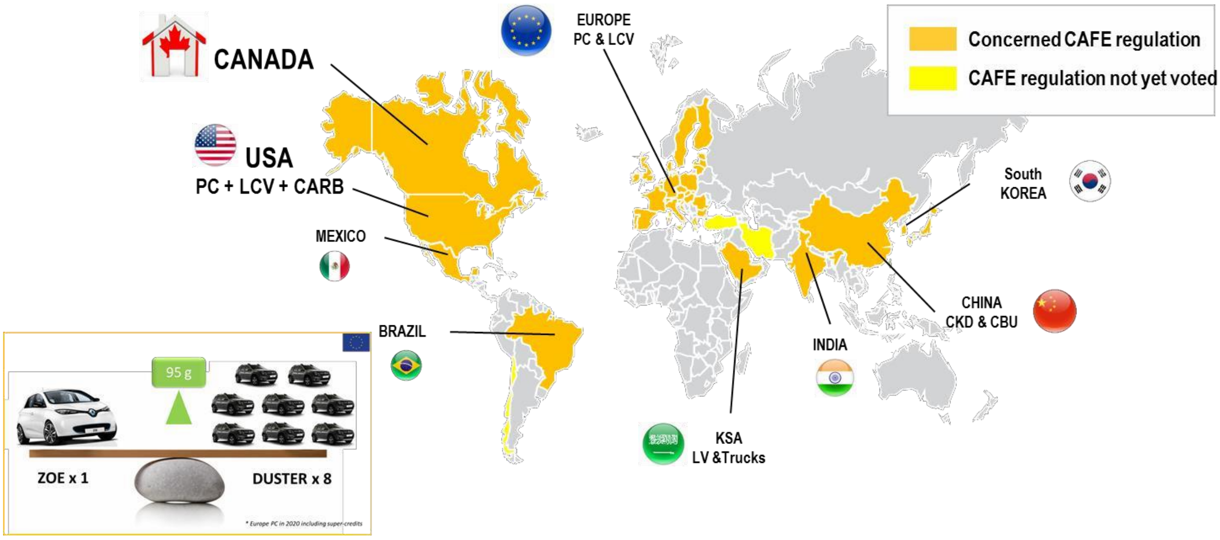


Figure 10: CAFE standard in the world

In order to tackle the global warming, strict measures have been taken to reduce CO2 emissions, in particularly for the automotive sector, which contributes to 14% of the total CO2 emissions worldwide. It is in this perspective that the European parliament has voted in 2014 new standards for OEM's, like CAFE (Corporate Average Fuel Economy). The objective is to have an average of 95g CO_2/km for the global range of car manufacturers for 2020.

We understand that to reach this goal, the OEM's are forced to develop low emission vehicles. Electric cars, being zero emission cars, are the best candidate to contribute to lowering the CO_2 average. This will permit car manufacturers to still sell ICE cars which are above the limit of 95g CO2/km for several years before developing new technologies (very low consumption engines, hydrogen etc...).

3. Picture of technologies

3.1 EV features

Connectivity

Today, navigation systems are turning into global HMI (Human Machine Interface), with navigation being just one feature of it. Indeed, navigation is standard on new vehicles, except on delivery cars where the take up rate is below 5%.

The table below shows the connectivity status per brand:

Brand	RENAULT	KIA	Volkswagen	NISSAN	BMW	Tesla Motors
Connected application name	ZE Services	UVO EV Services	Car-net	NissanConnect EV	BMW Remote / iRemote	Tesla Motors / Tesla Model S & Model X
Availability	Zoé, Kangoo and Fluence	Kia Soul EV, Kia Optima Hybrid and Kia Niro	BEV : e-up et e-Golf PHEV : Golf GTE, New Passat GTE	LEAF, E-NV200 EVALIA , NISSAN E-NV200 FOURGON	BMW i3, BMW i8	Model S, Model X, Model 3
Pricing	3 years free	Free	3 years free	Free	3 years free	Free

Figure 11: Connectivity status per vehicle brand

In vehicle Smartphone Integration

The use of smartphones and their integration in the vehicle is also offered by many vehicle manufacturers since many years. Starting first with audio integration for hands-free phone via Bluetooth and media accessing of music using USB connection, it has been recently extended to enable using the driver's smartphone as an app-platform for additional features. Such features include navigation, music streaming and other apps, which the vehicle owner wishes to use while driving.

Currently there are several smartphone integration technologies which are available in today's vehicles.

1. Google Android Auto (only Android)
2. Apple Carplay (Only iOS devices from Apple)
3. Mirrorlink from Car-Connectivity-Consortium (Android and Windows devices)
4. MySpin (by Bosch for Android and iOS devices)
5. SmartDeviceLink (SDL) (by Ford and Toyota for Android and iOS devices)

In order to use smartphone navigation apps to find and navigate to charge points (CPs), the smartphone integration is a valuable feature as there are some apps which can be safely used while driving to avoid driver distraction. However, currently there is no in-vehicle data access possible using smartphone integration technology provided by vehicle manufacturers. This in-vehicle data access would allow the apps running on the smartphone to use data from the vehicle, such as state of charge (SoC) or remaining distance of the battery capacity while searching for CPs.

EU Platform C-ITS and Access to In-Vehicle Data

The need to access in-vehicle data has been recognised by the EU Platform C-ITS, moderated by DG MOVE, in its working group WG6 and was noted in February 2016 in its report of phase 1. From the independent services providers' perspective (for example: insurance companies, repair and maintenance companies and others) the access to in-vehicle data can be provided via:

1. In-Vehicle Interface connector (OBD+)
2. In-Vehicle Application Platform
3. Extended Vehicle (Connected Vehicle Backend Access)

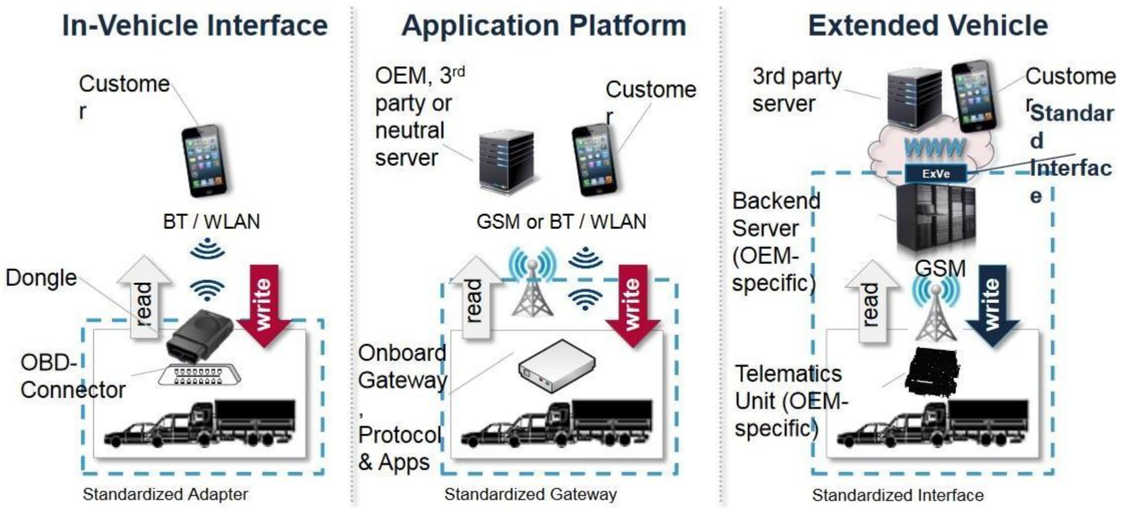


Figure 12: Access to in-vehicle data (Source: The ExVe ISO 20078 Daimler AG Dr. Christian Scheiblich, Dr. Thomas Raith, November 2014)

The following sections will describe the three possibilities in more details.

