Using OCPP with CHAdeMO

v1.0, 2020-12-03

Relevant for:

- OCPP version: 1.6 and 2.0.1.
- CHAdeMO version: 1.1 and 2.0.1

Version History

VERSION	DATE	AUTHOR	DESCRIPTION
1.0	2020-12-03	Franc Buve *OCA* Milan Jansen *OCA*	First release.

1. Executive Summary

A CHAdeMO charging station "speaks" CHAdeMO to the electric vehicle and OCPP to the charging station management system. How do they relate to each other? This white paper has been written by Open Charge Alliance together with the CHAdeMO Association to show how these protocols work together to charge a vehicle. It provides a translation table for the terminology used in both protocols and a set of diagrams that show the exchange of messages between electric vehicle and charging station on the one hand and charging station and management system on the other hand. It also explains how information from CHAdeMO about the DC charging session in progress can be made available to a charging station management system via the OCPP 2.x device model functionality.

2. Introduction

OCPP is a standard communication protocol between a charging station and a charging station management system and it is independent of the type of connection between the charging station and the electric vehicle. CHAdeMO is a standard for the connection between a charging station and an electric vehicle for DC fast charging.

As such, these two standards do not overlap. It is the charging station that needs to be able to translate information between these two protocols. For example, when the electric vehicle provides its current state of charge via CHAdeMO to the charging station, then the charging station will translate this to OCPP and pass this on to the charging station management system. Similarly, when the management system sends an OCPP message to the charging station to reduce the charging power (e.g. in a smart charging scenario), then the charging station will translate this to CHAdeMO parameters that are communicated to the electric vehicle.

In a joint working group, the CHAdeMO Association and Open Charge Alliance sat together to create a translation table, for the terminology used in both standards, and to create detailed sequence diagrams that show the interaction between OCPP and CHAdeMO. In addition, they documented how the wealth of information that CHAdeMO provides about the DC charging that is in progress, can be made available to the charging system management system via the OCPP device model.

The information provided in this white paper is useful for both charging station manufacturers and charging station operators. If you are developing a charging station with CHAdeMO, then the translation table and sequence diagrams will accelerate your development. If you have already developed such a charging station, then reading the chapter about publishing CHAdeMO data in the OCPP device model in OCPP 2.x will show you how to make everything you know from the DC charging session available to the management system. As a charging station operator you can use this data to show information about state of charge and remaining charging time on the charger display (if it does not already do so) or perhaps in the smartphone app that was used to start the session. This information can also be used to tailor your smart charging schedule to the vehicle that is being charged.

2.1. Reading Guide

The white paper continues with an OCPP - CHAdeMO translation table in chapter OCPP - CHAdeMO Translation Table. This is useful if you are familiar with the OCPP protocol specification and need to implement a charging station that supports CHAdeMO or vice versa.

Chapter OCPP and CHAdeMO Sequence Diagrams shows the sequence of messages that occur during starting and stopping of a transaction, on the CHAdeMO side of a charging station as well as on the OCPP side.

Chapter Showing CHAdeMO Data in OCPP Device Model shows how the OCPP device model can be used to make everything the charging station knows about the electric vehicle that is connected, available to the charging system management system. It is entirely up to the manufacturer of the charging station to decide what information is to be published in this way, because everything that is needed by the back-office to manage a charging session is already provided in the relevant OCPP messages. The information that is published about the connected vehicle can, however, be very useful for informational or diagnostic purposes. It might even be used to optimize your smart charging algorithm, for example by making use of values like "Total capacity of traction battery" and "Estimated charging time", that are provided by CHAdeMO.

3. OCPP - CHAdeMO Translation Table

3.1. Definitions

NOTE

OCPP includes additional concepts that have no equivalents in CHAdeMO, either because they relate to the link between the charging station and the charging station management system, because they relate to local HMI interactions that do not affect the EV charging interface directly, or because they're specifically related to EV charging interface protocols other than CHAdeMO.
Such concepts are not covered in this document — refer to the relevant OCPP specifications for details on these areas.

NOTE

CHAdeMO includes additional concepts that have no equivalents in OCPP, either because they relate to low level details of the electrical interface between the charging station and the electric vehicle, or because they relate to concepts that are not covered by OCPP 1.6 and 2.0.1 (such as V2G and V2H support).
Such concepts are not covered in this document — refer to the relevant CHAdeMO specifications for details on these areas.

OCPP 1.6 EDITION 2 SECTION 2. TERMINOLOGY AND CONVENTIONS		OCPP 2.0.1 PART 2 - SPECIFICATION SECTION 2. CONVENTIONS, TERMINOLOGY AND ABBREVIATIONS		CHADEMO 1.1 SECTION 3. TERMS AND DEFINITION		CHADEMO 2.0.1 SECTION 3. TERMS AND DEFINITION	
Definition	**Description**	**Definition**	**Description**	**Definition**	**Description**	**Definition**	**Description**
Charge Point	The Charge Point is the physical system where an electric vehicle can be charged. A Charge Point has one or more connectors.	**Charging Station**	The Charging Station is the physical system where EVs can be charged. A Charging Station has one or more EVSEs.	**Quick charger/Charger**		**Quick charger/Charger**	
Central System	Charge Point Management System: the central system that manages Charge Points and has the information for authorizing users for using its Charge Points.	**CSMS**	Charging Station Management System. The system that manages Charging Stations and has the information for authorizing Users for using its Charging Stations.	**N/a**		**N/a**	
EV	Electrical Vehicle, this can be BEV (battery EV) or PHEV (plug-in hybrid EV)	**EV**	Electric Vehicle, distributed energy resource with a remote battery and socket.	**Electric vehicle/Vehicle**	A vehicle using an electric motor as a powertrain.	**Electric vehicle/Vehicle**	A vehicle using an electric motor as a powertrain.
Connector	The term "Connector", refers to an independently operated and managed electrical outlet on a Charge Point. This usually corresponds to a single physical connector, but in some cases a single outlet may have multiple physical socket types and/or tethered cable/connector arrangements to facilitate different vehicle types.	**Connector**	The term Connector, refers to an independently operated and managed electrical outlet on a Charging Station. In other words, this corresponds to a single physical Connector. In some cases an EVSE may have multiple physical socket types and/or tethered cable/Connector arrangements(i.e. Connectors) to facilitate different vehicle types.	**Charging connector**	A connecting apparatus equipped to charging cable that complies with IEC62196-3 Standard Sheets Configuration AA	**Charging connector**	A connecting apparatus equipped to charging cable that complies with IEC62196-3 Standard Sheets Configuration AA

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Charging cable		**Charging cable**	Cable assembly equipped with a, by the EV accepted, plug, intended to be used for the connection between an EV and an EVSE. One side may be permanently attached to the EVSE, or also be equipped with a plug that is accepted by the EVSE.	**Charging cable**	An electrical cable comprising power wires and signal wires for charging a vehicle	**Charging cable**	An electrical cable comprising of power wires and signal wires for charging a vehicle (6)
N/a		**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.	**N/a**		**N/a**	
N/a		**N/a**		**Control circuit**	Circuit for charger control and supplying power (DC12V) to vehicle	**Control circuit**	Circuit for charger control and supplying power (DC12V) to vehicle
N/a		**N/a**		**Traction battery**	A battery used for traction mounted on an electric vehicle.	**Traction battery**	A battery used for traction mounted on an electric vehicle.
Connector lock		**Connector lock**		**Latch**	A component which prevents the release of charging connector from vehicle inlet	**Latch**	A component which prevents the release of charging connector from vehicle inlet
N/a		**N/a**		**Latch holding**	A function for immobilizing the latch by electrical signal	**Latch holding**	A function for immobilizing the latch by electrical signal
EV Driver		**EV Driver**	The Driver of an EV who wants to charge the EV at a Charging Station.	**User**		**User**	
State of charge (SoC)	State of charge of charging vehicle in percentage	**State of charge (SoC)**	State of charge of charging vehicle in percentage	**State of charge (SoC)**	Charged rate of traction battery calculated by vehicle that is only used for display on charger State of charge (SOC) of traction battery shall be set in % unit.	**State of charge (SoC)**	Charged rate of traction battery calculated by vehicle that is only used for display on charger State of charge (SOC) of traction battery shall be set in % unit.
Control Pilot signal	Signal used by a Charge Point to inform EV of maximum Charging power or current limit, as defined by [IEC61851-1].	**Control Pilot signal**	A signal used by a Charging Station to inform an EV of a maximum current limit, as defined by IEC61851-1.	**Control signal**	Signals used for establishing charging sequence between charger and vehicle (except for CAN communication).	**Control signal**	Signals used for establishing charging sequence between a charger and a vehicle (except for CAN communication).
		Contactor	An electrically controlled switching device, typically used by Charging Stations to switch charging power on/off.				
Transaction start point	Transaction starts at the point that all conditions for charging are met, for instance, EV is connected to Charge Point and user has been authorized.	**TxStartPoint**	Defines when the Charging Station starts a new transaction. The sequence diagrams are using the configuration EVConnected.	**Charging start trigger**	User triggers the charging process by plug the cable, or swipe a card or presse the charging start button etc.	**Charging start trigger**	User triggers the charging by plug the cable, or swipe a card or presse the charging start button etc.
Transaction stop point	Transaction ends at the point where one of the preconditions for charging irrevocably becomes false, for instance when a user swipes to stop the transaction and the stop is authorized.	**TxStopPoint**	Defines when the Charging Station ends a transaction. The sequence diagrams are using the configuration EVConnected.	**Charger detects stop instruction by user**	user indicates termination of charging, Stop button is pressed Termination signal from communication functions or authentication card (e.g. RFID)	**Charger detects stop instruction by user**	user indicates termination of charging, Stop button is pressed Termination signal from communication functions or authentication card (e.g. RFID)

