

Open Clearing House Protocol (OCHP)



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Preface

The protocol that is described in this document is how it is currently implemented in the active 'echs.wdl', and is currently commonly referred to as protocol version 0.2.

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Abbreviations

Abbreviation	Meaning
CDR	Charge Detail Record
CHS	Clearing House System
CMS	Chargepoint Management System
eCHS	European Clearing House System
EV	Electrical Vehicle
EVCO-ID	Electrical Vehicle Contract Identifier
EVSE-ID	Electrical Vehicle Supply Equipment Identifier
ID	Identifier
OCHP	Open Clearing House Protocol
PDU	Protocol Data Unit
RFID	Radio-frequency identification
RA	Roaming Authorisation
VAS	Value Added Service

1 INTRODUCTION

1.1 Primary Stakeholders Electrical Vehicles

To understand the playfield involved in the eCHS Figure 1 illustrates the stakeholders according to the current e-mobility market. As every country has different local stakeholders the model is to be further developed. The European clearinghouse's role is to facilitate the exchange of roaming authorisations and charge detail records on a European level. Other (local) clearinghouses might serve the same purpose on a different scale/region. Sometimes one party can have multiple roles simultaneously; E-Laad in this example has both an EV Infrastructureprovider function as well as a clearinghouse-function for some infrastructure/local charge providers.

Stakeholder	Example
Grid Operator	Liander
EV Customer	Mr. John Doe
Energy Supplier	Essent, Nuon
EV Mobility Service Provider	Travel Card
EV Infrastructure Provider	E-iaad
Local Charge Provider	Q-Park, IKEA, Arena
(local) Clearinghouse	European clearinghouse, Ladenetz.de
Charging Station Owner	City of Amsterdam

