OCPP 2.0.1

Part 0 - Introduction

Edition 3 FINAL, 2024-05-06

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Disclaimer

Version History

Version	Date	Description
2.0.1 Edition 3	2024-05-06	OCPP 2.0.1 Edition 3. All errata from OCPP 2.0.1 Part 0 until and including Errata 2024-04 have been merged into this version of the specification.
2.0.1	2020-03-31	Final version of OCPP 2.0.1
2.0	2018-04-11	OCPP 2.0 April 2018 First release of this Introduction document

1. Introduction

Electric Vehicles (EVs) are becoming the new standard for mobility all over the world. This development is only possible with a good coverage of Charging Stations. To advance the roll out of charging infrastructure, open communication standards play a key role: to enable switching from charging network without necessarily replacing all the Charging Stations, to encourage innovation and cost effectiveness and to allow many and diverse players participate in this new industry.

Additionally, the EV charging infrastructure is part of the Smart Grid, a larger and still evolving ecosystem of actors, devices and protocols. In this Smart Grid ecosystem, open communications standards are key enablers for two-way power flows, real time information exchange, demand control and eMobility services.

The Open Charge Point Protocol (OCPP) is the industry-supported de facto standard for communication between a Charging Station and a Charging Station Management System (CSMS) and is designed to accommodate any type of charging technique. OCPP is an open standard with no cost or licensing barriers for adoption.

1.1. OCPP version 2.0.1

This specification defines version 2.0.1 of OCPP.

After the release of OCPP 2.0, some issues were found in OCPP 2.0. Some of these issues could not be fixed issuing errata to the specification text only, as has been done with OCPP 1.6, but required changes to the protocol's machine-readable schema definition files that cannot be backward compatible.

To prevent confusion in the market and possible interoperability issues in the field, OCA has decided to name this version: 2.0.1. OCPP 2.0.1 contains fixes for all the known issues, to date, not only the fixes to the messages.

This version replaces OCPP 2.0. OCA advises implementers of OCPP to no longer implement OCPP 2.0 and only use version 2.0.1 going forward.

Any mentions of "OCPP 2.0" refers to revision 2.0.1 unless specifically stated otherwise.

1.2. Terms and abbreviations

This section contains the terminology and abbreviations that are used throughout this document.

1.2.1. Terms

Term	Meaning
Charging Station	The Charging Station is the physical system where an EV can be charged. A Charging Station has one or more EVSEs.
Charging Station Management System (CSMS)	Charging Station Management System: manages Charging Stations and has the information for authorizing Users for using its Charging Stations.
Electric Vehicle Supply Equipment (EVSE)	An EVSE is considered as an independently operated and managed part of the Charging Station that can deliver energy to one EV at a time.
Energy Management System (EMS)	In this document this is defined as a device that manages the local loads (consumption and production) based on local and/or contractual constraints and/or contractual incentives. It has additional inputs, such as sensors and controls from e.g. PV, battery storage.

1.2.2. Abbreviations

Term	Meaning
CSO	Charging Station Operator
CSMS	Charging Station Management System
EMS	Energy Management System.
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
RFID	Radio-Frequency Identification

1.3. References

Table 1. References

Reference	Description
[IEC61851-1]	IEC 61851-1 2017: EV conductive charging system - Part 1: General requirements. https://webstore.iec.ch/publication/33644
[IEC62559-2:2015]	Definition of the templates for use cases, actor list and requirements list. https://webstore.iec.ch/publication/22349
[ISO15118-1]	ISO 15118-1 specifies terms and definitions, general requirements and use cases as the basis for the other parts of ISO 15118. It provides a general overview and a common understanding of aspects influencing the charge process, payment and load leveling. https://webstore.iec.ch/publication/9272
[OCPP1.5]	http://www.openchargealliance.org/downloads/
[OCPP1.6]	http://www.openchargealliance.org/downloads/

2. New functionalities in OCPP2.0.1

OCPP 2.0.1 introduces new functionalities compared to OCPP 1.6 [OCPP1.6].
Due to improvements and new features, OCPP 2.0.1 is not backward compatible with OCPP 1.6 [OCPP1.6] or OCPP 1.5 [OCPP1.5].

2.1. Device Management

Device Management (also known as Device Model) is a long awaited feature especially welcomed by CSOs who manage a network of (complex) charging stations (from different vendors).

It provides the following functionality:

- Inventory reporting
- Improved error and state reporting
- Improved configuration
- Customizable Monitoring

This all should help CSOs to reduce the costs of operating a Charging Station network.

