

Understanding advanced features and implementation in the context of ISO 15118: use cases and recommendations

Eurelectric recommendations

[July 2020]

Eurelectric represents the interests of the electricity industry in Europe. Our work covers all major issues affecting our sector. Our members represent the electricity industry in over 30 European countries.

We cover the entire industry from electricity generation and markets to distribution networks and customer issues. We also have affiliates active on several other continents and business associates from a wide variety of sectors with a direct interest in the electricity industry.

We stand for

The vision of the European power sector is to enable and sustain:

- A vibrant competitive European economy, reliably powered by clean, carbon-neutral energy
- A smart, energy efficient and truly sustainable society for all citizens of Europe

We are committed to lead a cost-effective energy transition by:

investing in clean power generation and transition-enabling solutions, to reduce emissions and actively pursue efforts to become carbon-neutral well before mid-century, taking into account different starting points and commercial availability of key transition technologies;

transforming the energy system to make it more responsive, resilient and efficient. This includes increased use of renewable energy, digitalisation, demand side response and reinforcement of grids so they can function as platforms and enablers for customers, cities and communities;

accelerating the energy transition in other economic sectors by offering competitive electricity as a transformation tool for transport, heating and industry;

embedding sustainability in all parts of our value chain and take measures to support the transformation of existing assets towards a zero carbon society;

innovating to discover the cutting-edge business models and develop the breakthrough technologies that are indispensable to allow our industry to lead this transition.

Dépôt légal: D/2020/12.105/43

[WG E-mobility]

Contact:
[Petar GEORGIEV, Advisor Climate & E-mobility –
pgeorgiev@eurelectric.org]

This document builds on previous Eurelectric [work](#) on interoperability in the EV charging infrastructure domain and expands on our sector's [policy priorities](#) in this area

Eurelectric has long been a promoter of a single market approach to e-mobility services in Europe. Such an approach should work to ensure a non-discriminatory market environment for all involved market parties and also guarantee the accessibility of data as well as the data sovereignty of the customer. Only by safeguarding these principles will transition in the power and transport sectors be successfully advanced. Central to the single market approach is the customer's freedom of choice of the desired authentication and payment method as well as the e-mobility service provider in a competitive and innovative market environment.

In this paper, Eurelectric explores the use cases for communication protocols and standards across the EV charging ecosystem. This will reveal the type of data needed for the power system and its optimised operation with the integration of electric vehicles. Moreover, the paper highlights the necessary conditions for a level playing field among all market players concerning the value-added services that will significantly increase customer comfort.

1. A European single market approach to e-mobility requires EV charging interoperability

The EV charging interoperability domain is still in an early stage and is evolving rapidly. While hardware interoperability benefits from minimum standardisation requirements at EU level, the debate concerning communication protocols and standardisation is less clear. Some of the tools ensuring different interoperability features are *de facto* industry specifications (e.g. OCPI, OCPP, CCS, CHAdeMO, OpenADR) whereas some are *de jure* international standards (e.g. ISO/IEC 15118; IEC 61851 series; IEC 62196 series; and for demand response IEC 62746-10-1).

Findings from the latest report¹ by the Sustainable Transport Forum, the European Commission's expert group on alternative transport, show mixed reactions and approaches in respect to the need for harmonising communication protocols at EU level.

ISO 15118 – an international standard defining a protocol for communication between electric vehicles and charging infrastructure – offers Plug & Charge i.e. automatic authentication, roaming and payment, and advanced features, such as bidirectional charging (V2G) and wireless power transfer. All of ISO 15118's three "advanced" (outer loop²) features – automatic authentication, smart charging (management of EV charging load) and automatic payment – rely on cybersecurity provisions that were designed to establish digital trust between driver/EV and the EVSE/charging infrastructure.

The introduction of new EV models with ISO 15118 from 2020 onwards might provide an enabler for e-mobility at large. Unfortunately, the current **implementations of the ISO 15118 by the vehicle manufacturers may lead to market distortion and anti-competitive effects** due to the following aspects:

- A. Restriction of the customer's freedom of choice and distortion of competition through preselection of an e-mobility service provider (EMSP) by the vehicle manufacturer (OEM)