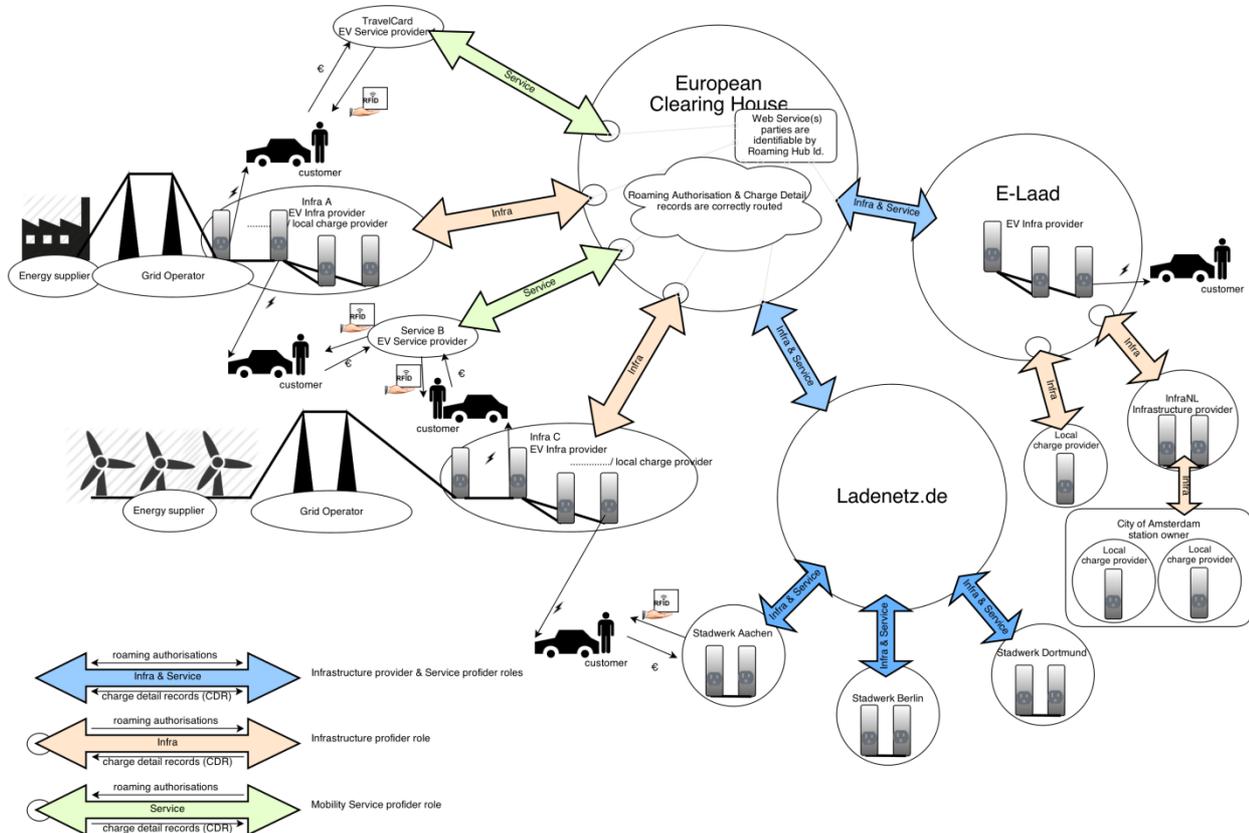


Figure 1 eCHS Stakeholder overview

1.1.1 EV CUSTOMER

An EV customer uses a electric vehicle for local transport and needs electricity for direct mobility needs. The EV customer is able to charge his/her car at home or uses public infrastructure. More and more EV charging stations are available at public accessible locations owned by the local government. Also EV charging locations are available in for example retail locations like IKEA. In this specific case IKEA operates like a local charge provider. The customer has a contract with a EV (mobility) Service Provider.

1.1.2 EV (MOBILITY) SERVICE PROVIDER

The EV (mobility) Service Provider operates as a contract party for the EV customer. The EV Service Provider takes care of the end user authentication and billing processes. The EV Service Provider provides the EV-customer an RFID identification card (or other type of authorization) that gives authorisation to use the contracted charging stations.

1.1.3 EV INFRASTRUCTURE PROVIDER

The EV infrastructure provider operates as a charging point supplier/owner for the EV customer. To fulfill its role, the Infrastructure Service Provider makes use of a Charge point Management System (CMS) that manages multiple charging stations and its charge points and has the information for authorizing users for using its charge points.

1.1.4 LOCAL CHARGE PROVIDER

The (local) Charge provider operates as contract party for the Energy Supplier and Energy Grid Operator. The Charge Provider purchases the Electricity from the Energy Supplier and will send the party that issued the roaming authorization an invoice for the delivered Electricity.

1.1.5 CHARGING STATION OWNER

Sometimes the (local) Charge Provider is not the same party as the owner of the charging stations. For instance, the City of Amsterdam can be owner of a charging station, located in a private Parking Place. For that specific case, the Parking company operates as local charge provider, while the City of Amsterdam is owner of the physical charging station.

1.1.6 ENERGY SUPPLIER

The Energy Supplier is contracted by the (local) Charge provider to deliver the Electricity against the contracted tariffs.

1.1.7 GRID OPERATOR

The Grid operator is owner of the public Electricity network and is responsible for the connection of the charging station to the grid and for the transport of the Electricity.

1.1.8 ROAMING HUB

Each party that serves an Infrastructure providing and/or a EV (mobility) Service Providing role for eCHs will be identifiable with a Roaming Hub ID.

1.2 EV Clearing house

The positioning of a EV Clearing House, and in particular the European EV clearinghouse is clarified in Figure 2. To describe the principal processes, 3 types of stakeholders are depicted in Figure 2, but the processes can easily be expanded to more instances of these types.