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N/a		**N/a**		**EV contactor**	A switching device dedicated for quick charging installed on the power lines of vehicle near vehicle inlet	**EV contactor**	A switching device dedicated for quick charging installed on the power lines of the vehicle near vehicle inlet
		Cable Plugged in	In this document this can mean the following: - Cable fixed on Charging Station side, cable plugged in to EV - Cable plugged into the Charging Station and EV - Wireless Charger detects an EV*			**Connector Proximity detection**	Both charger and vehicle shall have a means to confirm that they are connected with each other. The charger shall detect the status of connector mating and use it as a trigger to start charging
Charging Profile	Generic charging profile, used for different types of Profiles. Contains information about the Profile and holds the Charging Schedule. In future versions of OCPP it might hold more than 1 Charging Schedule.	**Charging Profile**	Generic charging profile, used for different types of Profiles. Contains information about the Profile and holds the ChargingSchedule.				
Charging Schedule	Part of a charging profile. Defines a block of charging Power or Current limits. Can contain a start time and length.	**Charging Schedule**	Part of a charging profile. Defines a block of charging Power or Current limits. Can contain a start time and length.				
Composite Charging Schedule	The charging schedule as calculated by the Charge Point. It is the result of the calculation of all active schedules and possible local limits present in the Charge Point. Local Limits might be taken into account.	**Composite Charging Schedule**	"The charging schedule as calculated by the Charging Station. It is the result of the calculation of all active schedules and possible local limits present in the Charging Station. Local Limits might be taken into account.				
		Energy Management System	A device that manages the local loads (consumption an 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.				
Energy Offer Period	Energy Offer Period starts when the EVSE is ready and willing to supply energy.	**Energy Offer Period**	Time during which a charging station is ready and willing to offer energy to an EV.				
Energy Transfer Period	Time during which an EV chooses to take offered energy, or return it. Multiple Energy Transfer Periods are possible during a Transaction.	**Energy Transfer Period**	Time during which an EV chooses to take offered energy, or return it.				

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Local Controller	Optional device in a smart charging infrastructure. Located on the premises with a number of Charge Points connected to it. Sits between the Charge Points and Central System. Understands and speaks OCPP messages. Controls the Power or Current in other Charge Point by using OCPP smart charging messages. Can be a Charge Point itself.	**Local Controller**	A logical entity between a CSMS and one or more charging stations that has the ability to control charging of a group of charging stations based on the input from the CSMS, and can send messages to its charging stations, independently of the CSMS.				
		Offline	There is no communication possible between the charging station and CSMS. For an OCPP-J connection this means the WebSocket connection is not open.				
Charging Session	A Charging Session is started when first interaction with user or EV occurs. This can be a card swipe, remote start of transaction, connection of cable and/or EV, parking bay occupancy detector, etc.	**Session**	A Session in OCPP is a general term that refers to the charging process of an EV, that might include a Transaction.				
Transaction	The part of the charging process that starts when all relevant preconditions (e.g. authorization, plug inserted) are met, and ends at the moment when the Charge Point irrevocably leaves this state.	**Transaction**	A transaction in OCPP is a part of the complete process of charging an EV that starts and stops based on configurable parameters. These configurable parameters refer to moments in the charging process, such as the EV being connected or the EV driver being authorized.	**Charging control sequence**	Generic Charging process based on CHAdeMO communication protocol, including charging start process, communicaiton sequence, charging parameter exchange, error handling and charging termination process	**Charging control flow**	Generic Charging process based on CHAdeMO communication protocol, including charging start process, communicaiton sequence, charging parameter exchange, error handling and charging termination process
		External Control System	An external system that may impose charging limits/constraints on the charging station or CSMS, for example a DSO or EMS.				
Energy Offer SuspendPeriod	During a transaction, there may be periods the EnergyOffer to EV is suspended by the EVSE, for instance due to Smart Charging or local balancing.						
				Vehicle inlet	Mating point of charging connector at vehicle side which is in compliance with IEC62196-3 Standard Sheets Configuration AA	**Vehicle inlet**	Mating point of charging connector at vehicle side that complies with IEC62196-3 Standard Sheets Configuration AA
				Input circuit	Charging circuit from the power receiving terminal connected to a power supply such as AC mains to the primary side of the isolation device which secures isolation between charger and vehicle	**Input circuit**	Charging circuit from the power receiving terminal connected to a power supply such as AC mains to the isolation device which secures isolation between a charger and a vehicle

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				Output circuit	Charging circuit from on the secondary side of the isolation device which secures the isolation between charger and vehicle to the tip of charging connector	**Output circuit**	Charging circuit from the secondary side of the isolation transformer which secures the isolation between the primary circuit of a charger and a vehicle to the tip of charging connector
				Main circuit	Circuit which includes the input circuit and the output circuit	**Main circuit**	Circuit which includes the input circuit and the output circuit
						Maximum current	The maximum value of current which can be output under the standard operating condition (the current specified by the charger manufacturer)
				CAN communication	Communication means used to exchange data between charger and vehicle for charging control.	**CAN communication**	Communication means used to exchange data between the charger and vehicle for charging control
				Data area	CAN parameter defined by byte and bit of each ID as data format of CAN communication. It does not include area which is not defined by the specification (value exceeding specified maximum value and value other than the fixed value).	**Data area**	CAN parameter defined by byte and bit of each ID as data format of CAN communication. It does not include the area which is not defined by the specification (value exceeding specified maximum value and value other than the fixed value)
				Energization	A state in which the output voltage is possible, including insulation test of charger and welding detection of vehicle or the output current is possible, and/or when a voltage of more than 10V is applied to the output circuit.	**Energization**	A period from before the start of the insulation test by the charger to the output voltage exceeding 10V is applied after the charging current is terminated including the welding detection
				Power failure	A state in which the input voltage falls below the specified input voltage range.	**Power failure**	A state in which the input voltage falls below the specified input voltage range
						Y capacitor	Capacitor which is installed between P and GND, N and GND of the charger and the vehicle, typically as noise filtering component.

3.2. Charger States

OCPP 1.6 EDITION 2 SECTION 4.9. STATUS NOTIFICATION		OCPP 2.0.1 PART 2 - SPECIFICATION SECTION 3.16. CHARGINGSTATEENUMTYPE & 2.6.4.1. TXSTARTSTOPPOINT VALUES		CHADEMO 1.1 APPENDED TABLE3.2.3 DEFINITION OF STATE OF CHARGER		CHADEMO 2.0.1 APPENDED TABLE 3.3.3 DEFINITION OF STATE OF CHARGER	
State	**Description**	**State**	**Description**	**State**	**Description**	**State**	**Description**
Available (Connector)	When a Connector becomes available for a new user (Operative)	**Idle**	Idle status is referred as the state in which a charging station is not performing any use case related tasks. Condition during which the equipment can promptly provide a primary function but is not doing so.	**State A / Standby**	Unconnected with vehicle	**State A / Standby**	Disconnected with vehicle
Preparing	When a Connector becomes no longer available for a new user but there is no ongoing Transaction (yet). Typically a Connector is in preparing state when a user presents a tag, inserts a cable or a vehicle occupies the parking bay (Operative)"	**EVConnected**	There is a connection between EV and EVSE, in case the protocol used between EV and the charging station can detect a connection, the protocol needs to detect this for the state to become active. The connection can either be wired or wireless.	**State B / Standby**	Connected with vehicle	**State B / Standby**	Connected with vehicle
SuspendedEVSE/SuspendedEV	SuspendedEVSE: When the EV is connected to the EVSE but the EVSE is not offering energy to the EV, e.g. due to a smart charging restriction, local supply power constraints, or as the result of StartTransaction.conf indicating that charging is not allowed etc. (Operative) SuspendedEV: When the EV is connected to the EVSE and the EVSE is offering energy but the EV is not taking any energy. (Operative)"	**PowerPathClosed/SuspendedEV/SuspendedEVSE**	PowerPathClosed: All preconditions are met, power can flow. In case of a wired charger, the cable is properly connected, driver is authorized, etc. This does not mean that the EV is read to charge it's battery, it might, for example, be to warm. SuspendedEVSE: When the EV is connected to the EVSE but the EVSE is not offering energy to the EV, e.g. due to a smart charging restriction, local supply power constraints, or when charging has stopped because of the authorization status in the response to a transactionEventRequest indicating that charging is not allowed etc. SuspendedEV: When the EV is connected to the EVSE and the EVSE is offering energy but the EV is not taking any energy."	**State C**	From [Switch(d1) = ON] to [opto-coupler (j) = ON and "vehicle charging enabled (H'102.5.0)"= 1]	**State C**	From [Switch(d1) = ON] to [opto-coupler (j) = ON and 'vehicle charging enabled (H'102.5.0)'= 1]
				State D	"From [opto-coupler (j) = ON and ""vehicle charging enabled""(H'102.5.0) = 1] to ["charger status (H'109.5.0)" = 1 and "charging stop control (H'109.5.5)" = 0]	**State D**	"From [opto-coupler (j) = ON and 'vehicle charging enabled'(H'102.5.0) = 1] to ['charger status (H'109.5.0)' = 1 and 'charging stop control (H'109.5.5)' = 0]
Charging	"When the contactor of a Connector closes, allowing the vehicle to charge (Operative)"	**Charging/EnergyTransfer**	The contactor of the Connector is closed and energy is flowing to between EVSE and EV.	**State E**	From ["charger status (H'109.5.0)" = 1 and "charging stop control (H'109.5.5)" = 0] via [charging] to [transmission / reception of stop instruction]"	**State E**	From ['charger status (H'109.5.0)' = 1 and 'charging stop control (H'109.5.5)' = 0] via [charging] to [transmission / reception of stop instruction]

