ID and Data Collection for Sustainable fuels in Europe

Report

Deliverable 2.2.5: ***Proposal to the Commission for complementary data protocols to enable e-Mobility service provision and proposal for relevant standards***

Project Acronym	IDACS
Project Full Name	ID and Data Collection for Sustainable Fuels in Europe
Grant Agreement number	MOVE/B4/SUB/2018-498/CEF/PSA/SI2.792684
Activity	2.2 Provision of static and dynamic data through the National Access Points of the Member States in requested format DATEX II
Deliverable Status	Final
Dissemination Level	Public
Version / date	V2.0 (final) / 30-06-2022
Main authors	Jan Wegener, NOW GmbH Anneke Bosma, Netherlands Enterprise Agency
Reviewers	Pauline Lanz, Netherlands Enterprise Agency Hielke Schurer, Netherlands Enterprise Agency Sophie Duval, Gireve

Co-financed by the Connecting Europe Facility of the European Union

Table of contents

List of abbreviations

AFI	: Alternative Fuels Infrastructure
AFID	: Alternative Fuels Infrastructure Directive
CNG	: Compressed Natural Gas
CPO	: Charge Point Operator
eMIP	: e-Mobility Protocol Inter-Operation
EVSE	: Electric Vehicle Supply Equipment
FCH-JU	: Fuel Cells and Hydrogen Joint Undertaking
GNSS	: Global Navigation Satellite System
HRS	: Hydrogen Refuelling Station
IDRO	: ID Registration Organization
IEC	: International Electrotechnical Commission
ITS	: Intelligent Transport Systems (directive)
LNG	: Liquefied Natural Gas
LPG	: Liquefied Petroleum Gas
MSP	: Mobility Service Provider
NAP	: National Access Point
OCHP	: Open Clearing House Protocol
OCPI	: Open Charge Point Interface
OICP	: Open Inter Charge Protocol
OSI	: Open Source Initiative
POI	: Point Of Interest
PSA	: Programme Support Action
P2P	: Peer-to-peer
SDO	: Standards Developing Organizations
SGEMS	: Sub-Group on Electro-Mobility Services (Sustainable Transport Forum)
WWCP	: World Wide Charging Protocol Suite

1. Introduction

The Programme Support Action (PSA) was derived from two directives of different disciplines, namely the Alternative Fuel Directive 2014/94/EU (AFID) and the Intelligent Transport System Directive 2010/40/EU (ITS). Whereas the AFID focuses on the stimulation of the uptake of alternative fuels, such as electromobility, the ITS directive focuses on optimal use of road, traffic and travel data for traffic (management) and transport purposes. Consequently, both directives serve different users, although there exist relevant points in common. AFID aims to make alternative fuel data available for consumers through third party service providers, while ITS intends to provide data for ITS services for traffic management and freight transport. However, efforts are being made to integrate systems and regulations from different disciplines, in order to facilitate broader application possibilities, from which this PSA is an example. Thus, the collection and exchange of data in DATEX II format through the National Access Point, derives from the ITS directive, whereas the data categories are derived from the alternative fuels framework, and in particular the AFIR proposal[1].

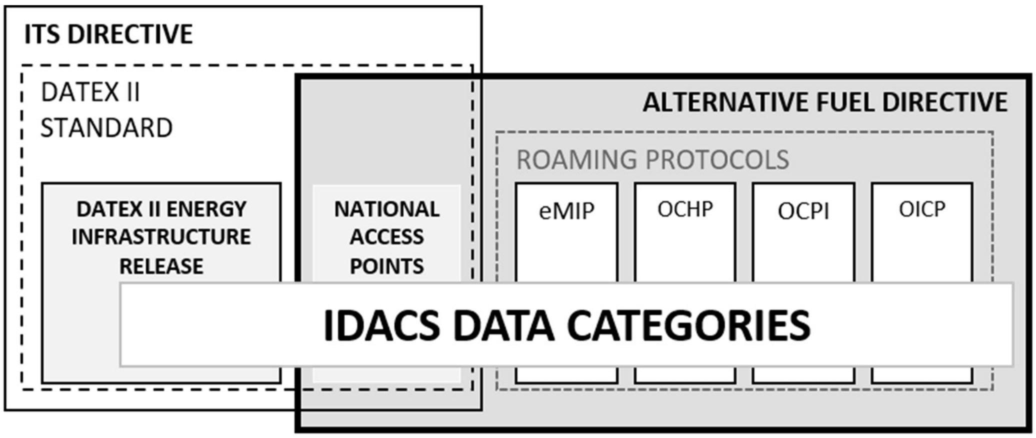

Figure 1: IDACS data categories exchangeable within standards & protocols from both ITS & AF directive