The following stakeholders are directly connected to a clearinghouse:

1. Other (local) Clearinghouses, these can be of two types:
 - a. Clearinghouses that do not do any financial transactions, therefore the connected (child)-parties will have to take care of the financial transactions themselves, using contracts. Currently ECHs belongs to this kind.
 - b. Clearinghouses that do take care of the financial transactions, and serves as a contract party for the transactions that are done on its undelaying infrastructure. For example Ladenetz.de is of this kind.
2. EV Infrastructure Providers
3. EV Mobility Service Providers, that have contracts with multiple customers

The basic idea is that a Clearing House gives “Roaming Support” for every EV mobility Service Provider that is connected to it, either directly or via other clearinghouses. The ultimately goal is that the EV-customer can easily charge his Electrical Vehicle on every charging station of every EV Service Provider. With roaming Support, provided by the Clearing House, the complexity of relationships can be reduced: from many-to-many bilateral EV Service Provider relationships towards a one-to-many relationship between Clearing House and the EV Service Providers.

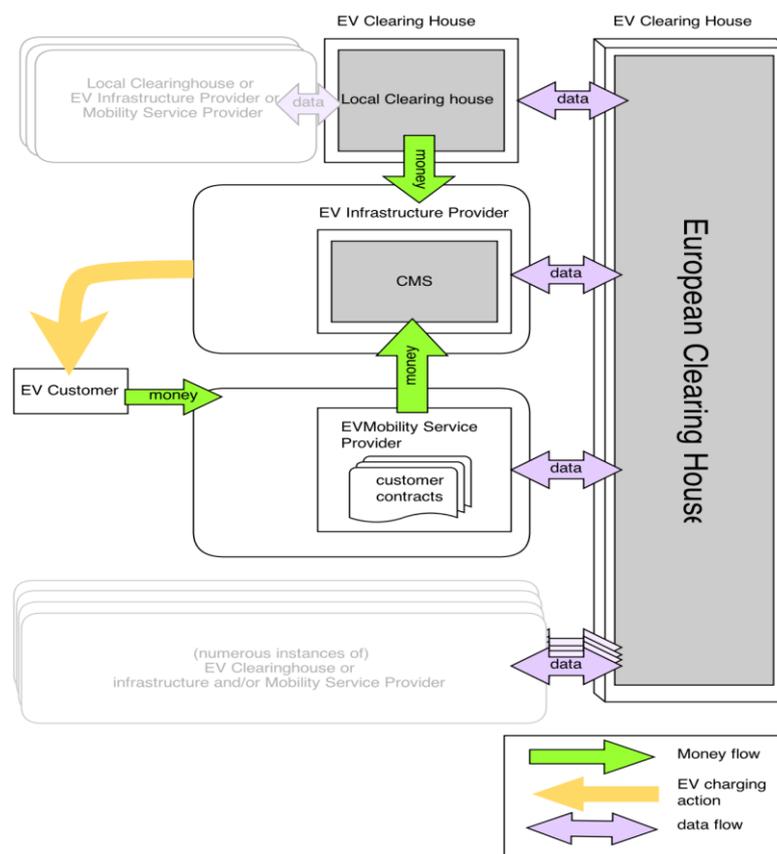


Figure 2 Positioning EV Clearing House

2 ECHS FUNCTIONALITY

ECHS facilitates the mutual exchange of Roaming Authorisations, Charge data & Chargepoint Information between its partners.

Normally the following steps are followed:

1. Partner A that has a EV mobility Service Provider role uploads Authorisation data to eCHS of its EV customers.
2. (Roaming) partners of A, that have an Infrastructure Provider role download this Authorisation data from eCHS, and enable these authorisations to be used with their CMS. (after checking the roaming partnership).
3. Any customer of partner A can now charge their electric vehicle at a charge point (roaming) of the roaming partners described in step 2.
4. These roaming partners upload the charge data (using Charge Detail Records) to the eCHS.
5. This charge data is then routed towards partner A.
6. Partner A pays the Roaming Partner for the charging action done by the customer of A.
7. Partner A bills its customer.

Authorisation data and Chargepoint information can be exchanged between 'connected' partners as soon as they are uploaded/downloaded to/from eCHS.