OCPP 1.6 EDITION 2 SECTION 4.9. STATUS NOTIFICATION		OCPP 2.0.1 PART 2 - SPECIFICATION SECTION 3.16. CHARGINGSTATEENUMTYPE & 2.6.4.1. TXSTARTSTOPPOINT VALUES		CHADEMO 1.1 APPENDED TABLE3.2.3 DEFINITION OF STATE OF CHARGER		CHADEMO 2.0.1 APPENDED TABLE 3.3.3 DEFINITION OF STATE OF CHARGER	
		StopAuthorized/Deauthorized/RemoteStop	StopAuthorized: An EV Driver has been authorized to stop charging. For example: By swiping an RFID card. Deauthorized: The transaction was stopped because of the authorization status in the response to a transactionEventRequest. RemoteStop: A RequestStopTransactionRequest has been sent.	**State F**	From [transmission / reception of stop instruction] to [current in the output circuit is less than or equal to 5A and “charger status (H'109.5.0)” = 0]	**State F**	From [transmission / reception of stop instruction] to [current in the output circuit is less than or equal to 5A and ‘charger status (H'109.5.0)’ = 0]
Finishing	When a Transaction has stopped at a Connector, but the Connector is not yet available for a new user, e.g. the cable has not been removed or the vehicle has not left the parking bay (Operative)	**EVConnected**	There is a connection between EV and EVSE, in case the protocol used between EV and the charging station can detect a connection, the protocol needs to detect this for the state to become active. The connection can either be wired or wireless.	**State G**	From [current in the output circuit is less than or equal to 5A and “charger status (H'109.5.0)” = 0] to [“vehicle status (H'102.5.3)” = 1]	**State G**	From [current in the output circuit is less than or equal to 5A and ‘charger status (H'109.5.0)’ = 0] to [‘vehicle status (H'102.5.3)’ = 1]
				State H	From [“vehicle status (H'102.5.3)” = 1] to [voltage in the output circuit is less than or equal to 10V and “energizing state (H'109.5.2)” = 0]	**State H**	From [‘vehicle status (H'102.5.3)’ = 1] to [voltage in the output circuit is less than or equal to 10V and ‘energizing state (H'109.5.2)’ = 0]
				State I	From [voltage in the output circuit is less than or equal to 10V and “energizing state (H'109.5.2)” = 0] to [End of CAN data transmission]	**State I**	From [voltage in the output circuit is less than or equal to 10V and ‘energizing state (H'109.5.2)’ = 0] to [End of CAN data transmission]
SuspendedEVSE/SuspendedEV	SuspendedEVSE: When the EV is connected to the EVSE but the EVSE is not offering energy to the EV, e.g. due to a smart charging restriction, local supply power constraints, or as the result of StartTransaction.conf indicating that charging is not allowed etc. (Operative) SuspendedEV: When the EV is connected to the EVSE and the EVSE is offering energy but the EV is not taking any energy. (Operative)"	**SuspendedEVSE/SuspendedEV**	SuspendedEVSE: When the EV is connected to the EVSE but the EVSE is not offering energy to the EV, e.g. due to a smart charging restriction, local supply power constraints, or when charging has stopped because of the authorization status in the response to a transactionEventRequest indicating that charging is not allowed etc. SuspendedEV: When the EV is connected to the EVSE and the EVSE is offering energy but the EV is not taking any energy.				
Faulted	When a Charge Point or connector has reported an error and is not available for energy delivery . (Inoperative).	**Faulted**	When a Connector (or the EVSE or the entire charging station it belongs to) has reported an error and is not available for energy delivery. (Inoperative).	**Charger error/Charging system error**	Charging system error: Error flag indicating vehicle error or charger error detected by charger Charger error: Error flag indicating charger’s error detected by charger	**Charger error/Charging system error**	Charging system error: Error flag indicating a vehicle error or a charger error detected by vehicle Charger error: Error flag indicating charger’s error detected by charger"

4. OCPP and CHAdeMO Sequence Diagrams

The clearest way to show the relationship between OCPP and CHAdeMO message is to graphically show in chronological order which message are exchanged between EV and charging station and charging station and charging station management system. These so-called sequence diagrams show messages that are sent as lines with arrows from one party to another. When lines are encapsulated this can mean one of two things. It is either optional or conditional. An optional message sequence is indicated by 'opt' and a conditional message sequence is indicated by 'alt', which is followed by the condition that describes when the message sequence will occur. Note, that the time flow from top to bottom of the diagram is not to scale, i.e. the vertical spacing between messages does not say anything about the timing between them — it only describes the order in which they are sent.

This chapter holds sequence diagrams for the most common scenarios:

1. Starting a charging session
2. Stopping of a session by charging station
3. Abnormal termination of a session by charging station
4. Stopping of a session by EV
5. Abnormal termination of a session by EV
6. Dynamic control

Since the messages for OCPP 1.6 differ from OCPP 2.0.1 we have added dedicated sequence diagrams for OCPP 1.6 after the OCPP 2.0.1 diagrams.

NOTE

If it is necessary to take legacy vehicles supporting only CHAdeMO version older than 1.1 into account, then the following can be done: When the Charging Station receives a signal from the cable proximity detection at the start of the charging session, then it can also use the cable proximity detection to verify when the EV leaves. In case the CAN communications starts before a cable proximity detection signal is received, then the Charging Station knows it should also not expect a cable proximity detection signal after the CAN communications ends. For the Charging Station to be able to verify when the EV leaves a vendor-specific method could be used. An example would be detecting that the cable is removed from/placed back into the holster.

4.1. Sequence Diagrams for OCPP 2.0.1 and CHAdeMO

This section contains all sequence diagrams related to OCPP 2.0.1 in correspondence with CHAdeMO 1.1 and 2.0.1.

NOTE	There is almost no difference between the message flows of CHAdeMO 1.1 and 2.0.1. Therefore no separate sequence diagrams were needed. Differences between the versions are marked by notes.

4.1.1. Start charging session

The sequence diagram below describes OCPP 2.0.1 and CHAdeMO message flows between the systems, when starting a charging session.

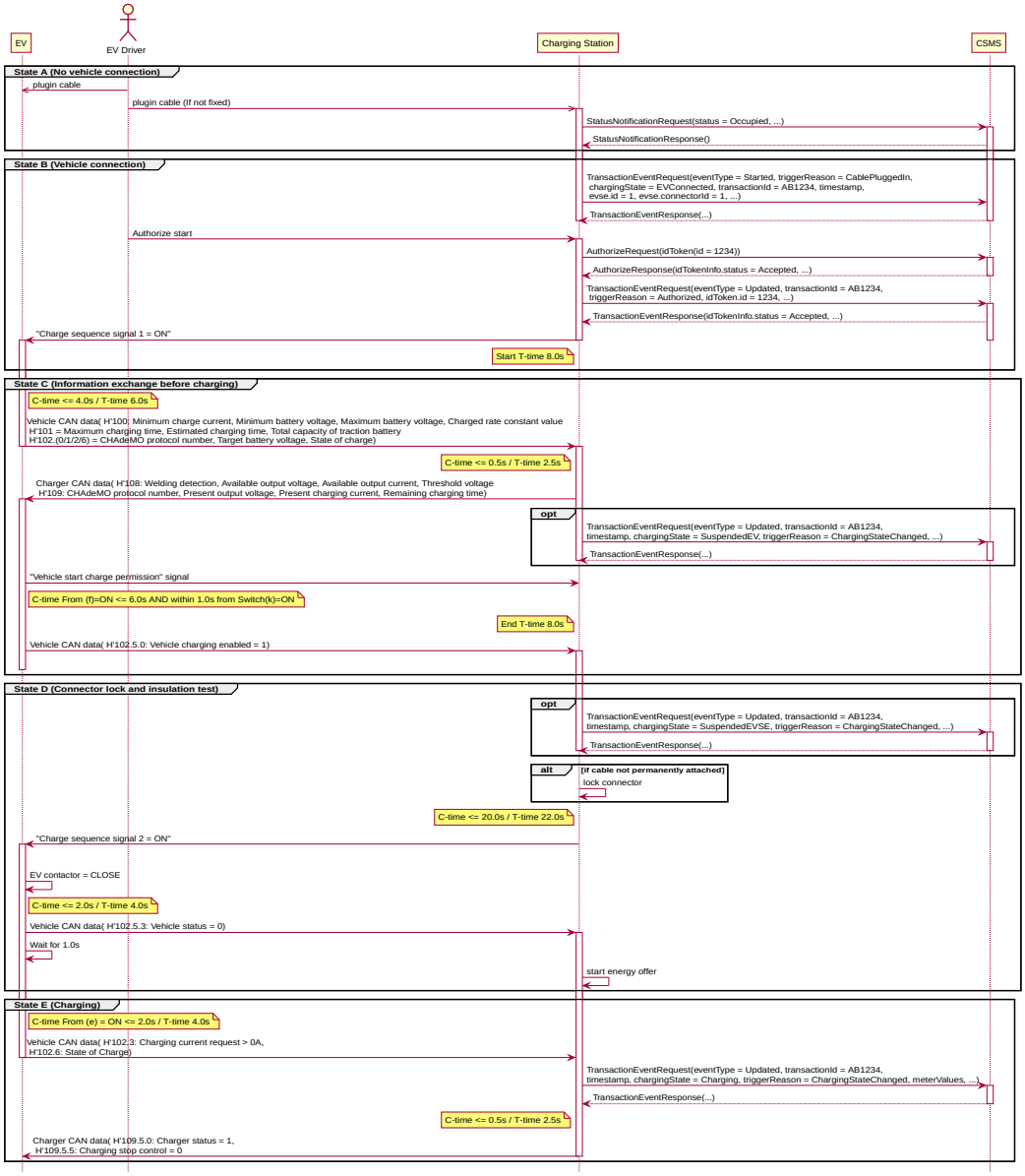

Figure 1. Sequence diagram: Start charging session

4.1.2. Stop by Charging Station

The sequence diagram below describes OCPP 2.0.1 and CHAdeMO message flows between the systems, when the charging station initiates a stop of the charging session.