Consequently, this has implications for the PSA. The Grant Agreement specifies that: *the provision of static and dynamic data through the National Access Points of the Member States* should be *in requested format DATEX II (or any machine-readable format fully compatible and interoperable with DATEX II)* In June 2021, the *Energy Infrastructures* publication, also known as the DATEX II version 3.2, including Point of Interest (POI) electromobility data, was launched. However, in the practice, whilst third party service providers or end users in electromobility may benefit from the data collection on the National Access Point, the provided DATEX II format is not yet in use in the electromobility market, because it serves a different purpose, namely the exchange of data for traffic management and freight transport's use. The protocols that are in use in the electromobility market for sharing POI data are the roaming protocols. Their initial intended purpose has been authentication of the end user (EV driver), authorisation of charging sessions and billing. For these purposes all the static and dynamic data categories are part of the protocols, albeit in different data fields (attribute names) and data types (integer, Boolean etc.). The DATEX II format offers the advantage of a uniform format for this type of data.

The Grant Agreement states that fuel specific standards and protocols may become more relevant in future when innovative services in the energy system such as smart charging and vehicle to grid applications are developed. Therefore, the Grant Agreement also requires to study what fuel

[1] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52021PC0559

specific data formats and communication protocols in the electromobility market are relevant on top of DATEX II. Thus, this document explores commonly used communication protocols with a focus on those that are used for e-roaming[2] (hereinafter: roaming protocols)[3].

2. Purpose of this document

This document aims to present complementary data protocols on top of DATEX II to the Commission to enable e-Mobility service provision. The purpose of this document is therefore not to give a recommendation for any of the roaming protocols but it will analyse these in terms of their origin, distribution, and openness. The document will find that none of the protocols can be considered *open source* and that all of them have different kinds of cost attached to them. The analysis presented in this document provides insight into available protocols, facilitating third party service developers to access and/or re-use the data, made available through the different NAPs. This overview will further promote the provision of static and dynamic data related to the alternative fuels infrastructure for electricity, which is the main aim of activity 2.2 of the IDACS project.

3. Methodology

The analysis of roaming protocols comprises a summary of the basic functions of the protocols and will briefly touch upon the backgrounds of the protocols, i.e. the initially intended use cases for them. The latest versions will be described even though older versions may still be in use in some cases.

The Grant Agreement states that *robust and secure open standards and protocols* should be promoted. Consequently, a discussion of how *openness* is defined according to different perspectives and an analysis of the different data protocols will be part of section 4 of this document.

Lastly, the document will show to what extent and how the roaming protocols contain fields for the different data categories that are in the scope of IDACS. This will give insight into what IDACS required POI data roaming protocols are able to convey. Moreover, the results will be interpreted in the context of different applications and whether the use of conversion tools allows to convert the data into DATEX II.

4. Roaming protocols

Roaming protocols in use in Europe and relevant for IDACS, are for example the eMobility Inter-Operation Protocol (eMIP), the Open Clearing House Protocol (OCHP), the Open Charge Point Interface (OCPI) and the Open Inter Charge Protocol (OICP). Further, roaming protocols such as

[2] According to Article 2 (21) of the proposal for a regulation on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU of the European Parliament and of the Council “e-roaming means the exchange of data and payments between the operator of a recharging or refuelling point and a mobility service provider from which an end user purchases a recharging service”.

[3] Protocols used for the communication between charging points and the backend of the operators, such as OCPP, will not be described in detail as the Member States in the Consortium decided in their approaches to enable data conversion from different roaming protocols to DATEX II v 3.2 only. OCCP as a protocol seemed ill-suited for the data aggregation via NAP databases because at least hundreds of connections would need to be established between NAP and every CPO to collect charging point data. Fewer connections are required between NAP and roaming platforms.

the World Wide Charging Protocol Suite (WWCP) or interfaces such as OIOI are not described here due to their limited relevance in the context of IDACS. The relevance is limited as only a few or certain market actors make use of them, whereas the others connect thousands of charging points of a multitude of CPOs and MSPs.