Charge data (as Charge Detail Records) is periodically (currently once each day) put into a report for each partner/user. Therefore the same report can be downloaded as long as the next report isn't created. Currently the 'docLink' element in the GetCDRsResponse PDU can be used to check if a new CDR report has been created by comparing it with the previous value.

KNOWN FLAWS/INCONSISTENCIES

1. *CDRInfo:infraProviderId* is defined as a string that enholds the 'InfrastructureProviderType', while the *AuthorisationInfo:roamingHubId* is defined as an int and also enholds the 'InfrastructureProviderType'.
2. *InfrastructureProviderTypes* is not very accurate as it can currently refer to a EV mobility Service Provider (or other clearinghouses) as well.

3 CHS-CMS INTERFACE DESCRIPTION

The interfaces between the European Clearing House System (eCHS) of the Clearing House and the Charge point Management Systems (CMS) of the different EV Service Providers consist mainly out of the three following components:

1. Exchange of Authorisation Data (Roaming Authorisations)
2. Exchange of Charge Data
3. Exchange of Charge Point Information for VAS

The exchange of data takes place via standardized web services.

An essential basic rule is that the lead for partner management will remain at each individual CMS. This rule has the following consequences for each CMS:

- client for every roaming partner is implemented in each CMS (identification through provider ID);
- data will only be accepted if the provider ID (Roaming Hub ID) of the partner is known at CMS.

3.1 Authenticate

3.1.1 SYSTEM AUTHORIZATION BY ECHS

Prior to all interactions, in the eCHS system a user_id and a password has to be defined for each EV Service Provider that needs access to the eCHS. That user_id and password has to be handed over from Clearing House towards the EV Service Provider. From that point, an EV Service Provider can access the eCHS.

The first step in exchanging data is that a CMS user gets authorized access to eCHS. This authorised access can be received in the following way.

1. CMS sends an Authenticate.req PDU.
2. eCHS responds with an Authenticate.conf PDU.

Note that when the authentication was successful, the Authenticate.conf PDU contains the token that MUST be used in the soap header of all other requests from CMS to eCHS.

3.1.2 PARTNER MANAGEMENT

New eCHS users are created setting user ID and password. These administrator tasks are not part of the CMS – eCHS interface and are therefore not described in this document

3.2 Exchange Authorisation Data

3.2.1 UPLOAD OWN AUTHORISATION DATA (ROAMING LIST) TO THE ECHS

Each CMS has to exchange the own EV-Customer authorisation data with the Clearing House, to share that data with other EV Service providers. The upload of the own roaming list is done in the following way:

1. CMS sends the SetRoamingAuthorisationList.req PDU.
2. eCHS responds with a SetRoamingAuthorisationList.conf PDU.

3.2.2 DOWNLOAD GLOBAL ROAMING AUTHORISATION DATA FROM ECHS

A CMS downloads the global authorisation data repository from the eCHS. The download of the global roaming list is done in the following way:

1. CMS sends the GetRoamingAuthorisationList.req PDU.
2. eCHS responds with GetRoamingAuthorisationList.conf PDU.

3.3 Exchange Charge Data

3.3.1 UPLOAD CHARGE DATA RECORDS

Local roaming charge data records are sent from the CMS to the eCHS. The upload has to be done in the following way:

1. CMS sends the AddCDRs.req PDU.
2. eCHS responds with: AddCDRs.conf PDU.

3.3.2 CLEAR ROAMING CHARGE DATA RECORDS

The clearing of all pending roaming CDRs can be done in the following way:

1. CMS sends ClearCDRs.req PDU.
2. eCHS responds with a ClearCDRs.conf PDU.

Note that the CMS must be added to the administrator group to be allowed to perform this operation.

