

INTERNATIONAL STANDARD

**Standard interface for connecting charging stations to local energy management systems –
Part 3: Communication protocol and cybersecurity specific aspects**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2025 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search -

webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	10
2 Normative references	10
3 Terms, definitions, and abbreviated terms	11
3.1 Terms and definitions	11
3.2 Abbreviated terms	14
4 Overview	15
5 SPINE protocol.....	15
5.1 General.....	15
5.2 Architecture overview	16
5.2.1 General rules	16
5.2.2 Common data types	16
5.2.3 Address level details	21
5.3 SPINE datagram	22
5.3.1 Overview	22
5.3.2 Header	23
5.3.3 Payload	31
5.4 Communication modes	45
5.4.1 General	45
5.4.2 Simple communication mode	46
5.4.3 Enhanced communication mode	46
5.5 Functional commissioning	47
5.5.1 General	47
5.5.2 Detailed discovery.....	47
5.5.3 Destination list	63
5.5.4 Binding	66
5.5.5 Subscription.....	75
5.5.6 Use case discovery	82
6 SHIP	85
6.1 Architecture overview	85
6.1.1 General	85
6.1.2 General considerations on closing communication channels.....	87
6.1.3 SHIP node parameters	87
6.2 Registration	88
6.2.1 General	88
6.2.2 Successful registration	89
6.2.3 Registration details and recommendations (informative).....	89
6.3 Reconnection	90
6.3.1 General	90
6.3.2 Reconnection details in case of changed key material (informative).....	90
6.4 Discovery.....	91
6.4.1 General	91
6.4.2 Service instance	91
6.4.3 Service name.....	91
6.4.4 Multicast DNS name.....	92

6.4.5	Recommendations for re-discovery	94
6.5	TCP	95
6.5.1	General	95
6.5.2	Limited connection capabilities	95
6.5.3	Online detection	95
6.5.4	TCP connection establishment	96
6.5.5	Retransmission timeout	96
6.6	TLS	96
6.6.1	General	96
6.6.2	Cipher suites	97
6.6.3	Maximum fragment length	98
6.6.4	TLS compression	98
6.6.5	Renegotiation	98
6.6.6	Session resumption	98
6.6.7	TLS extension for ECC	99
6.6.8	TLS probing	100
6.7	WebSocket	100
6.7.1	General	100
6.7.2	TLS dependencies	100
6.7.3	Opening handshake	101
6.7.4	Data framing	101
6.7.5	Keep-alive connection	101
6.8	Message representation using JSON text format	102
6.8.1	General	102
6.8.2	Definitions	102
6.8.3	Examples for each type	103
6.8.4	XML to JSON transformation	103
6.8.5	JSON to XML transformation	109
6.9	Key management	110
6.9.1	General	110
6.9.2	Certificates	110
6.9.3	SHIP node specific public key	115
6.9.4	Verification procedure	117
6.9.5	Symmetric key	123
6.9.6	SHIP node PIN	124
6.9.7	SHIP commissioning tool	125
6.9.8	QR code	127
6.10	SHIP data exchange	130
6.10.1	General	130
6.10.2	Terms in the context of SHIP data exchange	131
6.10.3	Protocol architecture/hierarchy	132
6.10.4	SHIP message exchange	133
6.11	Well-known protocolId	173
7	ECHONET Lite	173
Annex A (normative)	SHIP XSD	175
Bibliography	180

Figure 1 – Overview of communication protocols within IEC 63380-3	15
Figure 2 – PossibleOperationsType.....	19
Figure 3 – DeviceAddressType.....	20
Figure 4 – EntityAddressType	20
Figure 5 – FeatureAddressType	20
Figure 6 – SPINE datagram	23
Figure 7 – SPINE header	24
Figure 8 – SPINE payload.....	32
Figure 9 – Example of selectors part (extract) with entity address part	44
Figure 10 – Communication modes of SPINE devices A, B and C	45
Figure 11 – Discovery example	47
Figure 12 – Hierarchy types	48
Figure 13 – Function Discovery Example over Feature Description	49
Figure 14 – nodeManagementDetailedDiscoveryData function overview, part 1	52
Figure 15 – nodeManagementDetailedDiscoveryData function overview, part 2: deviceInformation.description.....	53
Figure 16 – nodeManagementDetailedDiscoveryData function overview, part 3: entityInformation.description	53
Figure 17 – nodeManagementDetailedDiscoveryData function overview, part 4: featureInformation.description	54
Figure 18 – nodeManagementDestinationListData function overview, part 1	65
Figure 19 – nodeManagementDestinationListData function overview, part 2.....	65
Figure 20 – Binding request	68
Figure 21 – nodeManagementBindingRequestCall function overview	68
Figure 22 – nodeManagementBindingData function overview	70
Figure 23 – nodeManagementBindingDeleteCall function overview	72
Figure 24 – Subscription request.....	76
Figure 25 – nodeManagementSubscriptionRequestCall function overview	76
Figure 26 – nodeManagementSubscriptionData function overview	78
Figure 27 – nodeManagementSubscriptionDeleteCall function overview	80
Figure 28 – nodeManagementUseCaseData function.....	83
Figure 29 – Physical connections in the overall system.....	86
Figure 30 – SHIP stack overview.....	86
Figure 31 – Full TLS 1.2 handshake with mutual authentication	97
Figure 32 – Quick TLS Handshake with Session Resumption.....	99
Figure 33 – Easy mutual authentication with QR codes and smart phone	124
Figure 34 – QR code model 2, "low" error correction code level, 0,33mm/module, with SKI and PIN.....	129
Figure 35 – QR code model 2, "low" error correction code level, 0,33 mm/module, with all values.....	130
Figure 36 – QR code model 2, "low" error correction code level, 0,33 mm/module, with brainpoolP256r1 SKI and brainpoolP384r1 SKI.....	130
Figure 37 – Protocol architecture and hierarchy.....	132
Figure 38 – CMI Message sequence example.....	136