In-Vehicle Interface

Access to a limited set of in-vehicle data can be performed using an OBD adapter connected to the OBD port of today's vehicles. This OBD port allows for example access to vehicle data such as vehicle distance, oil temperature and other data. The EU Platform C-ITS recommended to leverage this interface and to provide other vehicle data requested by independent service providers. A first set of vehicle data has been documented as part of the phase 1 report published in February 2016 which should be part of this new OBD+ standard extension.

Figure 13: OBD Adaptor

Using such an OBD adaptor, data from EVs, such as battery State of Charge, can be read by a smartphone. However, it is noticed that this market is currently fragmented and based on proprietary data, as there is no standard data set being defined across all the vehicle manufactures.

In-Vehicle Application Platform

Some vehicle manufacturers provide today some way to load and install new "apps" in the in-vehicle application platform of their brands. As this is different for each vehicle manufacturer, each developer needs to develop, test and provide the "app" to the vehicle manufacturer for certification before it can be made available for download by the customer from the vehicle manufacturer "App-Store".

One example for such an in-vehicle application platform and app-store is the one from TOYOTA, that partnered with IBM to provide the T-Connect systems. See figure 15 for more details below.

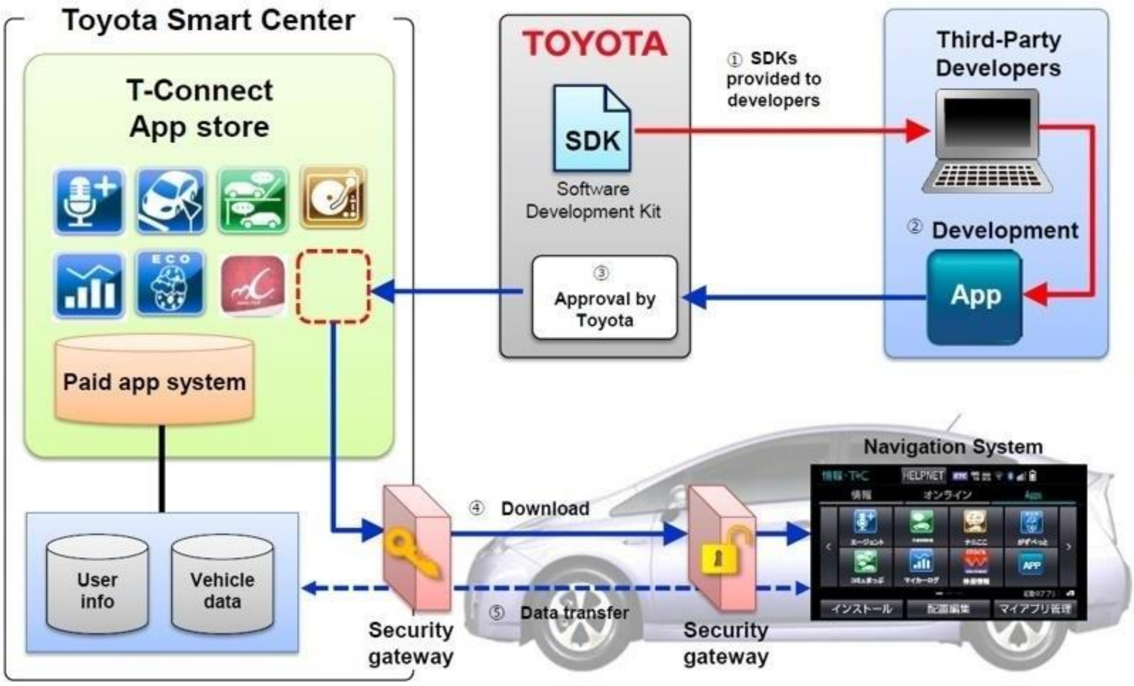


Figure 14: TOYOTA Open Vehicle Architecture (Quoted from T-Connect Announcement material 2014)

Most of the members of the EU C-ITS Platform have proposed a standard in-vehicle application platform which would allow 3rd party developers to develop apps for a broader customer base. This would enable innovative apps to be provided by 3rd party developers who would be able to directly access in-vehicle data, where there is a need for low latency of data.

Extended Vehicle (Connected Vehicle Backend Connectivity)

The standardization of the Extended Vehicle has started in 2014 in the ISO committees. The main use case is related to Repair and Maintenance Information (RMI), however the IT interface should allow also other vehicle data to be accessed. The relevant ISO standards are ISO 20077 (overall process), 20078 (Web Service Interface) and 20050 (RMI use case). The Extended Vehicle interface is quite advanced from a standardization point of view, while the other means for accessing in-vehicle data, using the in-vehicle interface or application platform, are fragmented across all the vehicle manufactures.

IT Technology Trends

In a world where the Internet of Things (IoT) and cloud concepts are main stream concepts, the OEMs tend to keep their vehicle under the umbrella of an in-house OEM server and manage data exchange in a cautious way.

The main reasons are:

- Privacy regulation making the VIN (Vehicle Identification Number) a private data on the one hand and a key entry point for OEMs on the other

- Vehicle hardware and software are changing continuously and OEMs don't want to manage updates of software by every backend using car connectivity
- Access to EVs is a key business enabler

For this, NeMo should not consider EVs as directly accessible by services and connected to IoT, but as always connected to network through an OEM backend.

3.2 EVSE features

Charging station feature overview

Renault did an analysis based on 10.000 field tests with EVSE in October 2016, which shows that:

- 100% of connected charge points are equipped with 1 meter per EVSE
- 90% are equipped with RFID readers
- 20 % have a screen (100% of Quick Charge)

Out of those charge points equipped with screen, slow charge points have basic small 4 lines screens while QC (Quick Charge) charge points have bigger screens. Still, these screens aim to support the charging process (under authentication, charging, charge not allowed …) and display the kWh. They are by no means a dynamic display allowing to offer more specific services. In other words, texts are pre-embedded in the hardware and cannot be transmitted via Open Charge Point Protocol (OCPP). Moreover, the number of languages supported is very limited.