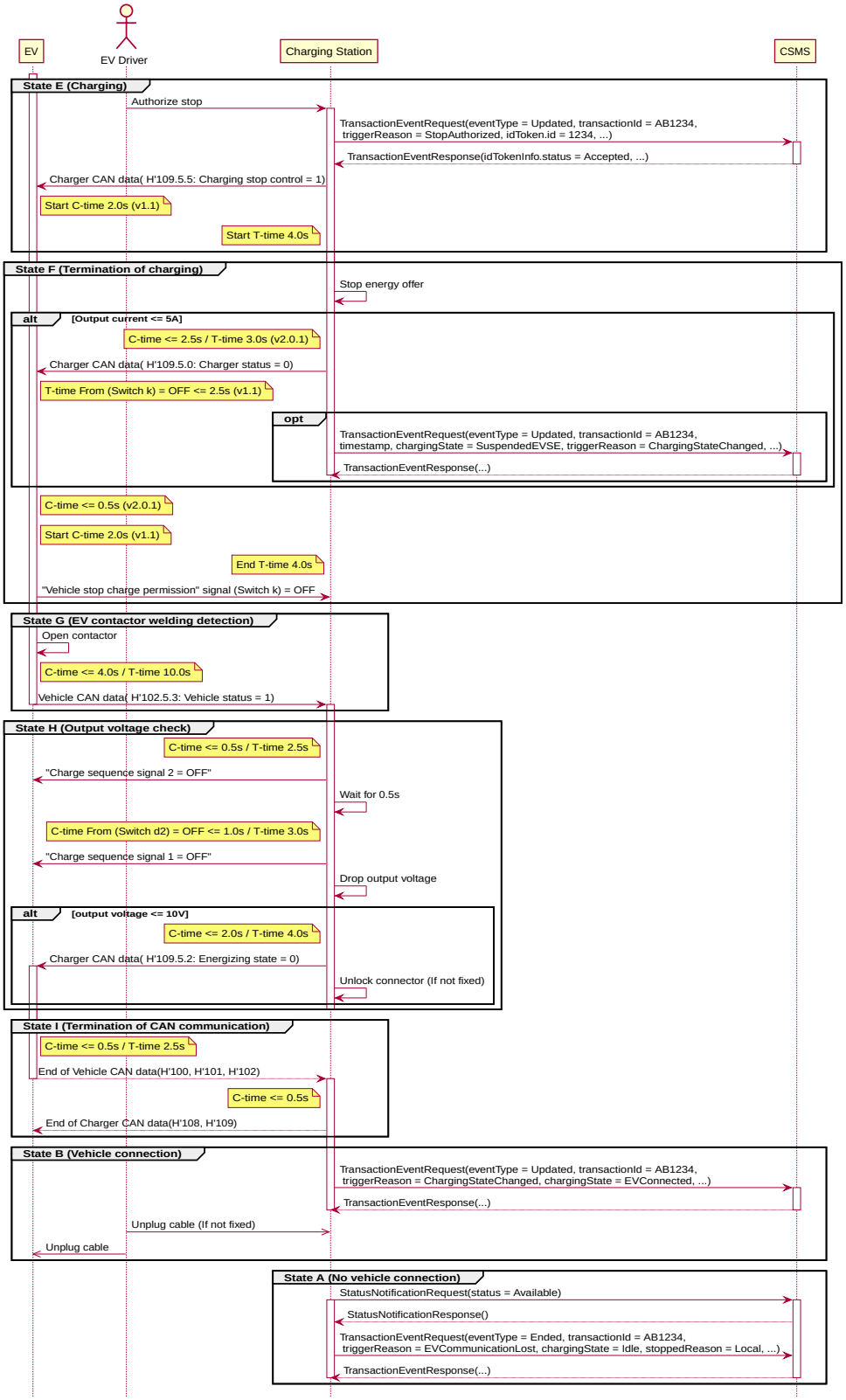

Figure 2. Sequence diagram: Stop by Charging Station

4.1.3. Stop by Charging Station (abnormal)

The sequence diagram below describes OCPP 2.0.1 and CHAdeMO message flows between the systems, when the charging station initiates an abnormal stop of the charging session.

NOTE An abnormal stop by a charging station can occur for example in case of; Ground fault, overcurrent fault, power loss, power quality, emergency stop, etc.

NOTE In case of a power failure, it might not be possible to send the OCPP messages at that time. In this case the TransactionEventRequest messages must be queued as described at the OCPP specification.

NOTE In case an error occurs prior to charging, the Charging Station will not necessarily send a TransactionEventRequest with eventType = Ended. When using OCPP 2.0.1, this depends on the configured TxStartPoint. As mentioned before, the sequence diagram examples shown use the EVConnected value for both the TxStartPoint and TxStopPoint. This means that as long as the EV and EVSE are still connected, the Charging Station will not send a TransactionEventRequest with eventType = Ended.

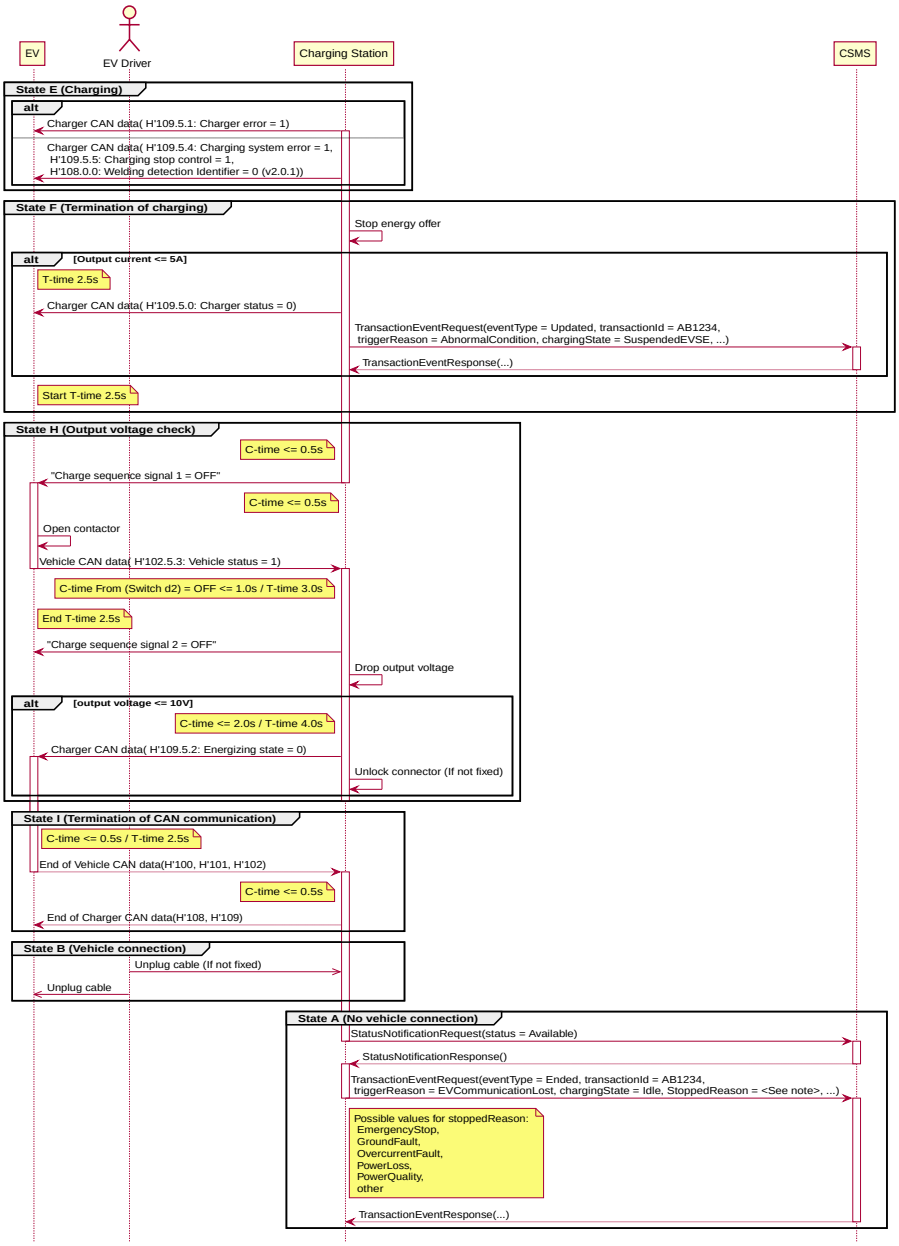

Figure 3. Sequence diagram: Stop by Charging Station (abnormal)

4.1.4. Stop by EV

The sequence diagram below describes OCPP 2.0.1 and CHAdeMO message flows between the systems, when the EV initiates a stop of the charging session.