Figure 39 – Connection state "hello" sequence example without prolongation request: "A" and "B" already trust each other; "B" is slower/delayed	143
Figure 40 – Connection state "hello" sequence example with prolongation request.....	144
Figure 41 – Connection State "Protocol Handshake" message sequence example.....	149
Figure 42 – Connection state "PIN verification" message sequence example (begin).....	158
Figure 43 – ECHONET Lite frame format.....	174
Table 1 – Structure of the SPINE datagram	23
Table 2 – cmdClassifier values and kind of messages for a message "M" and scope of related acknowledgement messages	27
Table 3 – Structure of the SPINE header	30
Table 4 – Elements of the SPINE payload	32
Table 5 – Example table (template).....	36
Table 6 – Considered cmdOptions combinations for classifier "write"	37
Table 7 – Considered cmdOptions combinations for classifier "notify"	38
Table 8 – Considered cmdOptions combinations for classifier "read".....	39
Table 9 – Considered cmdOptions combinations for classifier "reply"	39
Table 10 – Address path examples.....	43
Table 11 – Notify/response list of entities and their corresponding features with nodeManagementDetailedDiscoveryData	54
Table 12 – nodeManagementDetailedDiscoveryDataSelectors	61
Table 13 – Notify/response of DestinationList information with nodeManagementDestinationListData	66
Table 14 – Binding request with nodeManagementBindingRequestCall	68
Table 15 – nodeManagementBindingData holds list of binding entries.....	71
Table 16 – Remove binding with nodeManagementBindingDeleteCall	73
Table 17 – Subscription request with nodeManagementSubscriptionRequestCall	77
Table 18 – nodeManagementSubscriptionData holds list of subscription entries	79
Table 19 – Remove subscription with nodeManagementSubscriptionDeleteCall.....	81
Table 20 – nodeManagementUseCaseData	84
Table 21 – SHIP parameters default values	87
Table 22 – Mandatory parameters in the TXT record.....	93
Table 23 – Optional parameters in the TXT record.....	93
Table 24 – Mapping from the XSD types to JSON types.....	103
Table 25 – Transformation of a simple type	104
Table 26 – Mapping from the XSD compositors to JSON types.....	104
Table 27 – Examples for XML and JSON representations	106
Table 28 – Example transformation of several combined XSD item types	108
Table 29 – Example for JSON to XML transformation	110
Table 30 – Trust levels	123
Table 31 – MessageType values	134
Table 32 – Structure of SmeHelloValue of SME "hello" message.....	137
Table 33 – Structure of SmeProtocolHandshakeValue of SME "Protocol Handshake" message.....	145

Table 34 – Structure of SmeProtocolHandshakeErrorValue of SME "Protocol Handshake Error" message	146
Table 35 – Values of Sub-element "error" of messageProtocolHandshakeError	148
Table 36 – Structure of SmeConnectionPinStateValue of SME "PIN state" message	150
Table 37 – Structure of SmeConnectionPinInputValue of SME "pin input" message	151
Table 38 – Structure of SmeConnectionPinErrorValue of SME "Pin error" message	151
Table 39 – Values of Sub-element "error" of connectionPinError	157
Table 40 – Structure of MessageValue of "data" message	159
Table 41 – Structure of SmeConnectionAccessMethodsRequestValue of SME "Access methods request" message	162
Table 42 – Structure of SmeConnectionAccessMethodsValue of SME "Access methods" message	162
Table 43 – Structure of SmeConnectionCommissioningRequestValue of SME "commissioning request" message	164
Table 44 – Structure of SmeConnectionCommissioningResponseValue of SME "commissioning response" message	165
Table 45 – Structure of SmeConnectionKeyMaterialRequestValue of SME "key material request" message	165
Table 46 – Structure of SmeConnectionKeyMaterialValue of SME "key material" message	166
Table 47 – Structure of SmeConnectionKeyMaterialResponseValue of SME "key material response" message	167
Table 48 – Structure of SmeConnectionKeyMaterialDeleteValue of SME "key material delete" message	168
Table 49 – Structure of SmeConnectionKeyMaterialDeleteResponseValue of SME "key material delete response" message	169
Table 50 – Structure of SmeConnectionKeyMaterialStateValue of SME "key material state" message	170
Table 51 – Structure of SmeConnectionKeyMaterialStateResponseValue of SME "key material state response" message	170
Table 52 – Structure of SmeConnectionKeyMaterialStateRequestValue of SME "key material state request" message	171
Table 53 – Structure of SmeCloseValue of SME "close" message	172
Table 54 – Well-known values for the element "protocolId"	173

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Standard interface for connecting charging
stations to local energy management systems -
Part 3: Communication protocol and cybersecurity specific aspects**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 63380-3 has been prepared by IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
69/1051/FDIS	69/1060/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

In this document, all text record fields are written in lowercase Courier font, since they belong to protocol information/binary data exchange.