The essential functions of the aforementioned protocols are authorization and billing which enable charging sessions and payment. Table 1 summarizes the comparison of the functionalities and communication topologies (platform-based[4] or peer-to-peer) supported by each protocol.

	eMIP 0.7.4	OCHP 1.4 & OCHPdirect 2.0	OCPI 2.2	OICP 2.3
Authorization	●	●	●	●
Billing	●	●	●	●
EVSE static data	●	●	●	●
EVSE dynamic data	●	●	●	●
Tariff Information	●	●	●	●
Remote Start & Stop	●	●	●	●
Reservation	●	●	●	●
EVSE Monitoring[5]	●		●	
Smart Charging			●	
Hub	●	●	●	●
Peer-to-Peer		●	●	

Table 1 Basic functionalities of the roaming protocols

4.1 Origins of the different roaming protocols

The different protocols all have different origins that also partly explains their setup and design. Brief descriptions of their origin and the use cases they are intended to serve are illustrated in the following section. Each protocol is described along the same characteristics, namely: origin, owner, scope, compatibility with other protocols, the type of connections that are supported, its services, users and costs. Annex 1 provides links to more specific information, such as conditions for use and functionalities in the latest releases of these protocols.

4.1.1 eMobility Inter-Operation Protocol (eMIP)

Origin and ownership

eMIP is developed by the French roaming provider GIREVE, whose shareholders are the state-owned bank Caisse des Dépôts, electricity producer CNR, venture capital provider Demeter, electric utility company Électricité de France (EDF), electricity distributor Enedis and Renault.

[4] Following terms are used interchangeably: (roaming) hub, roaming platform, clearing house

[5] Function for immediate detection of malfunctions of the EVSE.

Scope
As of November 2021, GIREVE's roaming platform connects approximately 160 000 charging points in 32 countries.

Supported connections
eMIP works *via a clearing house* and does not support peer-to-peer connections.

Compatibility
According to GIREVE, eMIP is compatible with OCPI since 2018.

Services, users and costs
eMIP's primary use is for the connection to the GIREVE roaming platform. Different services are offered for different market players (MSPs, CPOs and navigation service providers). The prices of these different services are the following:

- Price for one off technical connection to GIREVE range from 5000€ (single role CPO or eMSP) to 7000€ (both roles).
- Yearly subscription CPO : 0 to 4000€
- Yearly subscription eMSP : 3000€ to 8000€ + fee per session or active drivers based on volume

More information
In Annex 1 more information about the conditions for use and functionalities of eMIP in the current version 1.0.1.4 can be found.

4.1.2 Open Clearing House Protocol (OCHP)

Origin and ownership
OCHP was developed by Smartlab Innovationsgesellschaft mbH, a limited liability company owned by 232 local power utilities in Germany, to enable roaming via their platform 'ladenetz.de'

Scope
As of August 2021 ladenetz.de connects more than 100,000 charging points in Europe. As a joint venture together with ElaadNL, a joint research initiative of the Dutch grid operators Smartlab operates another roaming platform called *e-clearing.net*, which also uses OCHP and connects more than 120,000 charge points. E-clearing.net received support from the Dutch and German ministries of economic affairs.

Supported connections
As the name suggests, OCHP is based *on a clearing house* which facilitates the data exchange between all participants. Meanwhile, there is an extension of OCHP protocol which is called OCHPdirect. It was developed to support peer-to-peer communication.

Compatibility
E-clearing.net is compatible with OCPI.

Services, users and costs
OCHP's primary use is to connect to the *ladenetz.de* platform. Different services are offered for different market players (MSPs, CPOs and navigation service providers). The prices of these different services are not disclosed. Prices for a connection to *e-clearing.net* range from €2,500 to €30,000 annually for MSPs (depending on the number connected cards) and €600 to €10,000 for CPOs (depending on the number of connected charge points).

More information
In Annex 1 more information about the data and functionalities of OCHP in the current version 1.4 can be found.

4.1.3 Open Charging Point Interface (OCPI)

Origin and ownership
OCPI was developed by Dutch and Belgian CPOs and MSPs (collaborating under the name eViolin) together with ElaadNL. Until the start of the EVRoaming Foundation in June 2020, the Dutch Knowledge Platform for Charging Infrastructure (Nationaal Kennisplatform Laadinfrastructuur - NKL) held the intellectual property of OCPI and led the development of the protocol. As of July 2021, the board of the EVRoaming Foundation, which currently holds the intellectual property rights, consists of representatives of NKL, EV Box, Chargepoint, LastMileSolutions, Freshmile and Google.

Scope
As of July 2021, OCPI covered 50.000 charging points and 27 CPOs.

Supported connections
OCPI was initially designed for peer-to-peer communication, meanwhile communication through a hub is also supported. Although, it is not based on a clearing house, it is used in internally used clearing houses, e.g. between CPO and MSP, which basically functions like a clearing house.

Compatibility
Two roaming providers are compatible with OCPI: *e-clearing.net* and *GIREVE* which are implemented using OCHP and eMIP, respectively. As a result, organisations can use it in a hybrid way for both peer-to-peer connections and in combination with roaming hubs.