This means that NeMo should not consider that there are available screens on the charge points, via which the customer may interact with a service.

Another outcome of the analysis is that less than 2% of the charge points are equipped with credit card device for ad hoc payment. Remote access is more and more spread but almost none exists in the majority of countries, except Germany which seems a bit ahead. The alternative charge point activation means are presented in the Appendix.

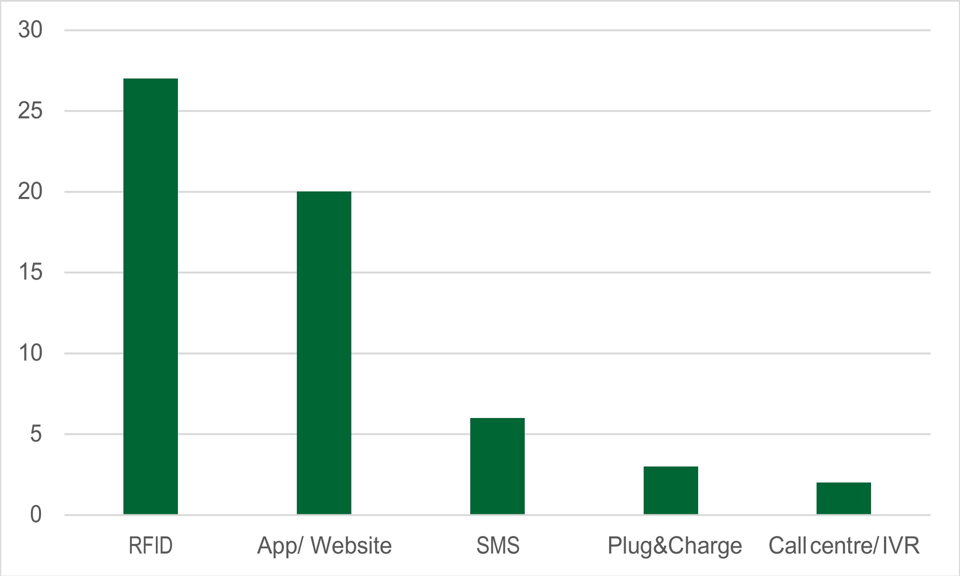


Figure 15: Number of European Countries commonly using each Authentication Method

We can also point out the diversity in the data update. Indeed, remote monitoring status is between 1 s and 15 min, depending on the operator and connectivity coverage.

Finally, even though a car presence sensor is not so costly, less than 1% of charge points are linked to such a sensor.

Charging station connectivity

Although OCPP is broadly adopted, this protocol does not allow real-time information. OCPP 1.2 was just considering remote start stop, OCPP 1.5 added remote diagnostic and load management tackling.

OCPP 1.6 is introducing load management, in which case the charge point (pole) is modulating the maximum current allowed to the car according to back end requests. A new ISO/IEC standard has just been initiated under number 63-110.

In further developments, OCPP and especially the version 2.0, should be considered as the only standard broadly rolled out for the coming years.

4. Grid intelligence: roll out of smart meters

Master Slave

With increasing number of charge points, a master slave structure appears. In such cases, the Master Unit is managing the global connection to the backend and sometimes the global intelligence and protections (Cf Allego's charging plaza). The Master unit is also managing the load by splitting the available power among sockets.

Smart metering

A smart meter is the official meter placed by the Distribution System Operator (DSO). Although every charge point has a meter inside, it is barely a Point of Delivery (POD). Moreover, the meter accuracy and position are not standardized (whether it is considering pole efficiency or not ….) and there is no regulation on this.

Three countries are currently considering a charge point as asset of the grid (POD), Luxembourg, Slovenia and Italy. Spain has a similar approach, Gestor de red de carga should have a dedicated POD for the poles.

This leads to different pricing models per country. In countries where charge points are assets, the price is based on kWh consumed. In the other countries submetering is not allowed, so the price is not based on kWh consumed but can only be based on time.

Paying with time has disadvantages for both the customer with slow charging vehicles, who will pay much more for the same amount of energy, and for the charge point operator, since slow charging cars need to stay too long connected to quick chargers.

Finally, we need to keep in mind that the installation cost for a quick charger is between 40k€ and 80k€ (plus in some countries an annual capacity subscription between 2 and 4k€/y). This means that the charging price on QC cannot be equal to home electricity price.

![NeMo logo]

5. Overview of EV standards

5.1 Expansion of existing and adoption of new eRoaming platforms

The eRoaming possibility per European country at the end of October 2016 is shown below.

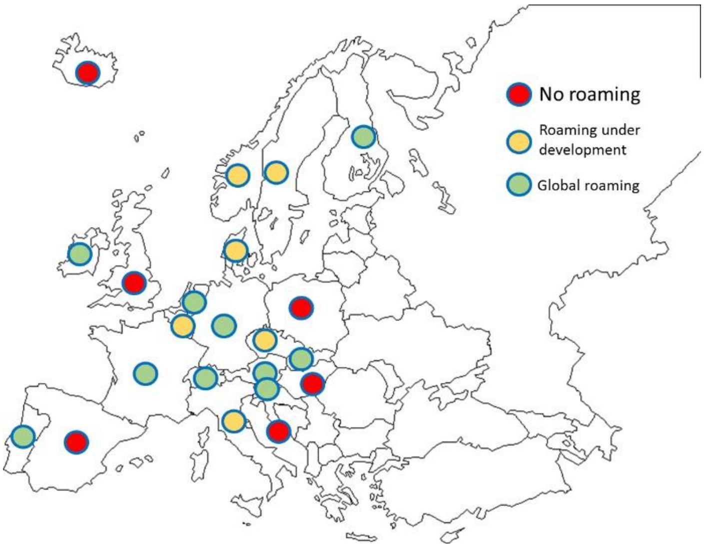


Figure 16: eRoaming in European countries

Only few countries have not initiated a “roaming step” yet, among them Spain and UK are the most problematic since the EV market is quite developed.

An overview of the Roaming connectivity of charge point operators, as forecasted in early 2017 per country is given below.

IT	IE	UK	DE	AT	CH	NL	BE	FR	NO	SE	FI	ES	LU	CZ	Baltic	SK
80%	10%	5%	95%	95%	80%	95%	80%	60%	85%	60%	95%	20%	80%	10%	40%	60%

Figure 17: Percentage of eRoaming connected charging points

It must be noted that public authorities investing in infrastructure are the most reluctant to connect due to several reasons, one of them being that they don’t want to enter into B2B relationships.

There are two possibilities for payment, either direct payment (without a service contract) and subscription-based billing. One issue is that there are different eRoaming standards in Europe for subscription-based billing and communication between charge point operators and service providers in Europe needs to be harmonised.