Charging Station Manufacturers are free to decide themselves how much details about a Charging Station they want to publish via Device Management: for example, they can decide what can be monitored, and what not.

2.2. Improvements for better handling of large amounts of transactions

2.2.1. One message for all transaction related functionalities

With the growing of the EV charging market, the number of Charging Stations and transactions that the CSMS needs to manage also grows. The structure and method for reporting transaction is unified in OCPP 2.0. In OCPP 1.x, the reporting of transaction data is split over the messages StartTransaction, StopTransaction, MeterValue and StatusNotification. With the market progressing towards more enhanced scheduling, a need is born for more sophisticated handling of transaction data. All the StartTransaction, StopTransaction, and transaction related MeterValue and StatusNotification messages are replaced by 'TransactionEvent'. The StatusNotification message still exists, but only for non-transaction related status notifications about connector availability.

2.2.2. Data reduction

With the introduction of JSON over Websockets in OCPP 1.6 [OCPP1.6] a great reduction of mobile data cost can be achieved. With OCPP 2.0, support for WebSocket Compression is introduced, which reduces the amount of data even more.

2.3. Improvements regarding cyber security

The following improvements have been added to harden OCPP against cyber attacks:

- Security profiles (3 levels) for Charging Station and/or CSMS authentication and Communication Security
- Key management for Client-Side certificates
- Secure firmware updates
- Security event log

2.4. Extended Smart Charging

In OCPP 2.0.1 Smart Charging functionality has been extended (compared to OCPP 1.6 [OCPP1.6]) to support:

- Direct Smart Charging inputs from an Energy Management System (EMS) to a Charging Station
- Improved Smart Charging with a local controller
- Support for integrated smart charging of the CSMS, Charging Station and EV ([ISO15118-1]).

2.5. Support for ISO 15118

The ISO 15118 standard [ISO15118-1] is a newer protocol for EVSE to EV communication, compared to IEC 61851 [IEC61851-1]. ISO 15118 allows a lot of new features and more secure communication between EVSE and EV. OCPP 2.0.1 supports the ISO 15118 standard, the newly added features are:

- Plug & Charge
- Smart Charging including input from the EV

2.6. Improvements for customer experience

2.6.1. More authorization options

OCPP 1.x was designed (mainly) for Charging Stations that authorize an EV driver via an RFID card/token. If other authorization systems or a mix of systems are used, the CSMS needs to know what system is used for which authorization. OCPP 2.0.1 has been extended to support things like: 15118 Plug & Charge [ISO15118-1], Payment Terminals, local mechanical key, Smart-phones, etc.

2.6.2. Display Messages

This provides Charging Station Operators with the possibility to configure - from the CSMS - a message on a Charging Station to be displayed to EV drivers. Messages can be transaction related or global.

2.6.3. EV Driver preferred languages

To be able to show messages to an EV driver in a language the driver understands best, OCPP 2.0.1 provides the possibility to send the language preference of a driver to a Charging Station.

2.6.4. Tariff and Costs

OCPP 2.0.1 allows Charging Stations to show the applicable tariff/price before an EV driver starts charging, to show the running total cost during a charging transaction and/or to show the final total cost after the transaction is finished.

2.7. Transport Protocols: OCPP-J Improvements

2.7.1. Simple Message routing

A description has been added on how to create a simple solution for OCPP message routing in, for example, a Local Controller. This is defined in Part 4, Section 6: OCPP Routing.

2.7.2. No SOAP Support

OCPP 2.0.1 no longer supports SOAP as a transport protocol. This decision was taken by the OCA members, who believe that the protocol does no longer lend itself for constrained computing resources that many Charging Stations operate under. The verbosity of the protocol could lead to slower performance and requires a higher bandwidth, which, in many cases, leads to higher cellular costs. SOAP is also difficult to support when communication is via local site networking.

2.8. Minor changes/extensions

2.8.1. Renamed messages

In the OCPP 1.x series, the names of all messages were kept unchanged for backward compatibility, even though some message names were found to be confusing or misleading in practice. In OCPP 2.0.1 message names have been changed, where appropriate, to improve clarity and understanding.

Example: RemoteStartTransaction.req: a lot of implementers though it meant the Charging Station should start the transaction, but in fact it is a request to try to start a transaction. However, for example, if no cable is plugged in, no transaction can be started. Since the message was always intended to be a request, it has been changed to a more logical name: RequestStartTransactionRequest.