¹ See Figure 16 of the [2019 STF report](#), responses by 77 organisations

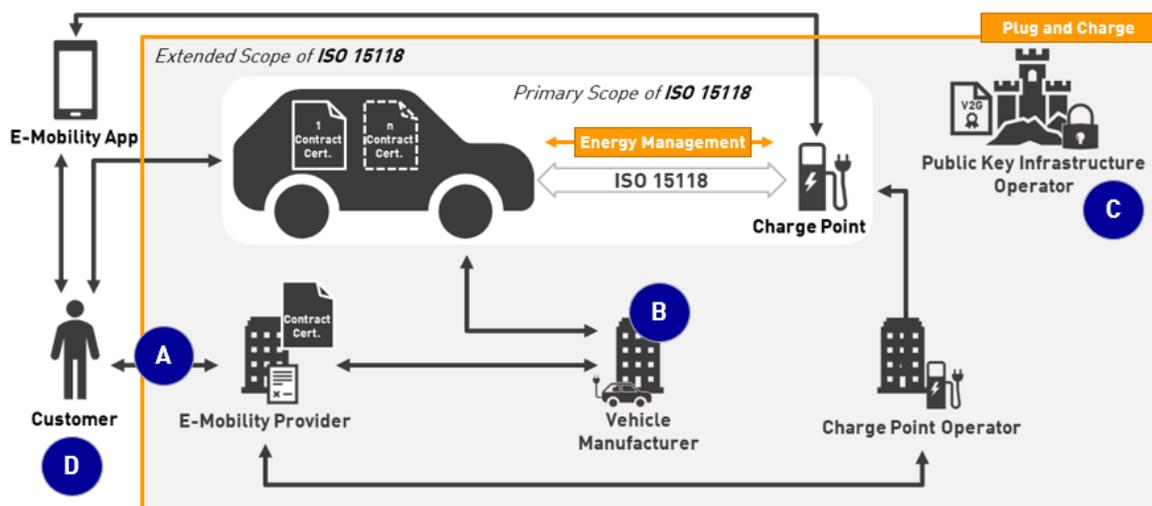
² ISO 15118 is a communication standard between EV, charging infrastructure and CPO and EMSP backends.

It has an inner loop that controls the energy transfer of kWh between EV and charger and an outer loop that manages the service contract (ID, payment, receipt).

by default respectively ex factory. Currently it is not ensured that there is a level playing field among all EMSP vis-à-vis the customer at the point of vehicle purchase.

- B. Market fragmentation and discriminatory behavior through the establishment of closed ecosystems by the OEMs, limiting innovation by other market players and causing high retrofitting or replacement cost for existing publicly accessible charging infrastructure
- C. Unclear application of secure and non-discriminatory public key infrastructures (PKI) at the expense of competition and of drivers' data.
 - a. The implementation of the PKI has not yet been clarified concerning their number, specific operators and governance, non-discriminatory access for all market participants and cross-border interoperability. There is currently no obligation for OEMs to make their selected PKI open and interoperable. Furthermore, the OEMs are not obliged to provide the vehicle provisioning certificates, which are necessary to generate the charging certificates. Both factors lead to a fragmentation of the European market and a situation in which EMSPs other than those associated to OEMs simply cannot issue charging certificates.
 - b. Charging infrastructure becomes vulnerable – it is regarded more and more as a critical infrastructure with potential impacts on the power grid, however DC charging has been proven to be vulnerable to hacking and the current ISO 15118 PKI does not remedy this. User data of every “Plug & Charge” session can be traced and hacked.
- D. Decrease in consumer experience:
 - a. No billing per driver without using additional features (app, RFID etc.) possible: ISO 15118 authenticates the EV, not the driver. Fleets, employers, and lease companies are restricted to counting the EV and are not able to differentiate between different drivers for one EV that belong to different legal entities or when a vehicle is transferred from one driver to another.
 - b. No loyalty programs possible: B2B customers such as retailers, hotels or gas stations have no use for their customer retention programmes via mobility app/RFID card. They cannot show prices/accept payment via the app/card.
 - c. No possibility for driver to choose an EMSP: At the charging station, the driver can use the cable only, and can not use an app or RFID card of another EMSP.

Overview of identified issues related to ISO 15118



Based on these facts it is evident that the ISO 15118 technical standard alone does not provide for a non-discriminatory market environment. Therefore, steps need to be taken to ensure fair market access and avoid anti-competitive behaviour. These rules cover the following applications and use cases.

2. Applications and use cases

Ranging from the preparation of charging to the execution of the charging session at the charging infrastructure, a number of issues concerning EV charging interoperability can be identified. To achieve a truly seamless charging experience for the European customer, the following applications and use cases need to be considered and attention must be paid that these are implemented in such a way that non-discriminatory market conditions are ensured.