Services, users and costs
Membership of the EVRoaming Foundation can be acquired for an annual fee. Released versions can be used freely, if there are any developer needs one can become a contributor when signing up for a membership of EV4Roaming.

More information
In Annex 1 the data and functionalities of OCPI in the current version 2.2 can be found.

4.1.4 Open InterCharge Protocol (OICP)

Origin and ownership
OICP was developed by Hubject GmbH, a limited liability company whose shareholders comprise

the vehicle manufacturer BMW Group, the tier 1 supplier Bosch, the vehicle manufacturer Daimler, the energy company EnBW, the energy as a service provider Enel X, E.ON, Siemens and Volkswagen.

Scope
OICP is used to enable roaming via the platform *Intercharge*, which currently connects more than 300,000 charging points in 52 countries.

Supported connections
OICP works via a clearing house and does not support peer-to-peer setup. The protocol is split into two parts, one for CPOs and one for EMSPs.

Services, users and costs
The intended use for OICP is to connect to the roaming platform *Intercharge*. Prices range from a one-time connection fee of €5,000 plus 99 per month (€ 1,188 annually) to €5 per charge point per month for CPOs and from €0 to €829/customized fees monthly (€14,256) plus a one-time connection fee of €5,000 annually for MSPs (depending on the number of connected cards).

More information
The data and functionalities of OICP in the current version 2.3 can be found in the Annex 1.

4.2 Characteristics of roaming protocols

The following characteristics of roaming protocols offer insight into the preferred option of utilization of different protocols depending on the starting situation.

4.2.1 Peer-to-peer vs. Platform-based approaches to roaming

As already mentioned in the description of the roaming protocols' origins, two different approaches to roaming for electric vehicles exist: they are either peer-to-peer (P2P) or platform-based (or hub- or clearing house-based). OCPI and OCHPdirect were initially designed as P2P protocols, however, nowadays they can also be used to connect to roaming platforms, if these implement the protocol. eMIP, OCHP and OICP were designed as protocols enabling the communication with roaming platforms.

P2P approach: $y = ((n^2 - n)/2)$ ***Platform approach:*** $y = n$

The formula above shows the difference in connecting through the platform-based approach as opposed to the P2P method. As soon as there are more than four actors involved, there will be more connections with a P2P approach than with a platform-based approach. In markets with many different CPOs, a pure P2P approach would make the connection between all players nearly impossible. For example, in Germany as of November 2021, 950 EVSE Operator IDs have been issued. If one assumes a single CPO per EVSE Operator ID[6], 450,775 connections would need to be made to connect all CPOs on a P2P basis (not considering mobility service providers).

The main advantage of using a platform-based approach is the comparably higher efficiency of having all partners connect to the hub only instead of having every actor connect to everyone else in the market. The disadvantage of the use of platform is that actors' business models can be limited by the functionalities supported by the hub (and its associated protocol). Actors connecting to roaming platforms need to accept terms and conditions which differ from platform to platform. Furthermore, the roaming platforms require their users to pay fees. The amounts to be paid are usually stated on the roaming platforms' websites and often depend on the size of the company involved, the market role (CPO or MSP), the level of support needed to connect to the platform and services used (see section 4.1.).

The main advantage of the peer-to-peer approach is that the actors have potentially higher degrees of freedom while developing their business model. However, as shown above, this type of communication topology potentially requires a lot of resources to establish and maintain a number of connections. The costs are implicit and not known beforehand as they pertain mostly to the activities of the legal departments making single contracts and the IT departments. As the formula indicates, the amount of resources needed increases almost exponentially with the number of connections that need to be made.

Concluding, depending on the starting situation, the market, its set-up and its needs, it may be preferred to choose one roaming approach over another.

4.2.2 Openness of protocols

With the exception of eMIP, all the roaming protocols are designated to be *open* according to their names. In its *Open Source Software Strategy 2020 – 2023* [7], the European Commission states that its aims to encourage and leverage open source principles and software. Furthermore, the Commission specifies that *Open source software (or free software) combines copyright and a license to grant users the freedom to run the software, to study and modify it, and share the code and modifications with others. It facilitates collaboration, innovation, and agility.* This section presents the different definitions of *open* and *open source* that are frequently used, such as the one described above and the *Open Source Initiative (OSI)*[8]. A more detailed assessment of single licenses can be found in Annex 2.

Table 3 illustrates to what extent the different protocols can be considered open according to the above-named definitions and under which licenses they are distributed. It becomes apparent that the *openness* of the protocols pertains to the full documentation of the protocols and to the fact that they can be downloaded free of charge. This should be distinguished from the definition of *open source*[9], which refers to the permission to modify works, such as a protocol.