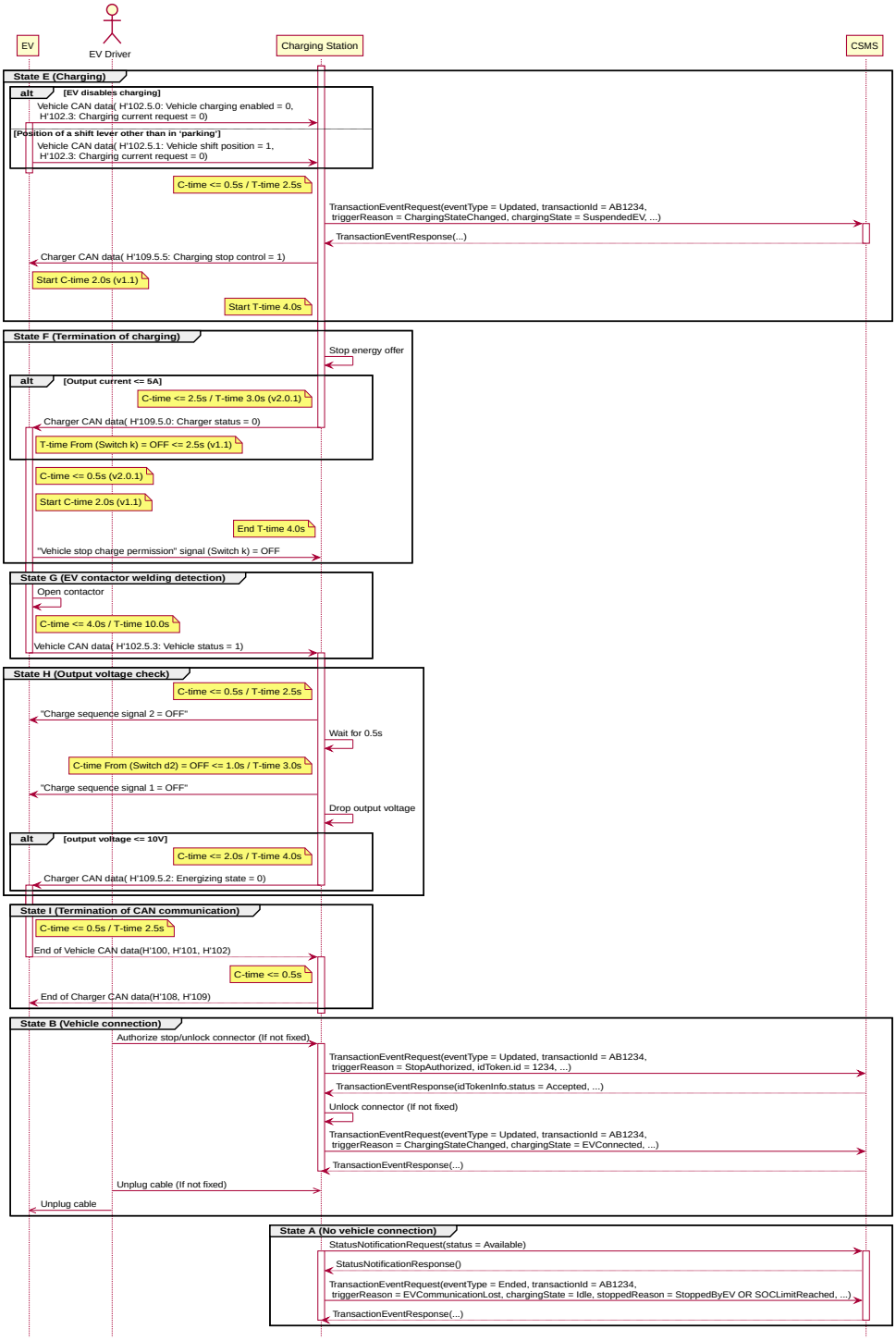

Figure 4. Sequence diagram: Stop by EV

4.1.5. Stop by EV (abnormal)

The sequence diagram below describes OCPP 2.0.1 and CHAdeMO message flows between the systems, when the EV initiates an abnormal stop of the charging session.

NOTE An abnormal stop by a EV can occur for example in case of; Battery overvoltage, battery undervoltage, battery current deviation, high battery temperature, battery voltage deviation, etc.

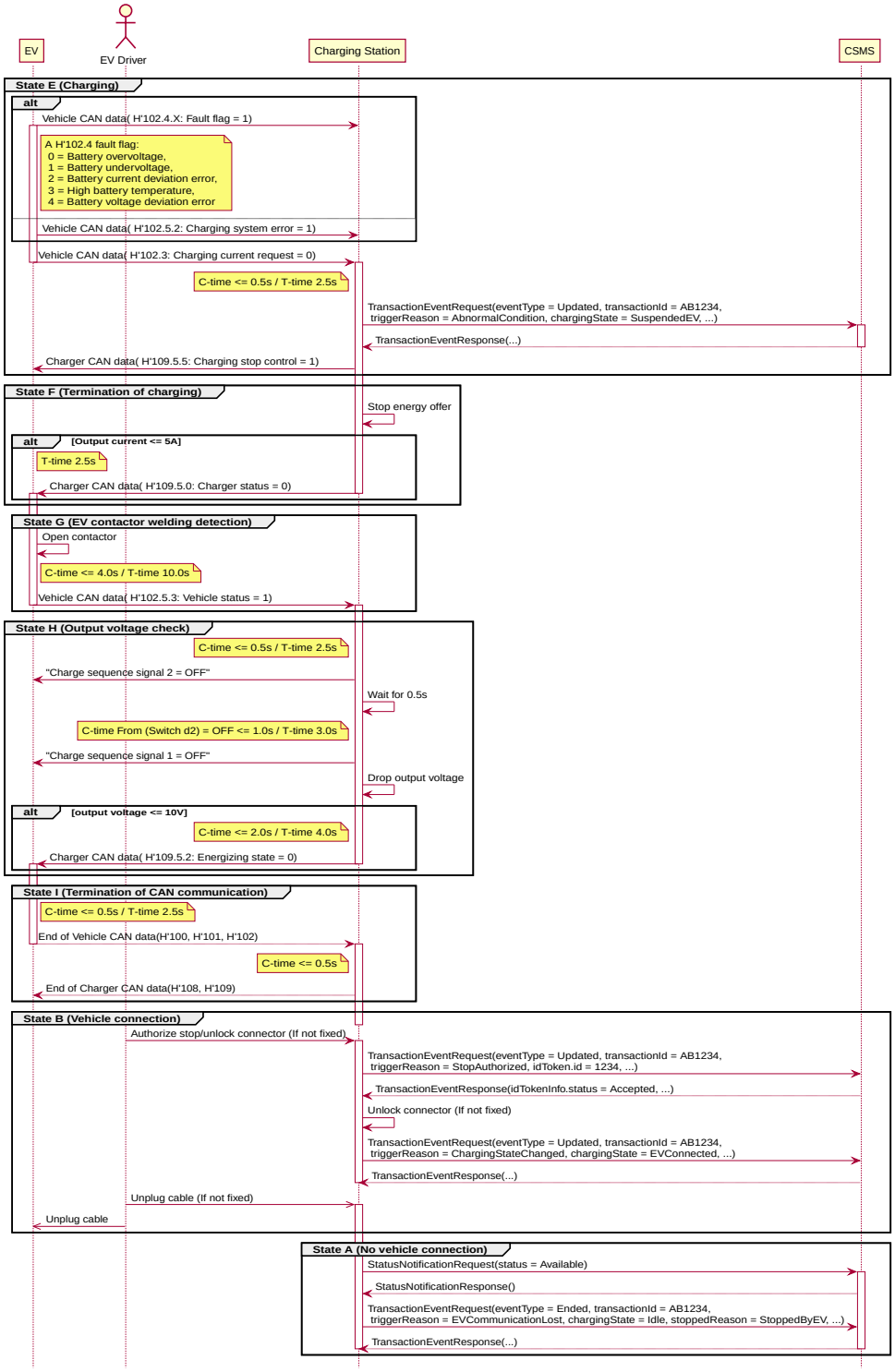

Figure 5. Sequence diagram: Stop by EV (abnormal)

4.1.6. Dynamic control

The sequence diagram below describes OCPP 2.0.1 and CHAdeMO message flows between the systems, when the CSMS provides a charging profile to the charging station, to request a charging current change.

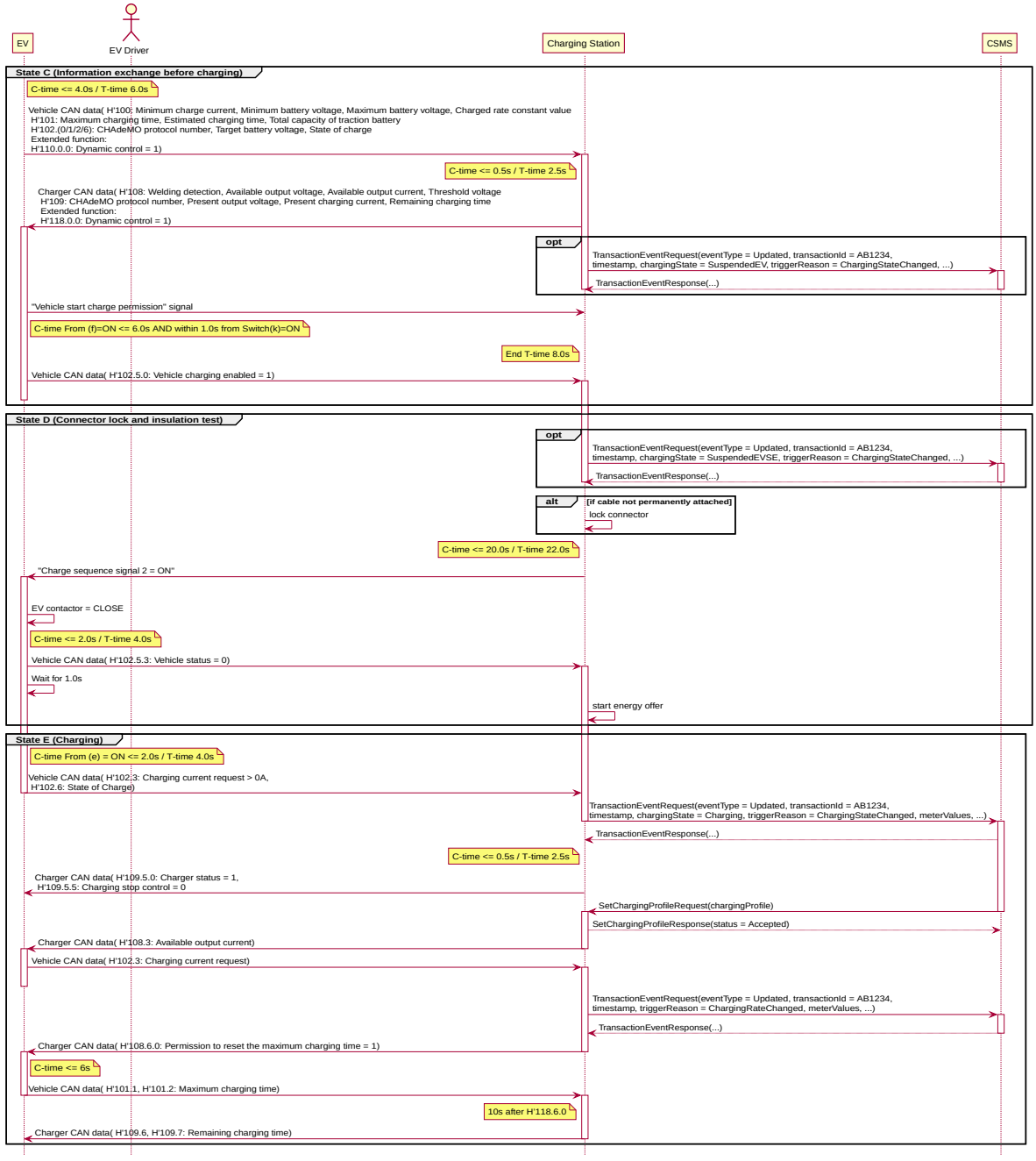

Figure 6. Sequence diagram: Dynamic control

4.2. Sequence Diagrams for OCPP 1.6 and CHAdeMO

This section contains all sequence diagrams related to OCPP 1.6 in correspondence with CHAdeMO 1.1 and 2.0.1.