2.8.2. TransactionId Identification & Message Sequencing

In OCPP 2.0, transaction identifiers are generated by the Charging Station, to facilitate offline charging sessions, in contrast to OCPP 1.x, where transaction identifiers were generated at the CSMS and sent to the Charging Station. In addition, all messages relating to a transaction are assigned incremental sequence numbering, to facilitate transaction data completeness checking at the CSMS.

2.8.3. Extended enumerations

Many enumerations have been extended to support more use cases, provide more options etc.

2.8.4. Offline Transaction Event Indication

Charging Stations can optionally indicate in transaction messages that a transaction event occurred while the Charging Station was Offline. This can assist a CSMS with the processing of transactions.

2.8.5. Personal message

Message that can be shown to the EV Driver and can be used for tariff information, user greetings and for indicating why a driver is not authorized to charge. When a driver uses an authorization method (RFID for example) and the CSMS does not authorize the driver to start charging, this field can thus contain additional reasons to provide the driver with a meaningful explanation why (s)he is not allowed to charge.

3. OCPP 2.0.1 Documentation Structure

3.1. Overview of Specification Parts

The overall structure of the standard has been improved, making the new specification easier to read, implement and test.

For readability and implementation purposes, OCPP 2.0.1 is divided in seven parts.

Table 2. Parts

Part 0	Introduction (this document)
Part 1	Architecture & Topology
Part 2	Specification: Use Cases and Requirements, Messages, Data Types and Referenced Components and Variables Appendices: Security Events, Standardized Units of Measure, Components and Variables
Part 3	Schemas
Part 4	Implementation Guide JSON
Part 5	Certification Profiles
Part 6	Test Cases

In contrast to OCPP 1.6 [OCPP1.6], the OCPP 2.0.1 specification is written in a different structure, based on [IEC62559-2:2015]: "Use case methodology - Part 2: Definition of the template for use cases, actor list and requirements list".

Part 2, the specification, is divided into 'Functional Blocks'. These Functional Blocks contain use cases and requirements. Messages, Data Types and Referenced Components and Variables are described at the end of the document. The Appendices can be found in the separate document: Part 2 - Appendices.
Messages and Data Types are structured in almost the same way as the previous OCPP specification [OCPP1.6].

3.2. Functional Blocks

OCPP 2.0.1 consists of the following Functional Blocks.

Table 3. Functional Blocks

Clause	Functional Block Title	Description
A.	Security	This Functional Block describes a security specification for the OCPP protocol.
B.	Provisioning	This Functional Block describes all the functionalities that help a CSO provision their Charging Stations, allowing them to be registered and accepted on their network and retrieving basic configuration information from these Charging Stations.
C.	Authorization	This Functional Block describes all the authorization related functionality: AuthorizeRequest message handling/behavior and Authorization Cache functionality.
D.	Local Authorization List Management	This Functional Block describes functionality for managing the Local Authorization List.
E.	Transactions	This Functional Block describes the basic OCPP Transaction related functionality for transactions that are started/stopped on the Charging Station.
F.	Remote Control	This Functional Block describes three types of use cases for remote control management from the CSMS: Remote Transaction Control, Unlocking a Connector and Remote Trigger.
G.	Availability	This functional Block describes the functionality of sending status notification messages.
H.	Reservation	This Functional Block describes the reservation functionality of a Charging Station.
I.	Tariff and Cost	This Functional Block provides tariff and cost information to an EV Driver, when a Charging Station is capable of showing this on a display. Before a driver starts charging tariff information needs to be given, detailed prices for all the components that make up the tariff plan applicable to this driver at this Charging Station. During charging the EV Driver needs to be shown the running total cost, updated at a regular, fitting interval. When the EV Driver stops charging the total cost of this transaction needs to be shown.
J.	Metering	This Functional Block describes the functionality for sending meter values, on a periodic sampling and/or clock-aligned timing basis.
K.	Smart Charging	This Functional Block describes all the functionality that enables the CSO (or indirectly a third party) to influence the charging current/power of a charging session, or set limits to the amount of power/current a Charging Station can offer to an EV.
L.	Firmware Management	This Functional Block describes the functionality that enables a CSO to update the firmware of a Charging Station.
M.	ISO 15118 Certificate Management	This Functional Block provides the installation and update of ISO 15118 certificates.
N.	Diagnostics	This Functional Block describes the functionality that enables a CSO to request and track the upload of a diagnostics file from a Charging Station, and to manage the monitoring of Charging Station data.
O.	Display Message	With the DisplayMessage feature OCPP enables a CSO to display a message on a Charging Station, that is not part of the firmware of the Charging Station. The CSO gets control over these messages: the CSO can set, retrieve (get), replace and clear messages.
P.	Data Transfer	This Functional Block describes the functionality that enables a party to add custom commands to OCPP, enabling custom extension to OCPP.