Public key infrastructure design

An essential requirement for the implementation of advanced charging-related functionalities is a reliable platform for digital trust and secure data communication. The ISO 15118 standard is based on a Public Key Infrastructure (PKI) design that is supposed to provide this technical foundation. It uses digital certificates to enable secure (encrypted) communication between the e-vehicle and the charging station, as well as for the use of charging service contracts for e-vehicles and drivers. The implementation of the PKI has to be clarified regarding the number, specific operators, governance and non-discriminatory access for all market parties and ensure cross-border interoperability. Especially the integrity of vehicle provisioning certificates, which are required to generate charging certificates, has to be ensured. To guarantee the above-mentioned single market approach to e-mobility, to avoid fragmentation of the European market, and to achieve a fair competitive environment, a proprietary and closed public key infrastructure of a privileged market participants, which ISO 15118 enables and in practice has facilitated, must be prevented. The public key infrastructure (PKI) should be operated by a neutral entity and ensure cross-border interoperability.

Preparation of charging sessions and accessibility of charging-related functionalities

The customer should be at the centre of all use cases concerning promotion of EV charging interoperability and derived recommendations. To provide the best possible charging experience,

the preparation of charging sessions and the accessibility of charging-related functionalities play a paramount role. One element is optimised fast charging, which shortens the overall charging time and thus the time a charging station is occupied. Optimised fast charging is enabled through the thermal preconditioning of the vehicle battery prior to the charging session. However, this feature is currently only accessible through the on-board navigation of the vehicle. Customers and third parties authorised by the customer must be able to access this functionality under fair and transparent conditions. Moreover, such functionalities should not be bound exclusively to the vehicle's systems.

Whilst there are communication standards defining interoperability between the vehicle and the charging station during the charging session, there is also a need for standardisation for the data communication between the vehicle and the charging station **prior** to the charging session (e.g. for triggering the thermal preconditioning process, or charging service reservations, etc.).

Increasing customer comfort through Plug & Charge

Plug & Charge may significantly enhance customer convenience through automated authentication of charging sessions, however the goal of increasing convenience should not be achieved at the expense of a competitive market. In addition to Plug & Charge, the ISO 15118 standard also has energy management features that might promote the long-term market penetration of e-mobility. Therefore, ISO 15118 and Plug & Charge are not a premium functionality. The costs associated with advanced functionalities in all charging infrastructure may increase costs paid by EV drivers, including those who may not wish to use them. Importantly, the customer's freedom of choice needs to be safeguarded to choose and change the e-mobility service provider, to change charging contracts before a charging session, to deactivate Plug & Charge and to choose a different means of authentication and payment at the charging station. It is therefore essential that these choices are not inhibited by unnecessary technical restrictions or requirements.

In addition, security and safety of users' data and network integrity are uncertain due to technology gaps in the PKI defined in ISO 15118. This PKI design has been carefully assessed by cybersecurity experts, who found it flawed as a scalable, extensible production implementation in light of critical governance, technology and operational issues that negatively impact the proposed goals of EV charging industry stakeholders. The proposed PKI design leaves too much room for different interpretations by the implementing parties, and conflicts with best practices from successfully deployed global PKIs. This aspect can be addressed with the set-up of an independent PKI and Certification Authority (CA) that would also guarantee full competitive autonomy with respect to the multiple e-mobility players evolving in the market and its various segments. The consumer authentication process needs to be handled by a totally neutral PKI design and independent service provider to avoid any potential conflict of interest or some form of monopoly.

3. Recommendations

1. Customers shall not be restricted in their choice of e-mobility service provider, nor of the charging station accessed – neither at the point of purchase of an electric vehicle, nor before each individual charging operation. In turn this means, that it has to be ensured that customers have transparency and access to all EMSP at the point of purchase and freedom of choice regarding their preferred method of authentication and payment.

2. Customers must be able to change their e-mobility service provider to the extent that the installation and regular update of charging certificates in the case of ISO 15118 must be guaranteed in a simple, customer-friendly, immediate manner and with maximum protection of its data. More generally, all available methods of authentication and payment at the charging station shall be equal.