A unique ID generation Association for EVSE-ID and EMSP-ID across Europe is required to support “eRoaming” across Europe, to identify EVSE connected either via eRoaming “Hub” providers or involved in bilateral contracts between service providers and charge points operators without eRoaming providers.

5.2 EV standards

The different communication protocols between electromobility actors are presented below.

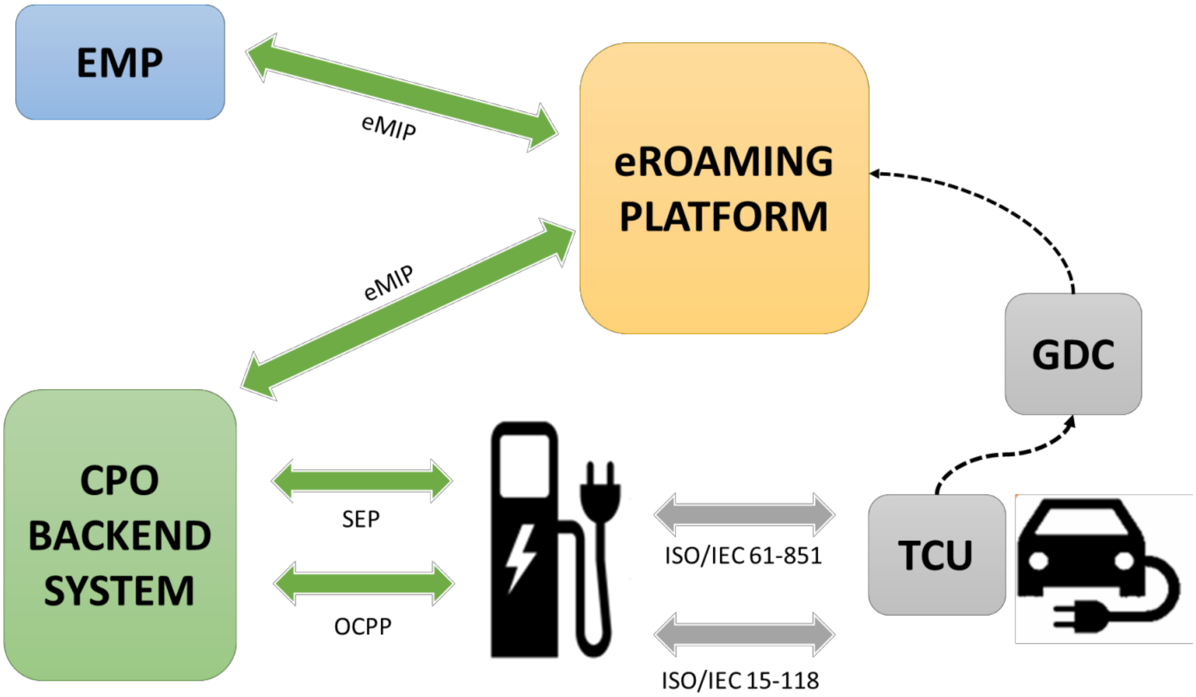


Figure 18: Communication protocols between electromobility actors

6. Conclusions

Task 1.2 of NeMo project aims to monitor the latest developments in the electric vehicles (EVs) market, trends and new technologies adoption, so as to adequately guide the NeMo developments. This document is the second deliverable of this task and aims to derive requirements and specifications for the NeMo project, according to the current market status and trends.

The deliverable presented the market status as regards electric vehicles which is expected to grow and the actors' vision to install the appropriate number of EVSE. As regards technical features of EVs, it was found that current EVs have connected functionalities and there are several smartphone integration technologies available, which could be used to access in-vehicle data needed by service providers. Reviewing the trends in this area, it is advised that the NeMo developments do not consider EVs as directly accessible by services and connected to IoT, but as always connected to network through an OEM backend.

As regards EVSE, NeMo services and developments should not be based on screen interface on the charge point. Several authentication methods are used currently in different countries. OCPP should be considered as the most widely used standard.

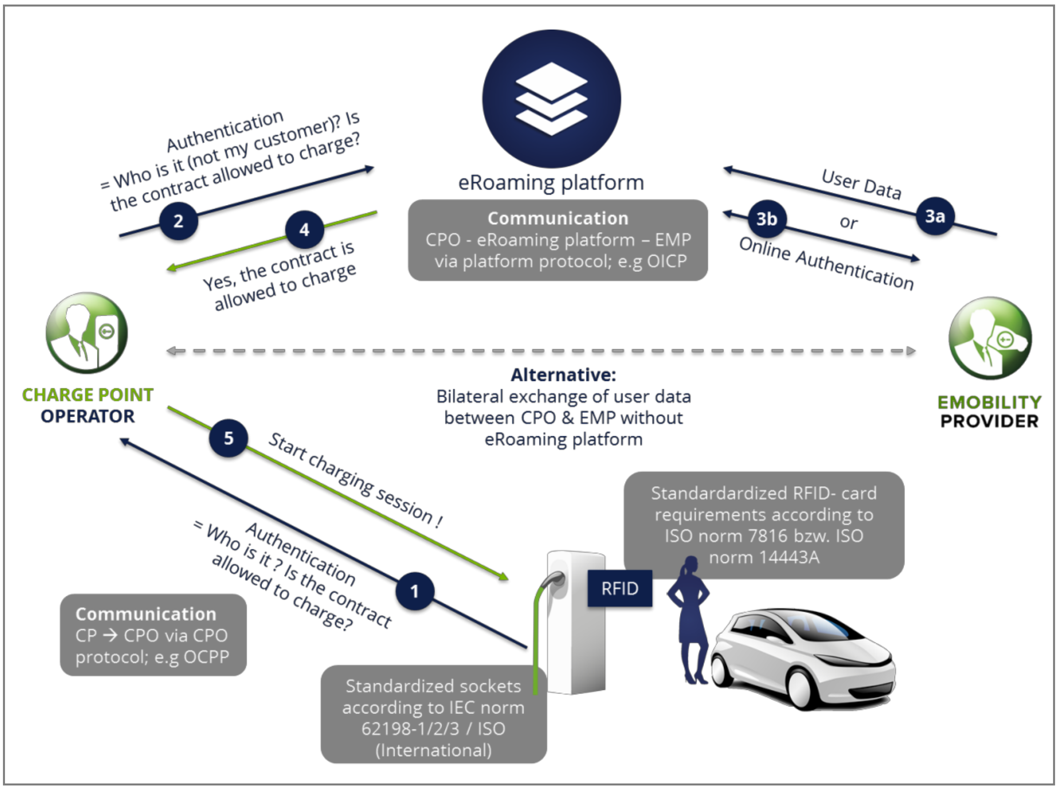
Although this is not the case today, charge points should be considered as Points of Delivery and smart meters should be installed on them. This has to be communicated to regulation bodies and manufacturers, so that they agree and enforce on the necessary measures.

eRoaming is expanding in European countries, still there are different standards and the communication between charge point operators and service providers needs to be harmonised. A unique ID generation Association for EVSE-ID and EVSP-ID needs to be established across Europe.