[6] According to the rules for ID issuing set as part of IDACS Activity 1 this should be the case.

[7] https://ec.europa.eu/info/sites/default/files/en_ec_open_source_strategy_2020-2023.pdf

[8] The definition of 'open source' by the OSI was chosen as it can be regarded as the main steward of the definition of the term even if it has not secured a trademark for it. Other organisations, such as the Free Software Foundation also provide definitions for licenses but focus more on 'free software' with a particular focus on ethics of software development that seemed to be beyond the scope of this paper. https://opensource.org/docs/osd

[9] This implies, among other things, that licensees are allowed to produce derivative works (i.e. modified versions) and distribute them. This carries the risk of distributing different incompatible versions, however, this could facilitate protocol development.

Protocol	Download for free	License	Open source (EU)	Open Source (OSI)
eMIP	Yes	Individual	No	No
OCHP	Yes	MIT License	Yes	Yes
OCPI	Yes	Creative Commons Attribution-NoDerivatives 4.0 International	No	No
OICP	Yes	Creative Commons ShareAlike 4.0 International	Yes	No

Table 3 Openness of protocols according to two commonly used definitions

There are other dimensions that can be discussed when considering the *openness* of these protocols. Even though, for example OCHP is the only protocol distributed under an open source licence as defined by the OSI, which enables that the software can be used, copied, modified, merged, published, distributed, sublicensed, and/or copies of it can be sold, its openness is limited by its use to connect to a roaming platform (ladenetz or e-clearing.net), for which fees have to be paid. The same is true for OICP as well as eMIP, which is distributed under an individual license[10]. These protocols are open in that they and the associated documentation are freely distributed. Furthermore, OCHP and OICP can be modified and modifications can be published, e.g. on software development platforms such as Github. In some cases the original software developer has to be named as part of a new version. The business models of the roaming platforms rely on the fees that are paid for their use. It is part of the roaming platforms' business models to further develop the protocols according to the services they provide and to offer support to the users of the software, which want to connect to the platforms. The software used to connect to the platform is mandated by the platform operators and partly they offer support for the software implementation and onboarding (see 4.1.).

OCPI is free to use and not conditioned on the use of a roaming hub as its initial intended use was to establish P2P connections. As noted above, several roaming platforms have announced plans to implement OCPI. Nevertheless, market actors connecting to a roaming platform with OCPI would still have to pay the fees (and accept terms and conditions) set by the roaming platform. If it is used to connect in a peer-to-peer approach the costs are implicit as described in section 4.2. From an open source perspective, OCPI is distributed under the most restrictive license compared to the other *roaming protocols* as it prohibits the publication of modified versions of the software. The reason for this approach is to forego the risk that different and incompatible versions get into circulation. On the other hand, in order to further develop OCPI, it allows to contribute to the software, when enrolling in one of the membership levels as a *contributor*. There are different costs attached to different membership levels.

[10] "The eMIP protocol is the exclusive property of GIREVE in accordance with the provisions of the Code of the intellectual property. GIREVE concedes to the User a non-exclusive, non-transferable license of use of the eMIP protocol, including its documentation, worldwide in the course of its usual professional activities and notably in order to develop software products based on the eMIP protocol. Any non-authorized use is strictly prohibited, notably any modification, communication, distribution and commercialization of the eMIP protocol as such by the User in any form whatsoever. The present license is conceded free of any charge and without any time limit. However, the present license could be terminated automatically ipso jure and without any formality or prior notice in the event of infringement of the terms of present license by the User, notably in case of an act that infringes the intellectual property rights of GIREVE."

As the use and in parts the development of all of the roaming protocols imply the payment of fees, none of them can be considered truly open, as defined in both the EU as the OSI open source descriptions. In addition to the above points, there are also other criteria for assessing open standards. In the evRoaming4EU project, a comparative analysis of standardized protocols for EV roaming was created. The conditions for international standardization processes of the World Trade Organization's Committee on Technical Barriers to Trade (WTO TBT) were used for this.[11] Next to that, there are standards developed by the standards developing organizations (SDO) such as the International Standardisation Organisation (ISO) or the International Electrotechnical Commission (IEC), which are not distributed freely, however they may solve issues with the applicability of definitions on both P2P- and platform based. For example, the standard IEC 63119 defines a protocol for information exchange for electric vehicle charging roaming services that is currently under development. This protocol might become more relevant in future, next to the roaming protocols described here. Its publication is forecast for 31 October 2023. It is currently unclear what the actual scope of the standards is and whether it will be available in time. Another example would be the standardisation of DATEX II v 2.3 (under the document name prCEN/TS 16157-10:2020) at the CEN, which is ongoing as of November 2021.