3.3. All Functional Blocks and use cases

The following table shows the full list of use cases supported by OCPP 2.0.1 and which use cases were already supported by OCPP 1.6 [OCPP1.6].

Clause	Functional Block	UC ID	Use case name	OCPP 1.6	New in OCPP 2.0.1
A	Security	A01	Update Charging Station Password for HTTP Basic Authentication		o
		A02	Update Charging Station Certificate by request of CSMS		o
		A03	Update Charging Station Certificate initiated by the Charging Station		o
		A04	Security Event Notification		o
B	Provisioning	B01	Cold Boot Charging Station	o	
		B02	Cold Boot Charging Station - Pending	o	
		B03	Cold Boot Charging Station - Rejected	o	
		B04	Offline Behavior Idle Charging Station	o	
		B05	Set Variables		o
		B06	Get Variables		o
		B07	Get Base Report		o
		B08	Get Custom Report		o
		B09	Setting a new NetworkConnectionProfile		o
		B10	Migrate to new CSMS		o
		B11	Reset - Without Ongoing Transaction	o	
		B12	Reset - With Ongoing Transaction	o	
C	Authorization	C01	EV Driver Authorization using RFID	o	
		C02	Authorization using a start button		o
		C03	Authorization using credit/debit card		o
		C04	Authorization using PIN-code		o
		C05	Authorization for CSMS initiated transactions		o
		C06	Authorization using local id type		o
		C07	Authorization using Contract Certificates		o
		C08	Authorization at EVSE using ISO 15118 External Identification Means (EIM)		o
		C09	Authorization by GroupId	o	
		C10	Store Authorization Data in the Authorization Cache	o	
		C11	Clear Authorization Data in Authorization Cache	o	
		C12	Start Transaction - Cached Id	o	
		C13	Offline Authorization through Local Authorization List	o	
		C14	Online Authorization through Local Authorization List	o	
		C15	Offline Authorization of unknown Id	o	
		C16	Stop Transaction with a Master Pass		o
D	LocalAuthorizationList	D01	Send Local Authorization List	o	
		D02	Get Local List Version	o	
E	Transactions	E01	Start Transaction Options		o
		E02	Start Transaction - Cable Plugin First	o	
		E03	Start Transaction - IdToken First	o	
		E04	Transaction started while Charging Station is offline	o	

Clause	Functional Block	UC ID	Use case name	OCPP 1.6	New in OCPP 2.0.1
		E05	Start Transaction - Id not Accepted	o	
		E06	Stop Transaction Options		o
		E07	Transaction locally stopped by IdToken	o	
		E08	Transaction stopped while Charging Station is offline	o	
		E09	When cable disconnected on EV-side: Stop Transaction	o	
		E10	When cable disconnected on EV-side: Suspend Transaction	o	
		E11	Connection Loss During Transaction	o	
		E12	Inform CSMS of an Offline Occurred Transaction	o	
		E13	Transaction related message not accepted by CSMS	o	
		E14	Check transaction status		o
		E15	End of charging process	o	
F	RemoteControl	F01	Remote Start Transaction - Cable Plugin First	o	
		F02	Remote Start Transaction - Remote Start First	o	
		F03	Remote Stop Transaction	o	
		F04	Remote Stop ISO 15118 charging from CSMS		o
		F05	Remotely Unlock Connector	o	
		F06	Trigger Message	o	
G	Availability	G01	Status Notification	o	
		G02	Heartbeat	o	
		G03	Change Availability EVSE	o	
		G04	Change Availability Charging Station	o	
		G05	Lock Failure	o	
H	Reservation	H01	Reservation	o	
		H02	Cancel Reservation	o	
		H03	Use a reserved EVSE	o	
		H04	Reservation Ended, not used	o	
I	Tariff and Costs	I01	Show EV Driver-specific tariff information		o
		I02	Show EV Driver running total cost during charging		o
		I03	Show EV Driver final total cost after charging		o
		I04	Show fallback tariff information		o
		I05	Show fallback total cost message		o
		I06	Update Tariff Information During Transaction		o
J	Metering	J01	Sending Meter Values not related to a transaction	o	
		J02	Sending transaction related Meter Values	o	
		J03	Charging Loop with metering information exchange		o
K	SmartCharging	K01	SetChargingProfile	o	
		K02	Central Smart Charging	o	
		K03	Local Smart Charging	o	
		K04	Internal Load Balancing	o	
		K05	Remote Start Transaction with Charging Profile	o	
		K06	Offline Behavior Smart Charging During Transaction	o	
		K07	Offline Behavior Smart Charging at Start of Transaction	o	
		K08	Get Composite Schedule	o	