Appendix: Identification means

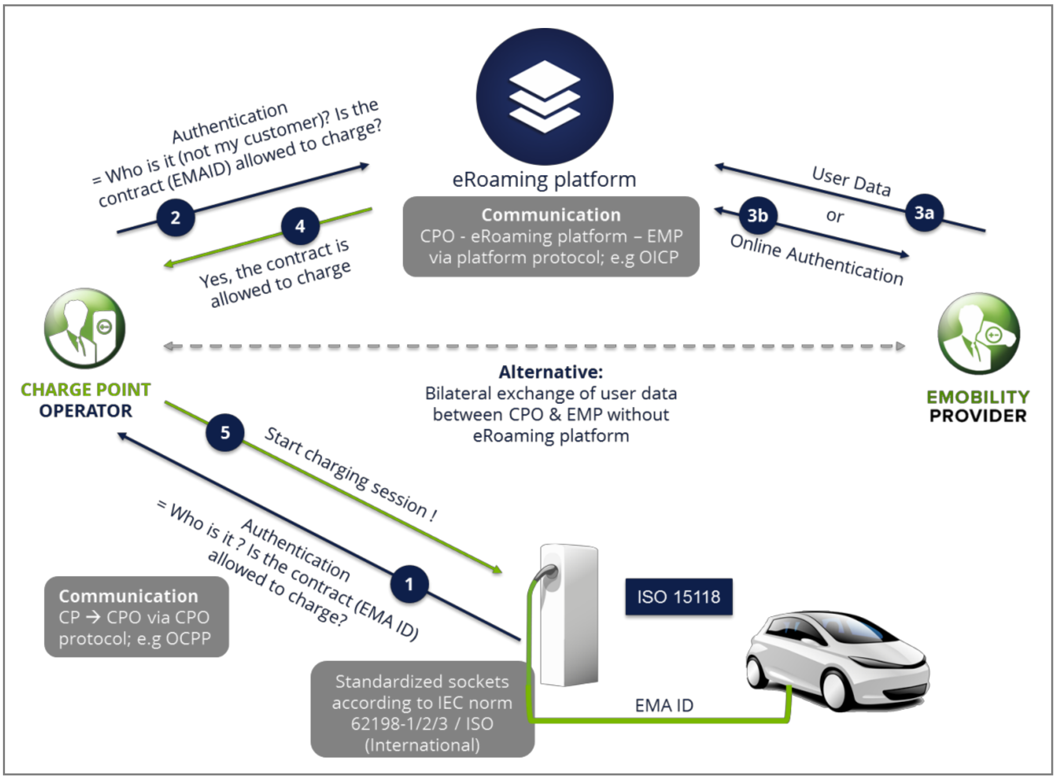
Various identification means used for charge point authentication are described below (source STF / SGEMS / Deliverable 1.1 / Hubject).

LOCAL RFID-Card



Subscription-based authentication (local) via RFID-card

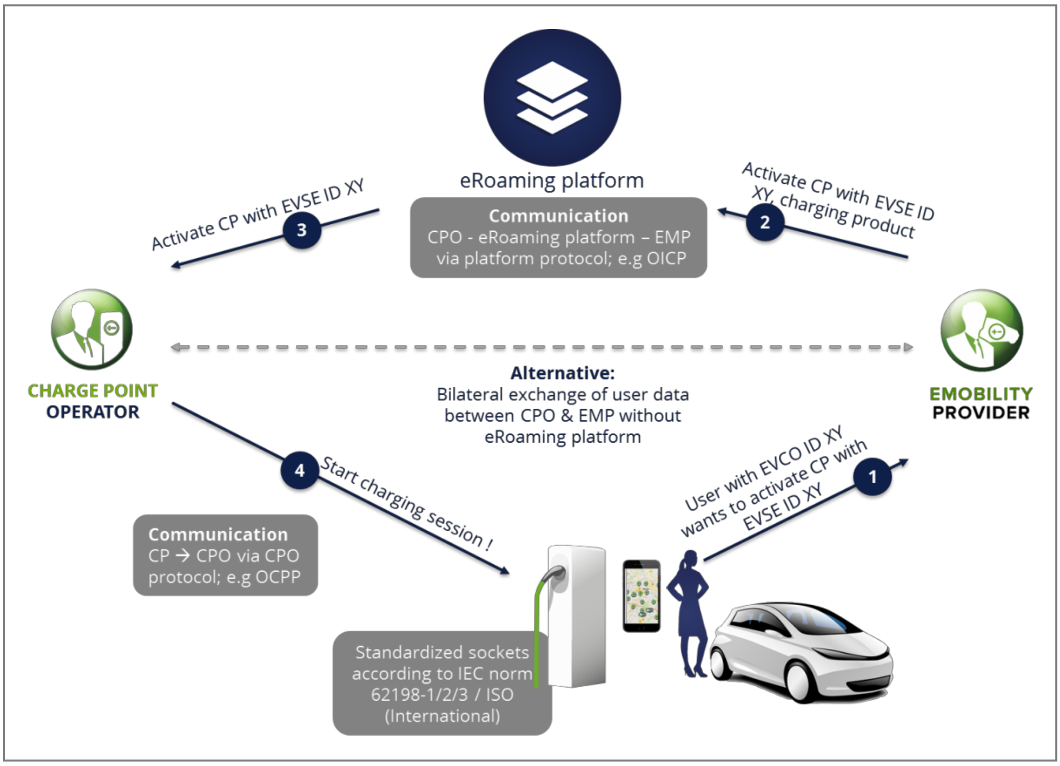
The driver requests the activation of a charge point with its specific EVSE ID at the CPO by holding a RFID-card in front of the charging station. The CPO requests the verification of the authentication at the eRoaming platform. The authentication data is either provided by the EMP as user data or an online authentication between eRoaming platform and EMP is set up. The CPO gets feedback of the eRoaming platform on whether the contract is allowed to charge at this charge point and the charging session is started. The driver stops the charging session by holding the RFID-card a second time in front of the charging station.



Subscription-based authentication (local) via Plug&Charge

The activation of a charge point with its specific EVSE ID at the CPO is ensured by a direct communication between the car and the charge point. The CPO requests the verifying of the authentication at the eRoaming platform. The authentication data is either provided by the EMP as user data or an online authentication between eRoaming platform and EMP is set up. The CPO gets feedback of the eRoaming platform on whether the contract is allowed to charge at this charge point and the charging session is started. The driver stops the charging session by disconnecting the charging cable vehicle-sided.