3.3.3 DOWNLOAD EXTRACTED ROAMING CHARGE DATA RECORDS

Cleared roaming charge data records, held at the eCHS are sent from the eCHS to the CMS. Note that only cleared CDRs that concern the CMS are sent. The download has to be done in the following way:

1. CMS sends GetCDRs.req PDU.
2. eCHS responds with a GetCDRs.conf PDU.

3.4 Exchange Charge Point information

3.4.1 UPLOAD OWN CHARGE POINT INFORMATION TO ECHS

Each CMS has to upload its own Charge point information to the Clearing House. The upload of the own charge point information is done in the following way:

1. CMS sends the SetChargePointList.req PDU.
2. eCHS responds with a SetChargePointList.conf PDU.

3.4.2 DOWNLOAD GLOBAL CHARGE POINT INFORMATION FROM ECHS

A CMS downloads the global charge point information from the eCHS. The download of the global charge point information is done in the following way:

1. CMS sends the GetChargePointList.req PDU.
2. eCHS responds with GetChargePointList.conf PDU.

4 MESSAGES

4.1 Authenticate.req

This contains the field definition of the Authenticate.req sent by the an eCHS partner to the eCHS.

Field Name	Field Type	Card.	Description
userId	string	1..1	Mandatory. This contains the user identification
Password	string	1..1	Mandatory. This contains the user's password.

4.2 Authenticate.conf

This contains the field definition of the Authenticate.conf sent by the the eCHS as response to the Authenticate.req.

Field Name	Field Type	Card.	Description
resultCode	AuthResultType	1..1	Mandatory. This contains the authentication result.
resultDescription	string	1..1	Mandatory. This contains the reason for failure.
authToken	string	1..1	Mandatory This contains the authToken that should be supplied (in the soap header) to all the other requests.

4.3 AddCDRs.req

This contains the field definition of the AddCDRs.req sent by an eCHS partner to the eCHS.

Field Name	Field Type	Card.	Description
cdrInfoArray	CDRInfo	1..*	Mandatory. This contains one or more Charge Data Records.

4.4 AddCDRs.conf

This contains the field definition of the AddCDRs.conf sent by the the eCHS as reponse to the AddCDRs.req.

Field Name	Field Type	Card.	Description
result	Result	1..1	Mandatory. This contains the result of the AddCDRs.req.

4.5 GetCDRs.req

This contains the field definition of the GetCDRs.req sent by the an eCHS partner to the eCHS.
No fields are defined.

4.6 GetCDRs.conf

This contains the field definition of the GetCDRs.conf sent by the the eCHS as reponse to the GetCDRs.req.

Field Name	Field Type	Card.	Description
result	Result	1..1	Mandatory. This contains the result of the GetCDRs.req.
docLink	string	1..1	Mandatory. This contains the link to the cleared CDR pdf document.
cdrInfoArray	CDRInfo	0..*	Optional. This contains the CDR's that have been cleared (in the last call to ClearCDRs).

4.7 ClearCDRs.req

This contains the field definition of the ClearCDRs.req sent by the an eCHS partner to the eCHS. No fields are defined.

4.8 ClearCDRs.conf

This contains the field definition of the ClearCDRs.conf sent by the the eCHS as reponse to the ClearCDRs.req.

Field Name	Field Type	Card.	Description
result	Result	1..1	Mandatory. This contains the result of the ClearCDRs.req.

4.9 GetRoamingAuthorisationList.req

This contains the field definition of the GetRoamingAuthorisationList.req sent by the an eCHS partner to the eCHS. No fields are defined.

4.10 GetRoamingAuthorisationList.conf

This contains the field definition of the GetRoamingAuthorisationList.conf sent by the the eCHS as reponse to the GetRoamingAuthorisationList.req.

Field Name	Field Type	Card.	Description
result	Result	1..1	Mandatory. This contains the result of the GetRoamingAuthorisationList.req.
roamingAuthorisationInfoArray	RoamingAuthorisationInfo	0..*	Optional. This contains the roaming authorisation records.

4.11 SetRoamingAuthorisationList.req

This contains the field definition of the SetRoamingAuthorisationList.req sent by the an eCHS partner to the eCHS.

Field Name	Field Type	Card.	Description
roamingAuthorisationInfoArray	RoamingAuthorisationInfo	1..*	Mandatory. This contains the roaming authorisation records.