3. Immature standards such as ISO 15118 should not be mandated, only general technical features and functionalities should be required. Specifically, ISO 15118 shall not be mandatory since it allows for only one Plug & Charge charging contract³ per vehicle with ISO 15118 and is therefore potentially highly damaging to market competition. In addition, the broadband Power Line Communication (PLC) technology that ISO 15118 requires was not widely adopted compared to more modern, robust, and affordable solutions (both wired and wireless). PLC is only used in CCS while some 90% of all DC chargers in the world use CAN (Controller Area Network) communication; moreover, due to its technical characteristics, unlike narrowband PLC (e.g. G3) broadband PLC is not suitable for use in the power-grid.

The market rollout with ISO15118 can start as a market driven pilot phase in various Member States and will provide transparency on available EVs and charging infrastructure. Data from other markets e.g. the US where DC chargers with CCS are operated without ISO 15118 will also be helpful. Therefore it can be avoided to set a premature standard as a mandatory requirement.

4. Market participants – especially those with more than one market role – shall neither establish closed corporate ecosystems nor restrict market competition.

5. The PKI forms the technical foundation for the implementation of advanced functionalities in e-mobility. To ensure non-discriminatory access for all e-mobility service providers and cross-border interoperability at least within Europe, it should be operated as sensitive and critical infrastructure by a neutral and independent party.

6. In principle, charging-related functionalities must be accessible to all customers and all parties that have been authorised by the customer to perform them. Concerning the preparation of charging sessions, the thermal preconditioning of the battery, must be directly accessible to customers and by the customer authorised third parties, without navigation via an on-board unit or other dependency on the automaker.

7. Data sovereignty lies with the customer. To ensure a fair and level playing field and to promote EV charging interoperability among all market parties to the benefit of the customer, data required for processes relevant to the energy industry, for the intelligent management of EV charging, and for the development of innovative services, must be made available to all market parties without pre-selection or manipulation of data.

8. Certificates should be issued according to cybersecurity industry best practices by independent Certification Authorities (CAs); those authorities should be tendered by a qualified, balanced, industry coalition. There can be multiple CAs but all following the same governance and operational policies and practices, as agreed by the industry coalition.

9. Pricing cannot be set by the security certifying authority as it needs to be freely negotiated at charging point operator (CPO) and EMSP level to ensure fair market rules.

³ ISO 15118-2 Ed.1 theoretically allows for different ways of changing the charging contract. However, the OEM is free to choose which ways to implement. This leaves space for uncertainty and might differ from vehicle to vehicle.

4. Concluding remarks

We believe that it is too early to mandate or privilege communication protocols via EU harmonisation measures, since a number of promising, competitive standards are in development but not yet finalised. Moreover, multiple international industry initiatives are in progress to harmonise the existing EV recharging technologies to achieve as much interoperability as possible, and technology neutrality should be guaranteed.

Prescribing a minimum level of charging interoperability should be achieved through consultation with industry experts and standardisation committees at the international / European levels, without mandating specific protocols, leaving the door open for all existing and upcoming technologies. Building on the skillful development of use cases can be a way to create protocol-agnostic requirements for achieving 'charging smartness'.

Promoting standardisation for EV charging interoperability must be accompanied by rules for a level playing field and fair competition that guarantee the free choice of customers and prevent anti-competitive behaviour. This approach is needed not only in EU legislation but also in corresponding transposition of EU laws at the national level.

Annex: Overview of charging protocols / standards

High level use case	Protocols / standards	Parties involved
Managed/smart charging	ISO/IEC 15118: CCS, IEC 61851-24: CHAdeMO, IEC 63110	EV, CP, CPO, EMSP
Bidirectional charging (V2G)	IEC 61851-24: CHAdeMO	EV, CP, CPO, EMSP, DSO
Management of charging infrastructure	IEC 63110, OCPP	EV, CP, CPO
Roaming	IEC 63119, OCPI, OICP, OCHP, eMIP	EV, eRoaming platform

Eurelectric pursues in all its activities the application of the following sustainable development values:

Economic Development

- Growth, added-value, efficiency

Environmental Leadership

- Commitment, innovation, pro-activeness

Social Responsibility

- Transparency, ethics, accountability



Union of the Electricity Industry - Eurelectric aisbl
Boulevard de l'Impératrice, 66 – bte 2 - 1000 Brussels, Belgium
Tel: + 32 2 515 10 00 - VAT: BE 0462 679 112 • www.eurelectric.org
EU Transparency Register number: [4271427696-87](https://ec.europa.eu/transparency/regexp1/index.cfm?do=entity.entity_details&entity_id=4271427696-87)