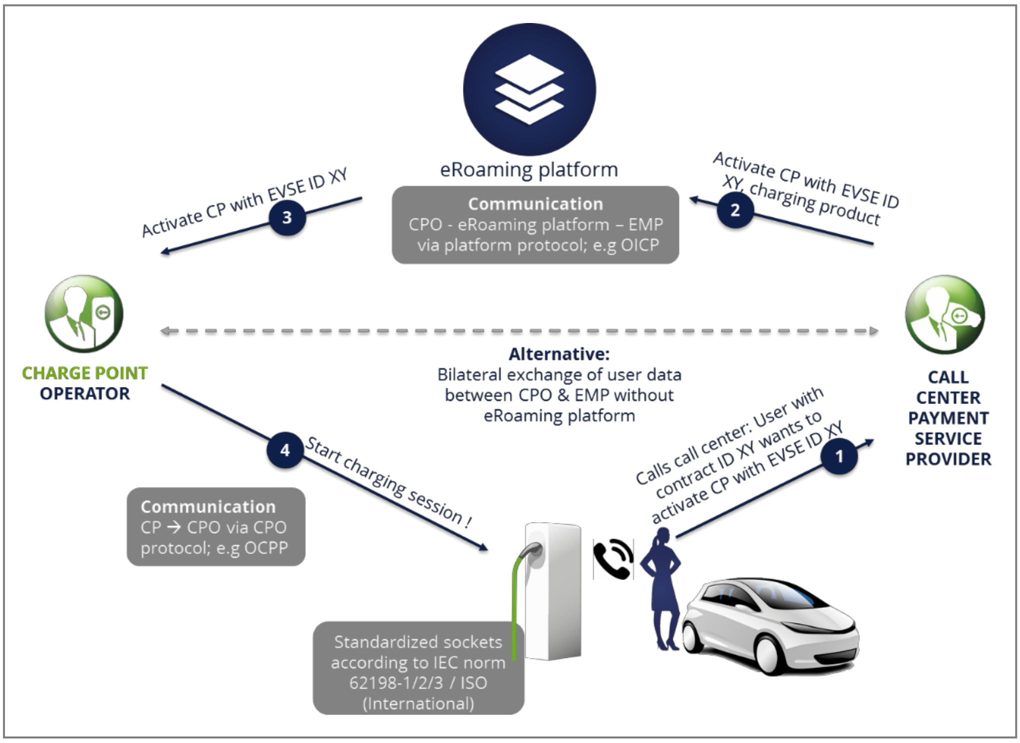
REMOTE App/ mobile Website



Subscription-based authentication (remote) via app or mobile website

The driver requests the activation of a charge point with its specific EVSE ID at his EMP via the mobile website or app either by scanning a QR code at the charge point or by selecting the charge point on the map of the website/app. The EMP then requests the activation of the charge point via an eRoaming platform at the authorized CPO, who then starts the charging session. The driver stops the session using the mobile application or website.

REMOTE Call Centre

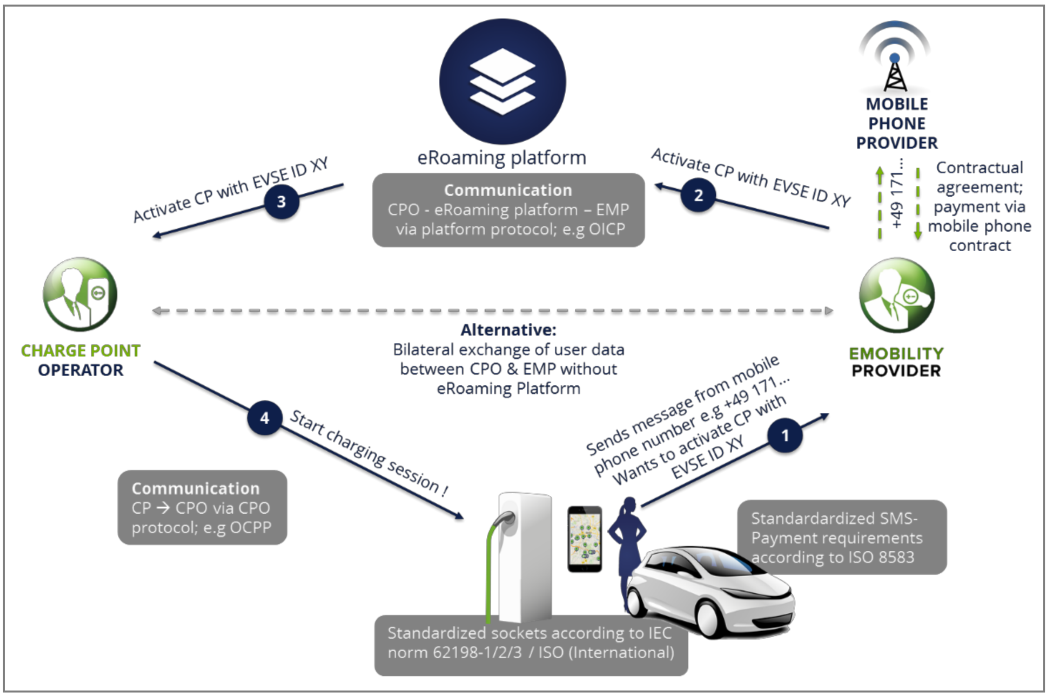


Subscription-based authentication (remote) via call centre

The driver requests the activation of a charge point with its specific EVSE ID at a call centre payment service provider by calling a call centre. The payment service provider then requests the activation of the charge point with a specific charging product via an eRoaming platform at the authorized CPO, who then starts the charging process. The driver stops the charging session by disconnecting the charging cable vehicle-sided.