NOTE	There is almost no difference between the message flows of CHAdeMO 1.1 and 2.0.1. Therefore no separate sequence diagrams were needed. Differences between the versions are marked by notes.

4.2.1. Start charging session

The sequence diagram below describes OCPP 1.6 and CHAdeMO message flows between the systems, when starting a charging session.

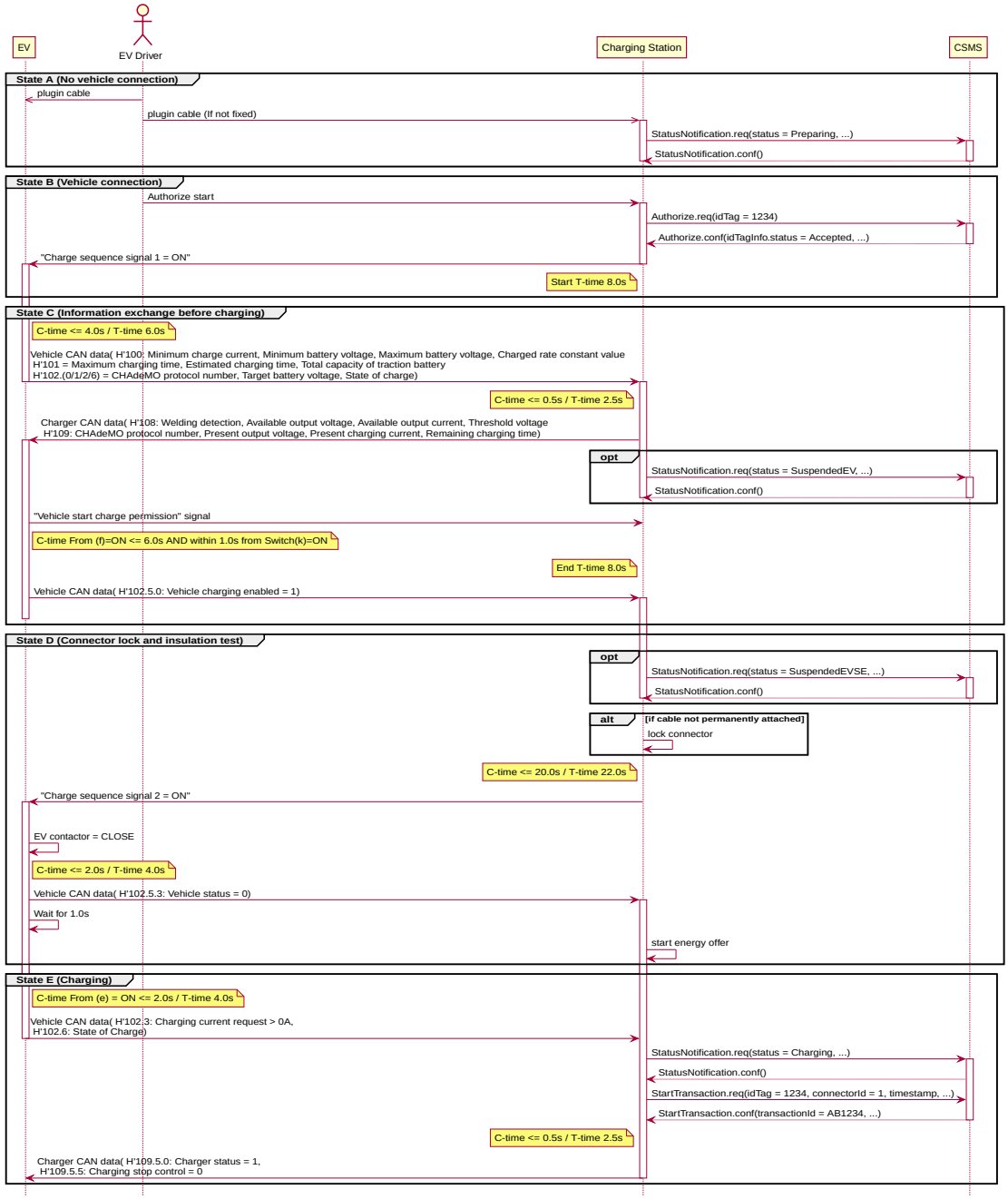

Figure 7. Sequence diagram: Start charging session

4.2.2. Stop by Charging Station

The sequence diagram below describes OCPP 1.6 and CHAdeMO message flows between the systems, when the charging station initiates a stop of the charging session.

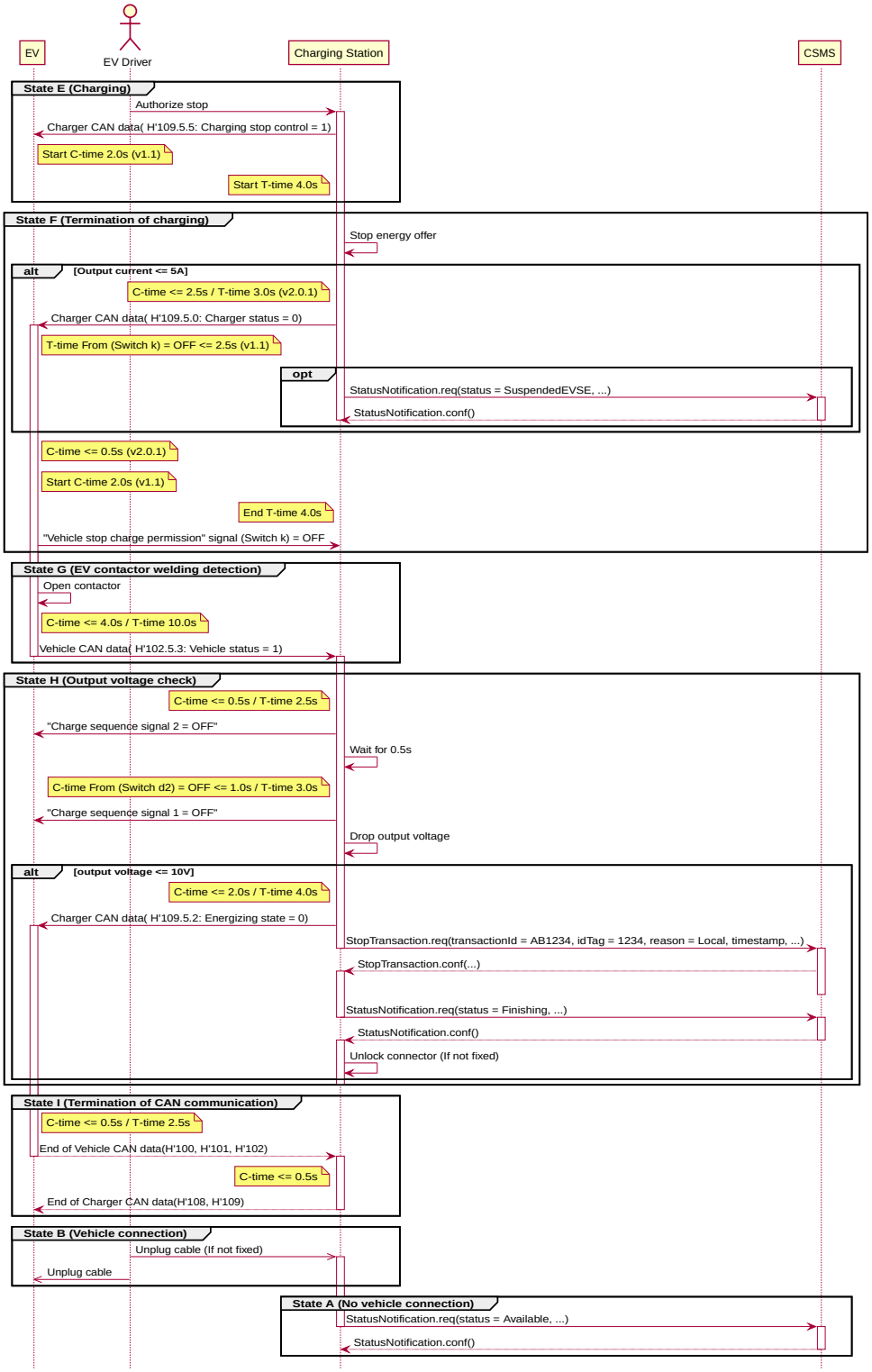

Figure 8. Sequence diagram: Stop by Charging Station

4.2.3. Stop by Charging Station (abnormal)

The sequence diagram below describes OCPP 1.6 and CHAdeMO message flows between the systems, when the charging station initiates an abnormal stop of the charging session.

NOTE An abnormal stop by a charging station can occur for example in case of; Ground fault, overcurrent fault, power loss, power quality, emergency stop, etc.

NOTE In case of a power failure, it might not be possible to send the OCPP messages at that time. In this case the transaction-related OCPP messages must be queued as described at the OCPP specification.

NOTE In case an error occurs prior to charging, the Charging Station will only send a StopTransaction.req if it already sent/queued a StartTransaction.req. The chance of this happening is low, because when using OCPP 1.6, the transaction will always start during state E.