Assessing the various protocols with regard to *openness* according to *open source* definitions that might not be suitable for all the different roaming approaches, as it emphasizes the futility of recommending one of the roaming protocols in the market over another. It is evident that the *openness* as suggested in the names of some of the protocols is not necessarily referring to *open source*, but more likely to its free use, its use outside of a platform, or complying with only one of the *open source* definitions. Therefore, the characteristic *openness* of a protocol does not seem valid to recommend one protocol over another one.

4.2.3 Data fields of protocols

The above-mentioned protocols have generally similar data fields for specifying and identifying charging points (see Annex 1). All of them include data fields to define each charging point such as address, geo-coordinates, power type, connector type, opening time, user authorization/identification methods, payment methods, contact, availability and tariff.

However, there are many differences. The main differences are as follows.

1) Data structure, i.e., how the data fields are organized and the information is composed:
   In general, several data fields make up a certain information. For example, address information is a combination of data fields such as country, state, city, street, house number, zip code, etc. In addition to this, some protocols include a data field 'floor' that indicates the floor on which charging points are located whereas other protocols do not.
2) Range of predefined values/options defined by each protocol:
   Some data fields have predefined values to be put into the data fields. For example, the data field 'connector type' has predefined values such as CHAdeMO, IEC 62196 Type 1/2/3, etc. Some protocols have a larger range of predefined values than others. For instance, some protocols have a predefined value 'AVCON Connector', while the others do not.
3) Naming of the data fields and values:
   The naming of data fields is different depending on protocols. For example, data fields for postal codes are named differently, e.g., 'postCode', 'zipCode', etc. Furthermore, predefined values are also differently named, e.g., some protocol names a connector 'Type F Schuko' while another protocol names the same connector 'DOMESTIC_F'.

11 Report can be retrieved at: D6.1-Comparative-analysis-of-standardized-protocols-for-EV-roaming.pdf (evroaming.org)

4) Data type:
   The data type of a data field may differ depending on protocols. For example, OCPI follows 'RFC 3339' format while eMIP and the OCHP follow 'ISO 8601' format to record date and time.
5) Ad hoc charging price:
   eMIP, OCHP and OICP do not have data fields for the prices for ad hoc charging (cf. Annex 3) as these protocols were intended for B2B purposes only with no connection to the end consumer. An option could be to display the prices in other data fields as free text.

   The data written according to each protocol need to be translated into DATEX II v 3.2 format to be *unlocked on the NAPs,* as stated in the Grant Agreement. This implies that the data needs to be carefully compared and matched to ensure correct translation into the single data format, i.e. DATEX II v 3.2. The data classes that are part of DATEX II v 3.2 (Energy Infrastructure) can be found as part of Annex 4.

Currently, the most feasible way to convert charging point data to comply with DATEX II requirements, is by using one of the above-mentioned roaming protocols. As part of IDACS, data conversion will be ensured from OCHP, OCPI and OICP to DATEX v 3.2, therefore compliance with the Grant Agreement with respect to DATEX II requirements is adequately taken care of. As described in the introduction, DATEX II is currently not relevant within the fuel specific infrastructure. The use of the converted data might prove relevant in future in a broader context than merely electromobility business/specific fuel infrastructure for example for new applications/services and interoperability in integrated systems/fields. In that case, it might be that more measures are required to improve conversion, such as the development and adoption of a future single roaming protocol, like IEC63119, which might contribute to DATEX II conversion for protocols that do not have a compatible format yet. Furthermore, if necessary, in a future release of DATEX II possibly other protocols 'data formats could be taken into consideration.

5. Conclusion

As required by the Grant Agreement, research has been performed to describe relevant fuel specific data formats and communication protocols in the electromobility market, on top of DATEX II. Summarizing, it can be concluded that all of the roaming protocols are currently in use for sharing POI data in the European market, albeit to different extents. Where roaming platforms offer the advantage of supplying aggregated data, the P2P approach offers more freedom for business models. Depending on the starting situation, the market, its set-up and its needs, it may be preferred to choose one roaming approach over another.

The *openness* of the protocols has been considered by comparing it to widely recognized *open source* definitions by the EU and the OSI. *Openness* is interpreted differently by all protocols. Nonetheless, the lack of an all-compassing definition or standard is probably not the most urgent issue for the data collection as part of IDACS. In practice, the coexistence of the various protocols is a market reality as they all serve in a particular setting or for a specific use. However, the IDACS consortium acknowledges that a common international standard or protocol focusing on interoperability would be favourable and more resilient.