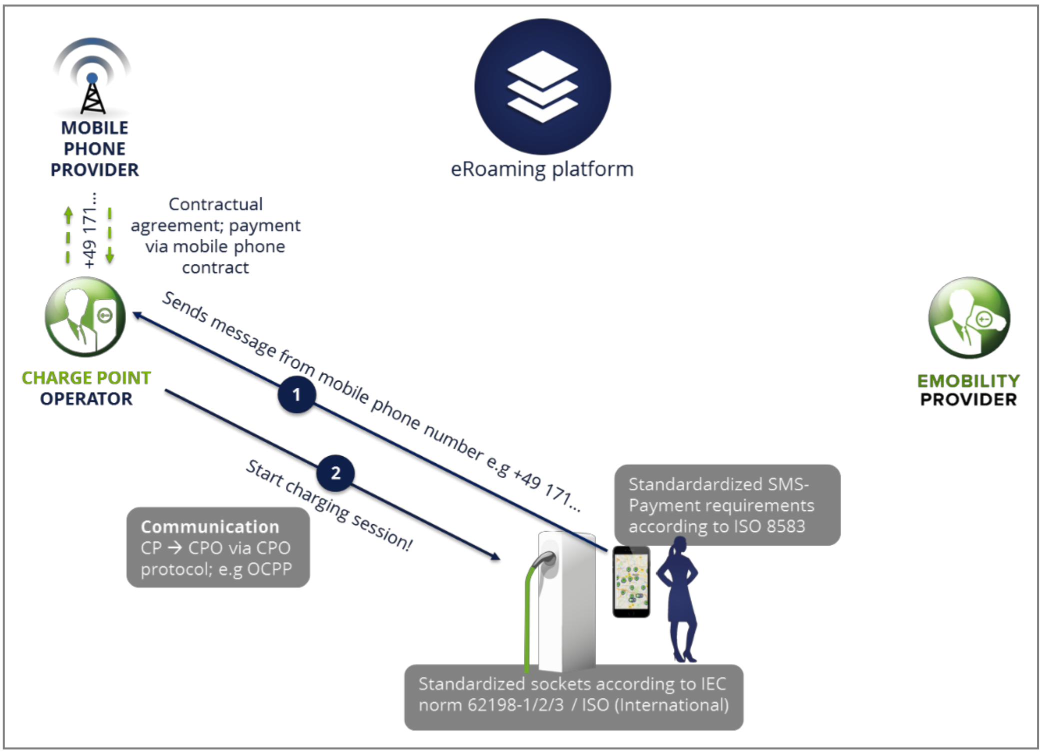
REMOTE via SMS

Ad-hoc charging becomes possible through mobile phone authentication by means of an SMS payment.



Ad-hoc authentication (remote) via SMS variant 1

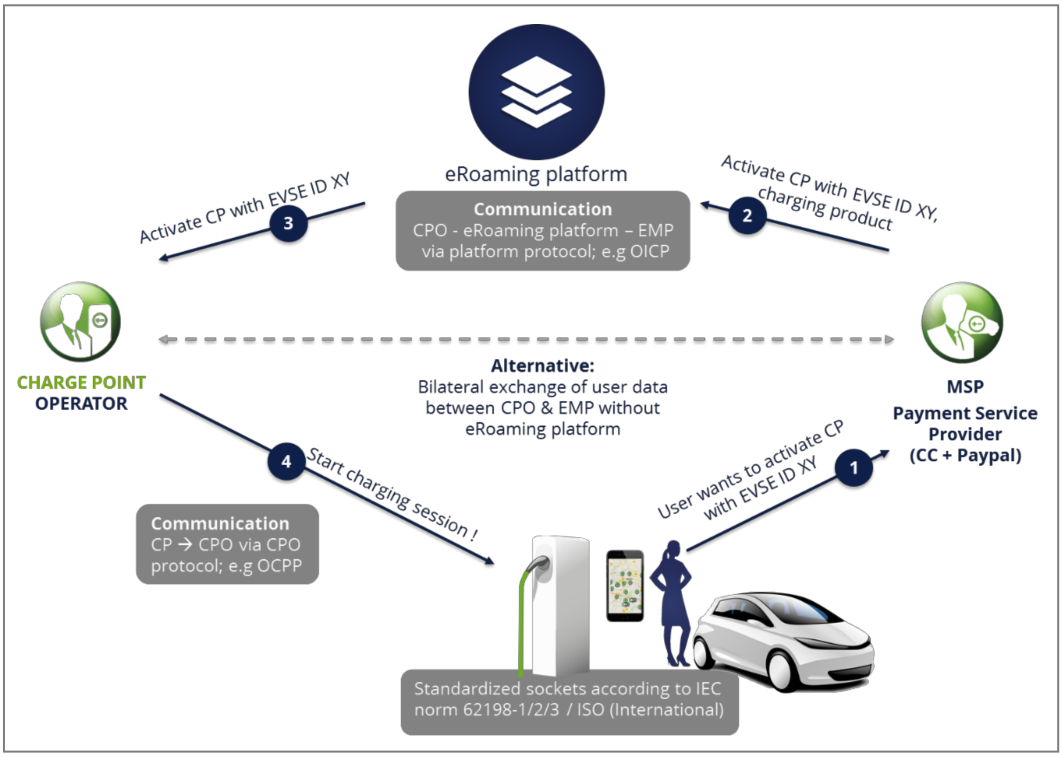
In the first variant of SMS payment is the driver able to choose the mobile phone provider. The driver requests the activation of a specific charge point with EVSE ID and sends a message from his mobile phone number to the EMP. The payment will be made via the mobile phone contract. The EMP then requests the activation of the charge point via the eRoaming platform at the authorized CPO, who then starts the charging process. The driver stops the charging session by disconnecting the charging cable vehicle-sided.



Ad-hoc authentication (remote) via SMS variant 2

In the second variant of SMS payment inherits the CPO at the same time the role of the EMP and chooses the mobile phone provider. The driver requests the activation of a specific charge point with EVSE ID and sends a message from his mobile phone number to the CPO. The payment will be made via the mobile phone contract. The authorized CPO starts the charging process. The driver stops the charging session by disconnecting the charging cable vehicle-sided.

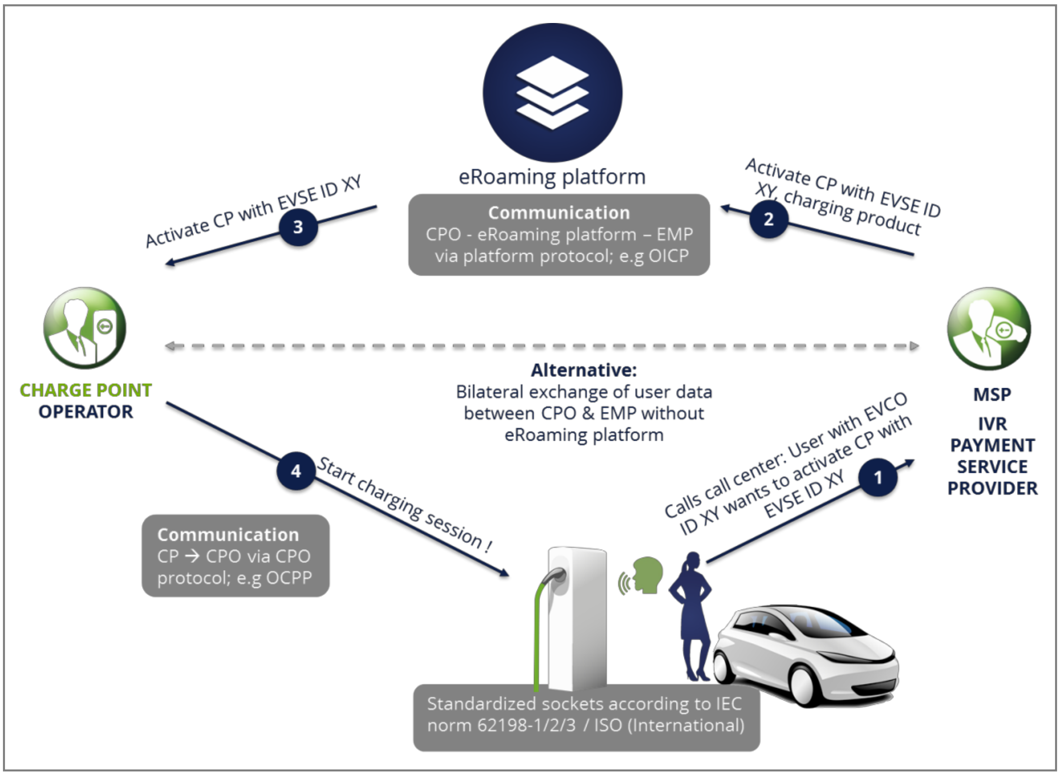
REMOTE Mobile Website



Ad-hoc authentication (remote) via mobile website

The driver requests the activation of a charge point with its specific EVSE ID at a payment service provider via the mobile website either by scanning a QR code at the charge point or by selecting the charge point on the map of the website. The payment is made either by Paypal or credit card. The payment service provider then requests the activation of the charge point via an eRoaming platform at the authorized CPO, who then starts the charging. The driver stops the session using the mobile website.