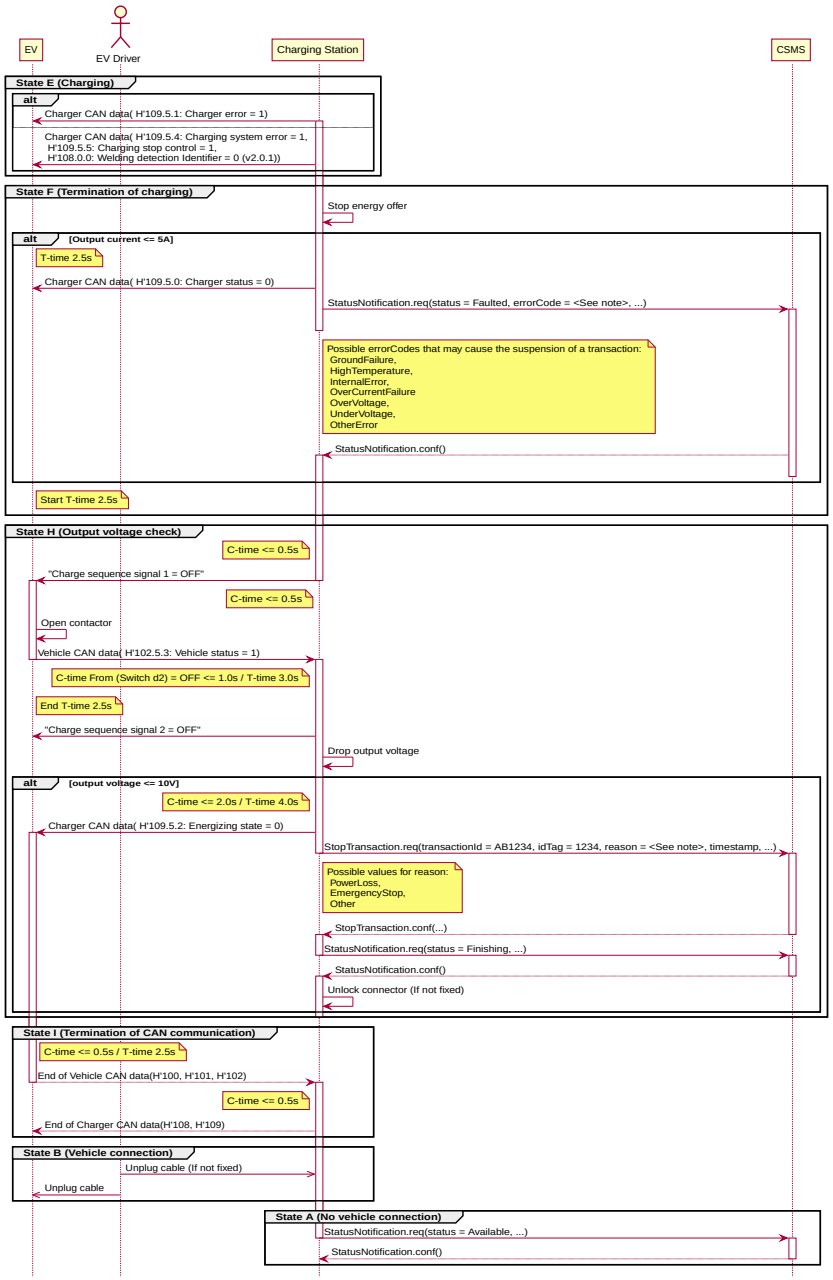

Figure 9. Sequence diagram: Stop by Charging Station (abnormal)

4.2.4. Stop by EV

The sequence diagram below describes OCPP 1.6 and CHAdeMO message flows between the systems, when the EV initiates a stop of the charging session.

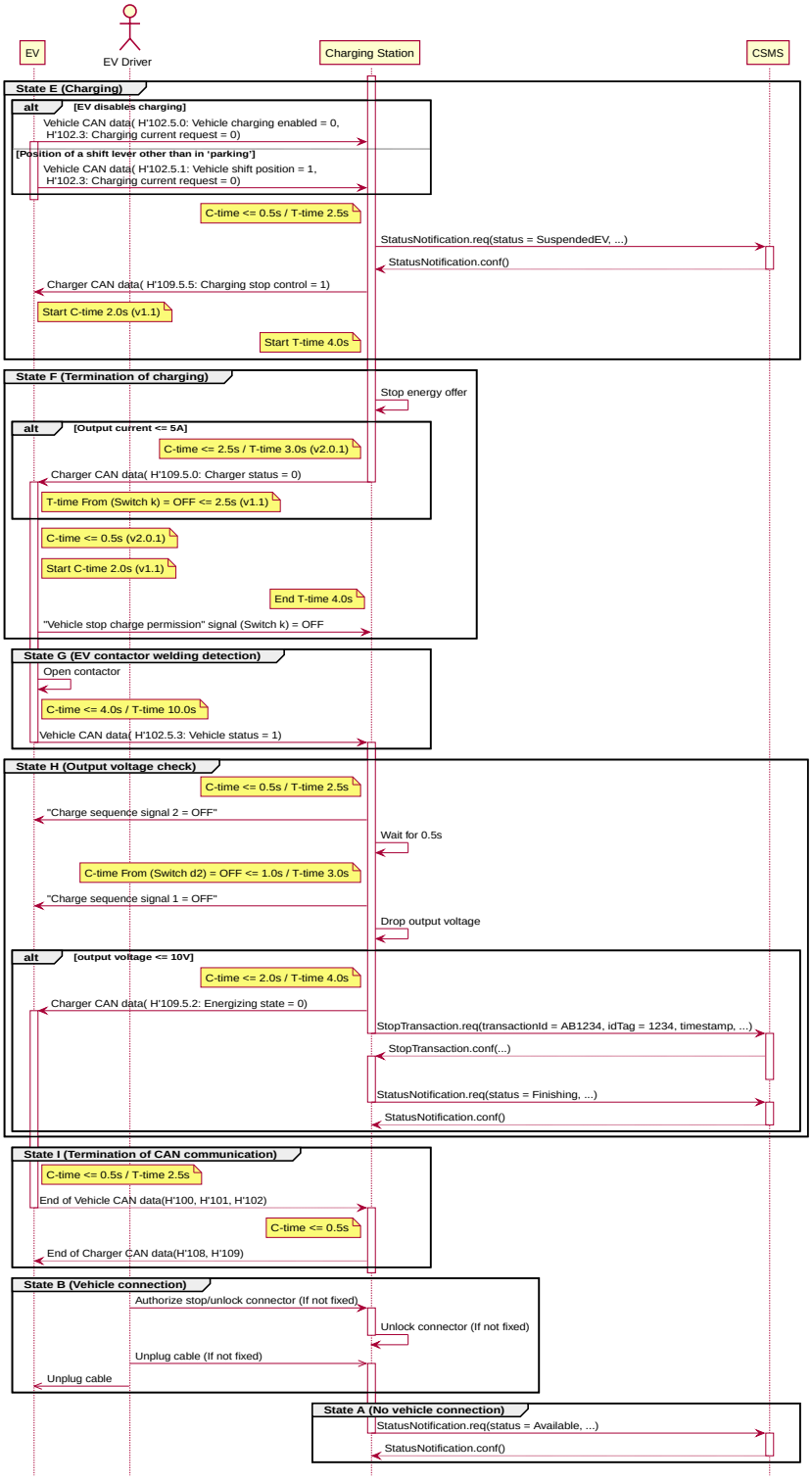

Figure 10. Sequence diagram: Stop by EV

4.2.5. Stop by EV (abnormal)

The sequence diagram below describes OCPP 1.6 and CHAdeMO message flows between the systems, when the EV initiates an abnormal stop of the charging session.

NOTE An abnormal stop by a EV can occur for example in case of; Battery overvoltage, battery undervoltage, battery current deviation, high battery temperature, battery voltage deviation, etc.

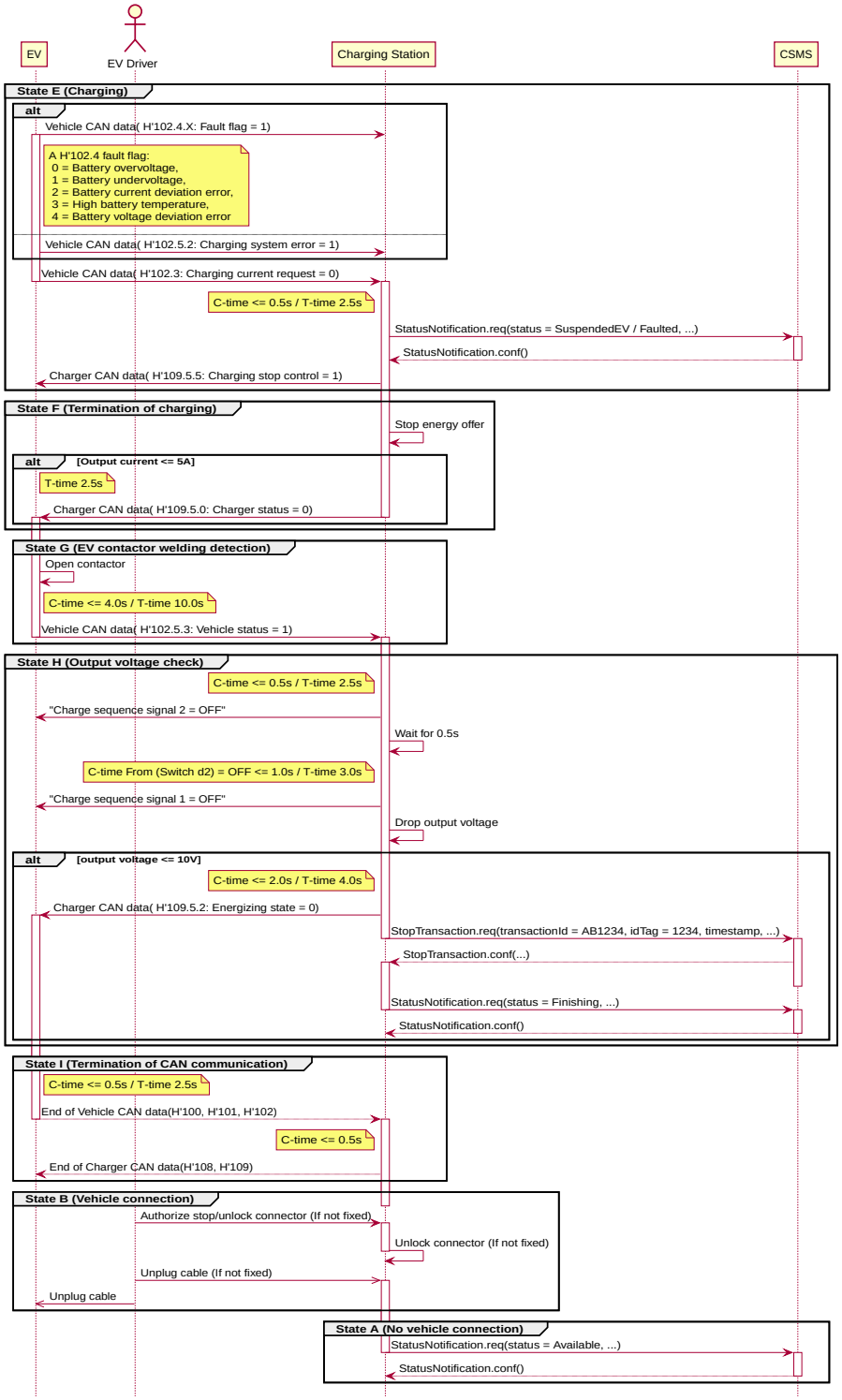

Figure 11. Sequence diagram: Stop by EV (abnormal)