A list of all parts in the IEC 63380 series, published under the general title *Standard interface for connecting charging stations to local energy management systems*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

The expansion of renewable energy and the simultaneous reduction in conventional generation of electricity result in new power flows and loads on the equipment in the grid and at the house connection point. At the same time, electrical consumers with high power consumption are increasingly being installed in low-voltage systems in private customer systems. These include charging systems for electric vehicles and heat pumps. These two developments can temporarily lead to peak loads and bottlenecks in the network. An expansion of the distribution grids for the comparatively few hours of high simultaneous power consumption is not considered economically sensible. The legislator of energy efficiency has therefore introduced the concept of "network-friendly control of controllable consumer devices".

It is crucial to define a standardized interface for the connected consumers and generating facilities, which also includes the charging infrastructure for electric vehicles. When developing a local, standardized interface, it is important to make a fundamental distinction between the terms "power management" and "energy management".

In order to avoid an overload and the associated emergency shutdown due to specified power limits in the property while all consumers are drawing electricity at the same time – especially heating and air conditioning technology as well as charging infrastructure –, power management is of great urgency. The maximum load at the grid connection point can therefore be reduced. Accordingly, it is important to give priority to local power management over, for example, optimization of operations and tariffs or desired charging plans.

Furthermore, the tariff-optimized operation can be pursued within the limits specified by the grid infrastructure – controlled by the energy management system. As a consequence, a charging infrastructure will be able to transmit information about procurement and tariff-optimized operation from the local energy management of the property to the electric vehicle so that it can coordinate its charging plan according to local demands. Effective coordination becomes essential if generating systems are used within the property in order to achieve the highest possible self-consumption of electricity.

The long-term goal is to buffer power and energy bottlenecks within a property using the energy stored in the vehicle, which also brings the topic of energy recovery into focus; this aspect needs to be considered during the development of a standardized interface for local power and energy management.

The aim of the IEC 63380 series is to define a standard interface for connecting charging stations to local energy management systems and the information exchange.

The IEC 63380 series specifies use cases, the sequences of information exchange, the data models as well as the communication protocols to be used and includes all aspects of local energy management of charging stations.

The IEC 63380 series covers scenarios where the charging infrastructure is managed by the entity that operates the private electrical network, and local energy management systems are used for local load management.

The IEC 63380 series addresses the energy management in installations with forward and bidirectional charging whereby the overall energy management is ensured by the customer energy manager.

The IEC 63380 series does not cover the secure information exchange between the charging station and the IT backend system(s), such as the management of energy transfer of the charge session, contractual and billing data, provided by the IT backend.

The IEC 63380 series consists of the following structure, describing the interface between charging stations and local energy management systems;

- IEC 63380-1¹: General requirements, use cases and abstract messages;
- IEC 63380-2: Specific data model mapping;
- IEC 63380-3: Communication protocol and cybersecurity specific aspects;
- IEC 63380-4²: Test specifications.

1 Under preparation: Stage at the time of publication: IEC/CFDIS 63380-1:2025.

2 Under preparation. Stage at the time of publication: IEC/ACD 63380-4:2021.

1 Scope

This part of IEC 63380 defines the secure information exchange between local energy management systems and electric vehicle charging stations. The local energy management systems communicate to the charging station controllers via the resource manager.

This document specifies the application of relevant transport protocols; in this case, SPINE (smart premises interoperable neutral-message exchange), SHIP (smart home IP), and ECHONET Lite. Other communication protocols can be defined in future editions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62394, *Service diagnostic interface for consumer electronics products and networks – Implementation for ECHONET*

IEC 63380-2, *Standard interface for connecting charging stations to local energy management systems – Part 2: Specific data model mapping*

ISO/IEC 14543-4-3:2015, *Information technology, Home Electronic Systems (HES) architecture – Part 4-3: Application layer interface to lower communications layers for network enhanced control devices of HES Class 1*

IETF RFC 793:1981, *Transmission Control Protocol*

IETF RFC 3280:2002, *Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile*

IETF RFC 6455:2011, *The WebSocket Protocol*

IETF RFC 6763, *DNS-Based Service Discovery*

IETF RFC 5246, *The Transport Layer Security (TLS) Protocol Version 1.2*

IETF RFC 5289, *TLS Elliptic Curve Cipher Suites with SHA-256/384 and AES Galois Counter Mode (GCM)*

IETF RFC 8422, *Elliptic Curve Cryptography (ECC) Cipher Suites for Transport Layer Security (TLS) Versions 1.2 and earlier*