Clause	Functional Block	UC ID	Use case name	OCPP 1.6	New in OCPP 2.0.1
		K09	Get Charging Profiles		o
		K10	Clear Charging Profile	o	
		K11	Set / Update External Charging Limit With Ongoing Transaction		o
		K12	Set / Update External Charging Limit Without Ongoing Transaction		o
		K13	Reset / release external charging limit		o
		K14	External Charging Limit with Local Controller		o
		K15	Charging with load leveling based on High Level Communication		o
		K16	Optimized charging with scheduling to the CSMS		o
		K17	Renegotiating a Charging Schedule		o
L	Firmware Management	L01	Secure Firmware Update		o
		L02	Non-Secure Firmware Update	o	
		L03	Publish Firmware file on Local Controller		o
		L04	Unpublish Firmware file on Local Controller		o
M	ISO 15118 Certificate Management	M01	Certificate Installation EV		o
		M02	Certificate Update EV		o
		M03	Retrieve list of available certificates from a Charging Station		o
		M04	Delete a specific certificate from a Charging Station		o
		M05	Install CA certificate in a Charging Station		o
		M06	Get Charging Station Certificate status		o
N	Diagnostics	N01	Retrieve Log Information	o	
		N02	Get Monitoring report		o
		N03	Set Monitoring Base		o
		N04	Set Variable Monitoring		o
		N05	Set Monitoring Level		o
		N06	Clear / Remove Monitoring		o
		N07	Alert Event		o
		N08	Periodic Event		o
		N09	Get Customer Information		o
		N10	Clear Customer Information		o
O	Display Message	O01	Set DisplayMessage		o
		O02	Set DisplayMessage for Transaction		o
		O03	Get All DisplayMessages		o
		O04	Get Specific DisplayMessages		o
		O05	Clear a DisplayMessage		o
		O06	Replace DisplayMessage		o
P	DataTransfer	P01	Data Transfer to the Charging Station	o	
		P02	Data Transfer to the CSMS	o	

NOTE	OCPP is used in many different regions and for many different charging solutions. Not all functionalities offered by OCPP 2.0.1 will be applicable to all implementations. Implementers can decide what specific functionalities apply to their charging solution. For interoperability purposes, the Open Charge Alliance introduces Certification Profiles in Part 5 of the specification.

4. Basic implementation of OCPP 2.0.1

This section is informative.

The OCPP protocol describes a large number of use cases and messages, which are not all needed to implement a basic Charging Station or CSMS. The table below lists messages that are typically implemented to deliver basic functionality for an OCPP managed Charging Station. The purpose of this list is to guide developers that are new to OCPP.

Please note: this table does *not* define what needs to be done to become OCPP 2.0.1 "certified". The functionality that is to be implemented to become OCPP 2.0.1 certified is described in Part 5 of the specification, "Certification Profiles".

Table 4. OCPP 2.0.1 Basic Implementation

Functionality	Use cases	Messages
Booting a Charging Station	B01-B04	BootNotification
Configuring a Charging Station	B05-B07	SetVariables, GetVariables and GetReportBase (respond correctly to requests with reportBase = ConfigurationInventory, FullInventory and SummaryInventory).
Resetting a Charging Station	B11-B12	Reset
Authorization options	One of C01, C02 and C04	Authorize
Transaction mechanism	E01 (one of S1-S6), E02-E03, E05, E06 (one of S1-S6), E07-E08, One of E09-E10, E11-E13	TransactionEvent
Availability	G01, G03-G04	Only ChangeAvailability and StatusNotification.
Monitoring Events	G05, N07	A basic implementation of the NotifyEvent message to be used to report operational state changes and problem/error conditions of the Charging Station, e.g. for Lock Failure. Also used for reporting built-in monitoring events.
Sending transaction related Meter values	J02	TransactionEvent
DataTransfer	P01-P02	Any OCPP implementations should at least be able to reject any request for DataTransfer if no (special) functionality is implemented.

NOTE	Please also refer to the section on Minimum Device Model in part 1.