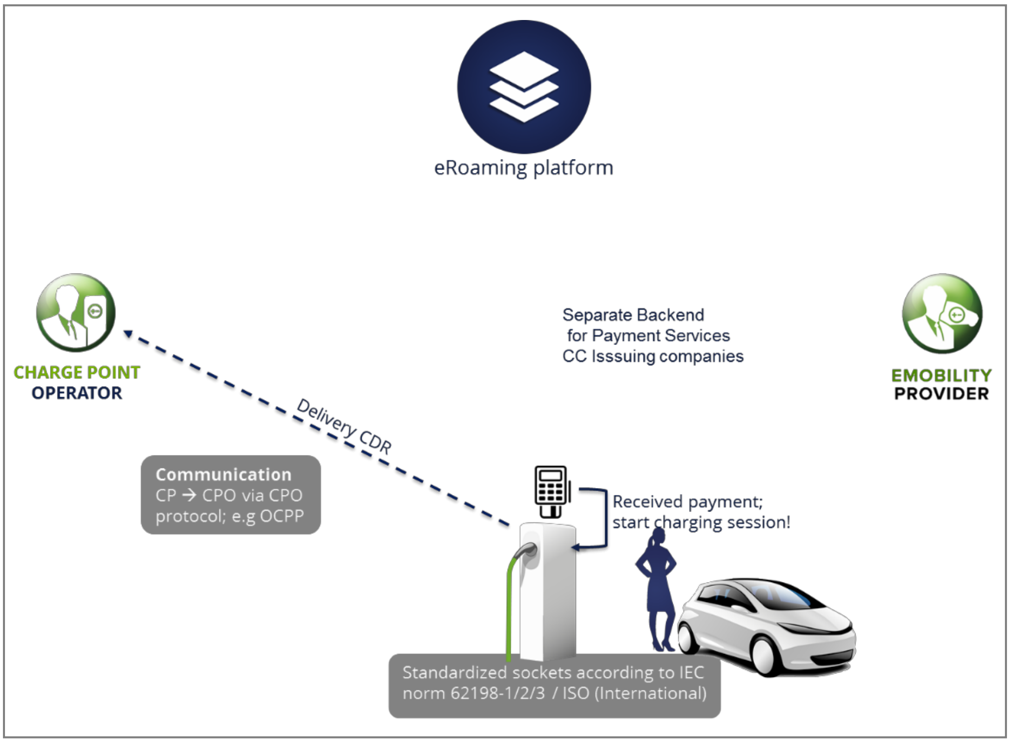
REMOTE via IVR



Ad-hoc authentication (remote) via IVR

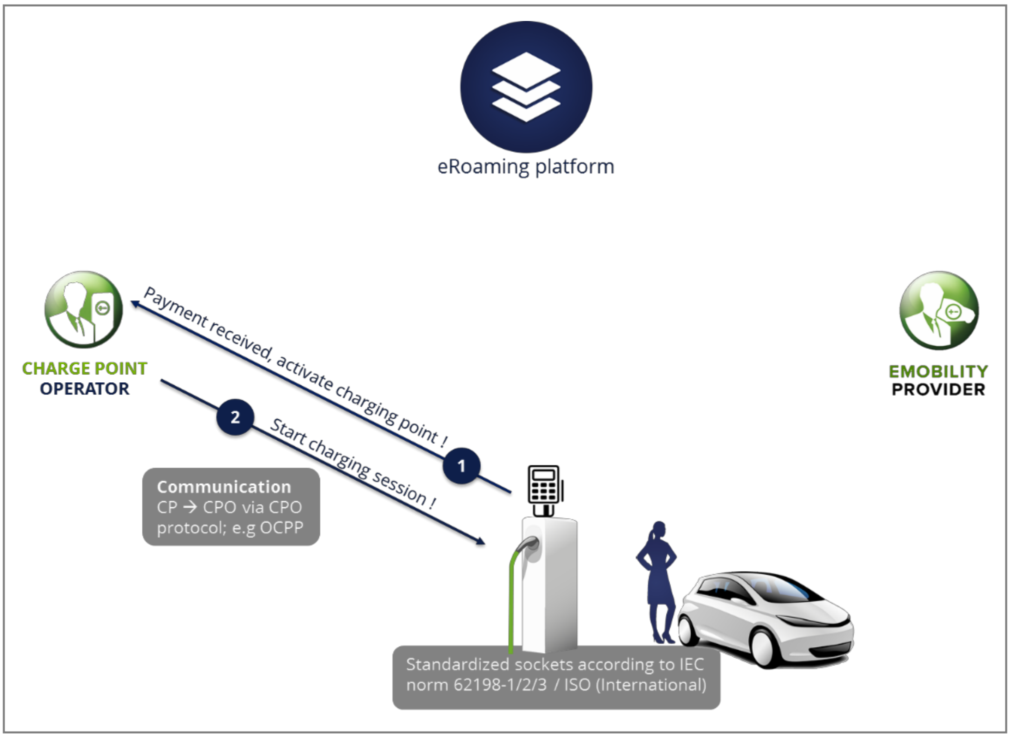
The driver requests the activation of a charge point with its specific EVSE ID at an IVR payment service provider by calling an IVR system. The payment service provider then requests the activation of the charge point via an eRoaming platform at the authorized CPO, who then starts the charging. The driver stops the charging session by disconnecting the charging cable vehicle-sided.

LOCAL CC Reader



Ad-hoc authentication (local) via CC reader variant 1

The driver starts the activation by paying with his credit card at the CC reader of the charging station for a specific charging time period. When the CC reader receives the payment, the charging session is started. The CDR of this session is sent to the CPO, who functions in this case as the EMP. A separate backend for payment services CC issuing companies is needed. As soon as the preselected time period run off, the charging process is stopped automatically.



Ad-hoc authentication (local) via CC reader variant 2

The driver starts the activation by paying with his credit card at the CC reader of the charging station for a specific charging time period. The CPO here also inherits the role of the EMP. When the CPO receives the payment, the charge point is activated and the session is started. As soon as the preselected time period run off, the charging process is stopped automatically.