While all of the roaming protocols can be used to deliver the data that is needed as part of IDACS, differences persist in the exact data properties. Conversion into DATEX II v 3.2 will become necessary on a protocol-by-protocol basis. The Consortium aims to achieve this by the end of the project phase even though DATEX II v 3.2 was only published in June 2021.

Thus, as part of IDACS, no recommendation for one of the existing roaming protocols can be made. An obligation to use only one roaming protocol (in the most current version), would represent a massive market intervention as the protocols are spread to different extents across the different markets across Europe (see section 4.1). The reasons for that are different market structures and accordingly different origins of the single roaming protocols. . On the other side, the existence of multiple e-roaming protocols creates additional costs and set-up issues for charging point operators. Therefore, it is expected that in the medium to long term, e-roaming protocols could converge under a common de jure standard such as IEC 63119.

Protocols developed by individual organizations have the potential to monopolize the market, once they have sufficient market share and power. Thus, such protocols should not be made mandatory. In order to avoid monopolizing the market, possibly in the future, an alternative protocol could be developed by a Standardization Organization (SDO) that unifies different solutions would be the optimal solution. However, this is a time-consuming and costly process since such a protocol is developed through an international standardization process, and it is necessary to reach an agreement considering the circumstances of each country. Moreover, in practice, it currently functions, though interoperability could be improved.

Annex 1 – Specific details per protocol

eMIP

Protocol description: https://www.GIREVE.com/wp-content/uploads/2020/12/GIREVE_Tech_eMIP-V0.7.4_ProtocolDescription_1.0.14-en.pdf

Features implementation guide: https://www.gireve.com/wp-content/uploads/2019/10/Gireve_Tech_eMIP-V0.7.4_ImplementationGuide_1.0.7_en.pdf

OCHP/OCHP direct

The data and functionalities of OCHP in the current version 1.4 can be found here: https://github.com/e-clearing-net/OCHP/blob/master/OCHP.md

The data and functionalities of OCHPdirect in the current version 0.2 can be found here: https://github.com/e-clearing-net/OCHP/blob/master/OCHP-direct.md

OCPI

The data and functionalities of OCPI in the current version 2.2 can be found here: https://ocpi-protocol.org/app/uploads/2019/06/OCPI-2.2-RC2.pdf

OICP

The data and functionalities of OICP in the current version 2.3 can be found here GitHub - hubject/oicp: Open intercharge Protocol

Annex 2 – Overview of common software licenses

Name	Commercial use	Modification	Distribution	Private use	Liability[12]	Warranty[13]	Trademark use[14]	Patent use[15]
Apache 2.0	✓	✓	✓	✓	×	×	×	✓
Creative Commons Attribution-NoDerivatives 4.0 International	✓	×	✓	✓	×	×	×	×
Creative Commons Attribution-ShareAlike 4.0 International	✓	✓	✓	✓	×	×	×	×
MIT License	✓	✓	✓	✓	×	×	Not specified	Not specified
The 3-Clause BSD License	✓	✓	✓	✓	×	×	×	Not specified
The 2-Clause BSD License	✓	✓	✓	✓	×	×	Not specified	Not specified
GNU General Public License version 2	✓	✓	✓	✓	×	×	Not specified	Not specified
GNU General Public License version 3	✓	✓	✓	✓	×	×	Not specified	✓

12 When an accident occurs while using the open source software, is the licensor responsible for it?

13 Does the open source software license provide warranty?

14 Can the names, trademarks and trade names of authors and contributors be used for promotional purposes?

15 Can open source be used for free even without the permission of the patent holder?

GNU Lesser General Public License version 2.1	✓	✓	✓	✓	✗	✗	Not specified	Not specified
GNU Lesser General Public License version 3	✓	✓	✓	✓	✗	✗	Not specified	✓
Mozilla Public License 2.0	✓	✓	✓	✓	✗	✗	Not specified	✓
Common Development and Distribution License 1.0	✓	✓	✓	✓	✗	✗	✗	✓
Eclipse Public License version 2.0	✓	✓	✓	✓	✗	✗	Not specified	✓