4.12 SetRoamingAuthorisationList.conf

This contains the field definition of the SetRoamingAuthorisationList.conf sent by the the eCHS as reponse to the SetRoamingAuthorisationList.req.

Field Name	Field Type	Card.	Description
result	Result	1..1	Mandatory. This contains the result of the SetRoamingAuthorisationList.req.

4.13 GetChargePointList.req

This contains the field definition of the GetChargePointList.req sent by an eCHS partner to the eCHS. No fields are defined.

4.14 GetChargePointList.conf

This contains the field definition of the GetChargePointList.conf sent by the eCHS as response to the GetChargePointList.req.

Field Name	Field Type	Card.	Description
result	Result	1..1	Mandatory. This contains the result of the GetRoamingAuthorisationList.req.
chargepointInfoArray	ChargepointInfo	0..*	Optional. This contains the charge point information records.

4.15 SetChargePointList.req

This contains the field definition of the SetChargePointList.req sent by an eCHS partner to the eCHS

Field Name	Field Type	Card.	Description
chargepointInfoArray	ChargepointInfo	1..*	Mandatory. This contains the charge point information records.

4.16 SetChargePointList.conf

This contains the field definition of the SetChargePointList.conf sent by the eCHS as response to the SetChargePointList.req.

Field Name	Field Type	Card.	Description
result	Result	1..1	Mandatory. This contains the result of the SetChargePointList.req.

5 TYPES

All string fields that are part of the types described in this section are currently defined as 'Mandatory', meaning that they have to be defined in the PDU as an element, however the value can still be left blank, without raising an (immediate) error.

5.1 AuthResultType

ENUMERATION

ResultCode of the Authenticate.req.

Field Name	Field Type	Description
Accepted		User is authenticated
Denied		Used is not authenticated

5.2 CDRInfo

CLASS

Contains all information concerning a Charge Data Record

Field Name	Field Type	Description
cdrId	string	Mandatory. Charge Data Record number. Unique per Infra_Provider_ID.
startDatetime	string	Mandatory. Start date and time of the charge session (logon with the RFID badge). Local time is used. Format is according to ISO8601 UTC+Offset. Example: "2011-06-01T11:45:30+02:00"
endDatetime	string	Mandatory. Start date and time of the charge session (logon with the RFID badge). Local time is used. Format is according to ISO8601 UTC+Offset. Example: "2011-06-01T11:45:30+02:00"
duration	string	Optional. Duration of the charge session. Example: "0:00:28"
volume	string	Mandatory. The volume delivered during the charge session in kWh. Four digits decimal precision (N4,N4). Example: "0,0004"
chargePointAddress	string	Mandatory. Adress (street and possibly housenumber) of the location of the chargepoint.
chargePointZip	string	Mandatory. Where available the ZIP code of the location of the chargepoint, conforming to country standard
chargePointCity	string	Mandatory. City of the location of the chargepoint.
chargePointCountry	string	Optional. Country of the location of the chargepoint. Format is according to the three-character ISO-3166 code.
chargePointType	string	Mandatory. Charge Point Type.
productType	string	Mandatory. Identifies the type of the product that is delivered on the chargepoint.
tariffType	string	Mandatory.
authenticationId	string	Mandatory. Customer identification, RFID decoded as stored in the central register.

Field Name	Field Type	Description
evcold	string	Mandatory. Customer contract identification or ExternalID of the ChargeBadge as stored in the central register (as ExternalID). Example: "NL-ESS-123456-7".
meterid	string	Mandatory. Meter identification.
obisCode	string	Mandatory. OBIS object identification of the register in the meter. Format is according to the OBIS if the COSEM application layer (defined in IEC 62056-61) and as such aligned with the Dutch Smart Meter Requirements. Example: "1-1:1.8.0" is the 'Total' register (".0") of the 1st ("1-1") meter regarding power delivered 'from the grid' ("1.8").
chargePointId	string	Mandatory. Charge Point Identification. The Charge Point ID identifies the physical socket (within the Chargepoint Operator) that was used for charging in for the particular CDR.
serviceProviderId	string	Mandatory. Service Provider Identification (ie the recipient of the CDR), as stored in the central register
infraProviderId	string	Mandatory. Infra provider Identification (ie the sender of the CDR), as stored in the central register. This corresponds to the National_Hub_ID (Example: "e-laad", "Ladennetz", "Blue Corner").
evseld	string	Mandatory.