Annex 3 – Data fields in respective protocols

	Category	Subcategory	Data field	Value	OCPI	eMIP	OICP	OCHP
Static data	Location	Address	Country	-	●	●	●	●
			State/province	-	●	●	●	
			City	-	●	●	●	●
			Street	-	●	●	●	●
			House no.	-	●	●	●	●
			Post code	-	●	●	●	●
		Geo-coordinate	Charging pool/entrance	-	●	●	●	●
			Related location	-	●			●
			EVSE	-	●	●	●	●
		Additional Info	Time zone	-	●		●	
			Floor	-	●	●	●	●
			Power type	AC 1 phase	●	●	●	●
	Charging option / charging	-	Power type	AC 3 phase	●	●	●	●
			Plug type	DC	●	●	●	●

	power / plug			CHADEMO	●	●	●	●
			Plug type Opening time	DOMESTIC_A	●	●		●
				DOMESTIC_B	●	●		●
				DOMESTIC_C	●	●		●
				DOMESTIC_D	●	●		●
				DOMESTIC_E	●	●	●	●
				DOMESTIC_F	●	●	●	●
				DOMESTIC_E+F		●		
				DOMESTIC_G	●	●	●	●
				DOMESTIC_H	●	●		●
				DOMESTIC_I	●	●		●
				DOMESTIC_J	●	●	●	●
				DOMESTIC_K	●	●		●
				DOMESTIC_L	●	●		●
				IEC_60309_2_single_16	●	●	●	●
				IEC_60309_2_three_16	●	●	●	●
				IEC_60309_2_three_32	●	●	●	●
				IEC_60309_2_three_64	●	●	●	●

				IEC_62196_T1	●	●	●	●
				IEC_62196_T1_COMBO	●	●	●	●
				IEC_62196_T2	●	●	●	●
				IEC_62196_T2_COMBO	●	●	●	●
				IEC_62196_T3A	●	●	●	●
				IEC_62196_T3C	●	●	●	●
				PANTOGRAPH_BOTTOM_UP	●			
				PANTOGRAPH_TOP_DOWN	●			
				TESLA_R	●	●	●	●
				TESLA_S	●	●	●	●
				AVCON Connector		●	●	
				Small Paddle Inductive			●	
				Large Paddle Inductive			●	
				NEMA 5-20			●	
				UNSPECIFIED		●		
				-	●	●	●	●
	Opening time	-	Identification method	Ad-hoc (e.g. credit card, debit card, cash, etc.)	●	●		

	Identification	-	Identification method Payment method	App	●	●	●	●
				RFID	●	●	●	●
				QR code	○	●	●	
				15118	○	●	●	●
				Ad-hoc (e.g. credit card, debit card, cash, etc.)	●	●	●	●
	Payment	-	Payment method Telephone	Subscription (e.g. RFID, App)	●	●	●	●
				Free of charge		●	●	
				Indication of existence of PED terminal	●			
				-		●	●	●
	Contact	-	Website	-	●			
			Status	AVAILABLE	●	●	●	●
Dynamic data	Availability / occupancy	-	Status Status Schedule	BLOCKED	●	●	●	●
				USABLE		●		
				CHARGING	●	●	●	●
				INOPERATIVE	●	●	●	●
				OUTOFORDER	●	●	●	●
				PLANNED	●	●		●

				REMOVED	●	●	●	●
				RESERVED	●	●	●	●
				UNKNOWN	●	●	●	●
				OPERATIVE		●		●
				EVSENOTFOUND			●	
				-	●			●
			Tariff	-	●	●	●	●
	Price/tariff	-	Ad-hoc price	-	∆			

Symbols in the table

● Protocol defines the data field/value

○ Not sure, if protocol defines the data field/value. Here, OCPI defines ‘OTHER’ method of identification. However, there is no detailed description which identification methods could be included in ‘OTHER’ method.

∆ Protocol provides only an example of the message.

Annex 4 – IDACS Data categories and related DATEX II v 3.2 data classes

	Class name	Atttribute name
Static Data		
Location (GNSS And Address (street name, zip code, city,…))	EnergyInfrastructureStation	location
List of available charge-solutions	ElectricChargingPoint	chargingPower chargingSolutionMode maximumCurrent usageType vehicletoGridCommunicationType voltage
List of available connectors (plugs, sockets, induction plate...)	Connector	cableAttached cableType chargingInterface maxPoweratSocket
Opening hours	EnergyInfrastructureSite	openingTimes
Payment methods	EnergyInfrastructureStation	payment authenticationAndIdentificationMethods
Contact info of the owner/operator	ElectricChargingPoint / EnergyInfrastructureSite	operator
Full e-mobility code of the charging point (outlet)	ElectricChargingPoint	externaldentifier

Dynamic Data		
Availability (if the station is operational/ non-operational)	EnergyInfrastructureStationStatus	isAvailable
Occupation status (free, occupied)	RefillPointStatus	currentStatus
Price for ad-hoc charging	PricingPolicy RefillPointStatus	pricePerHour pricePerMinute pricePerUnit