5.3 Result

CLASS

Contains result information.

Field Name	Field Type	Description
resultCode	int	Mandatory. 0 = ok, any other value = error
resultDescription	string	Mandatory. The reason of the error.

5.4 RoamingAuthorisationInfo

CLASS

Contains information about a roaming authorisation (card/token)

Field Name	Field Type	Description
evcold	string	Mandatory. Electrical Vehicle Contract Identifier
roamingHubId	Int/enum of InfraStructureProviderType	Mandatory.
tokenType	Int/enum of TokenType	Mandatory.
tokenId	string	Mandatory.
printedNumber	string	Mandatory.
expiryDate	string	Mandatory. dd/mm/yyyy
pin	Int	Mandatory.
pinMandatory	Int/enum of MandatoryType	Mandatory.
tokenActivated	Int/enum of ActivatedType	Mandatory.
hash	String	Mandatory.

5.5 InfraStructureProviderType

ENUMERATION

Description	Value
Other	0
Blue Corner	1
E-laad	2
Ladenetz.de	3
Ballast Neddam	4
The New Motion	5

5.6 TokenType

ENUMERATION

Description	Value
Other	0
MIFARE_CL	1
MIFARE_DES	2
MSISDN	3

5.7 MandatoryType

ENUMERATION

Description	Value
Not Mandatory	0
Mandatory	1

5.8 ActivatedType

ENUMERATION

Description	Value
Deactivated	0
Activated	1

5.9 ChargepointInfo

CLASS

Contains information about the charge points

Field Name	Field Type	Description
esveld	string	Mandatory. unique Alphanumeric ID number (containing charging point operator and country location)
locationName	string	Mandatory . Official name
locationNameLang	string	Mandatory . ISO-3 language code
houseNumber	string	Mandatory .
streetName	string	Mandatory .
city	string	Mandatory .
postalCode	string	Mandatory .
taLat	string	Mandatory . Charge point location: latitude
taLon	string	Mandatory. Charge point location: longitude
taLatEntranceExit	string	Mandatory . Charge point entrance/exit location: latitude
taLonEntranceExit	string	Mandatory . Charge point entrance/exit location: longitude
openingTime	string	Mandatory . exact time domain E.g. 24hr = [(h0){d1}] on each line of the same charging station
powerOutletStatus	string	Mandatory. Available, in use, out of order...
energyProviderId	string	Mandatory. Company Name
roamingHubId	string	Mandatory. Company Name of national roaming hubs
telephoneNumber	string	Mandatory . Service hotline for charging station
floorLevel	string	Mandatory . Level on which the charge station is located (in garage buildings)
paymentMethod		Mandatory . List of available payment methods on site(RFID, QR-code, cash...)
evChargingReceptacleType	string	Mandatory. Which receptacle type is/are present for a power outlet.

6 BINDING TO TRANSPORT PROTOCOL

This section describes how the eCHS PDUs can be conveyed over SOAP.

The rationale behind using SOAP as a transport is that SOAP already provides the infrastructure of sending messages. SOAP has a good support in the industry, which results in tools that improve the ease of implementing the protocol.

The used version of SOAP MUST be 1.2.

6.1 User Identity Header

All requests to the eCHS (except Authenticate.req) MUST send in each request PDU, its Authentication token (received in the Authenticate.resp) in the SOAP header. The header name is "UserIdentityHeader" of XSD type "string". For example:

```
<!-- Header containing the user identity token --> <ns:UserIdentityHeader>4b22f1316a88003846207a887d9f8d72</ns:
UserIdentityHeader >
```