4.2.6. Dynamic control

The sequence diagram below describes OCPP 1.6 and CHAdeMO message flows between the systems, when the CSMS provides a charging profile to the charging station, to request a charging current change.

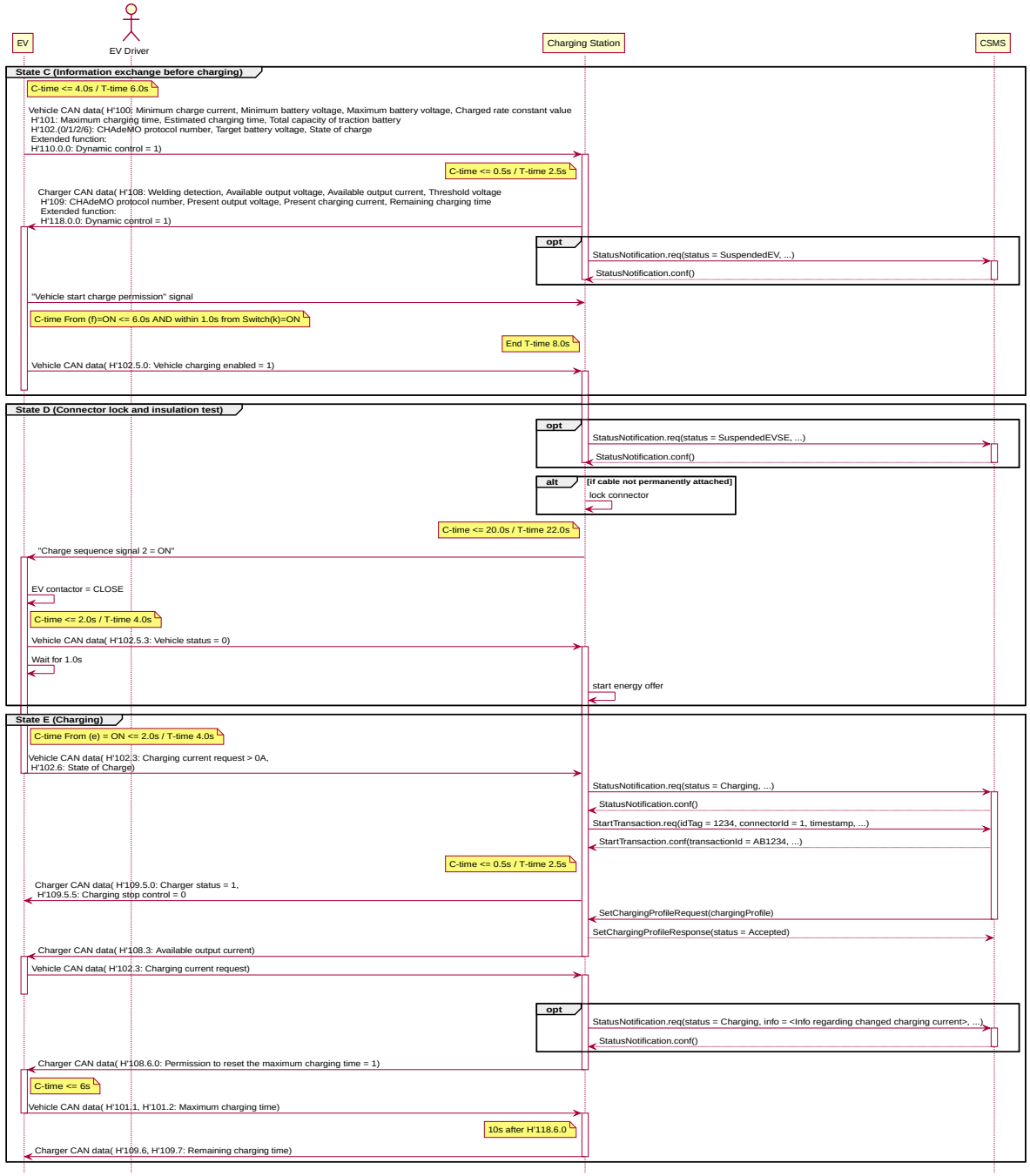

Figure 12. Sequence diagram: Dynamic control

5. Showing CHAdeMO Data in OCPP Device Model

5.1. Quick Introduction to OCPP Device Model

OCPP has a feature that is available as of release 2.x, called the Device Model, through which a charging station can publish a list of components which consist of associated variables with their values. The charging station management system can query these variables and can install monitors to be notified whenever these values exceed a certain threshold or change more than a certain amount. Most variables will be read-only, but some variables are writable, which means that the charging station management system can change their value.

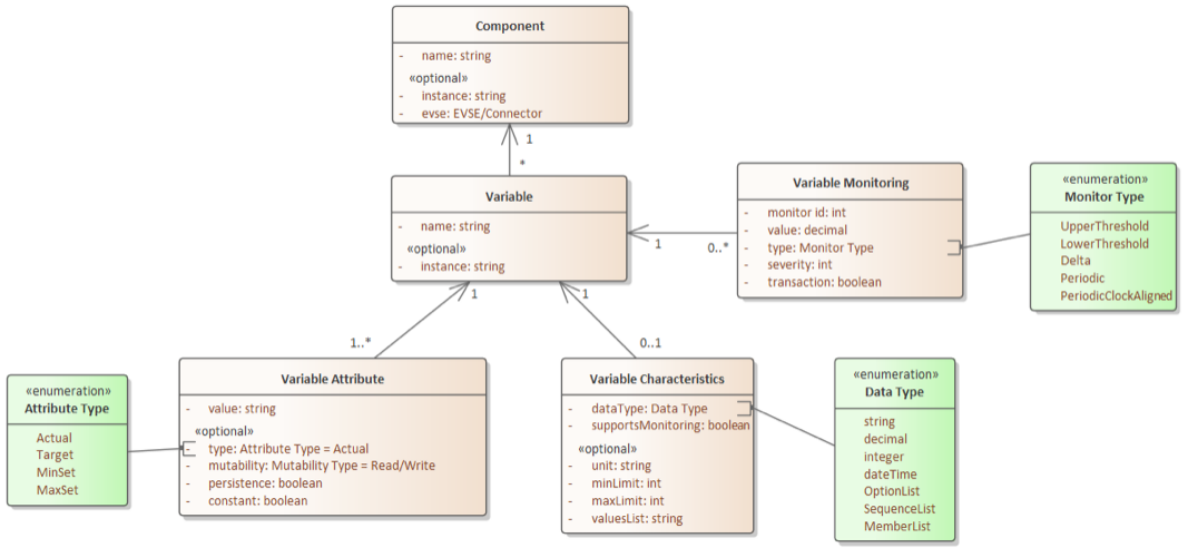

Figure 13. Device Model structure

A component can be part of the charging station as a whole, or it can be associated with a specific EVSE or connector. There are components that are real physical components, such as an *AcDcConverter* (representing the AC-DC converter in a DC charging station) and components that represent logical (software) components. These are called "controllers" in the device model. One such example is the controller for OCPP communication of a charging station, which is named *OCPPCommCtrlr*. Typical variables for an *AcDcConverter* are: *DCCurrent, DCVoltage, Power* and *Temperature*, which are operational values reported by the converter. For an *OCPPCommCtrlr* there will be variables like: *HeartbeatInterval, OfflineThreshold* and *ActiveNetworkProfile*, which are basically configuration parameters that can be set by the charging station management system to influence OCPP behaviour.

5.2. CHAdeMO Data in Device Model

If we want to represent data from the CHAdeMO controller in the device model, then the obvious choice is to introduce a component *CHAdeMOCtrlr*. Whereas only one *OCPPCommCtrlr* exists for the whole charging station, a dedicated *CHAdeMOCtrlr* is needed for every CHAdeMO connector in the station.

Some of the information reported by CHAdeMO is really CHAdeMO-specific, but lot of the data is generic charging data, such as power, current, voltage and state of charge. Such data might also be reported by other charging protocols, like ISO 15118. It therefore makes sense to extract all generic charging data about the connected vehicle into a generic component. We propose to call this component: *ConnectedEV*.

5.2.1. What Can CHAdeMO Data Be Used For?

The following sections in this white paper describe the data that is coming from CHAdeMO and *can* be represented in OCPP. This does not mean that every charging station will provide this information; that is up to the manufacturer. The information in existing OCPP messages is sufficient to manage a charging session. It is not required to disclose this data in order to support charging or smart charging.

Then why would a charging station management system be interested in these values? The information provided as part of *CHAdeMOCtrlr* or *ConnectedEV* may be of interest for a couple or reasons:

1. For diagnostic purposes, e.g. to record the reason why the EV aborted charging;
2. For testing purposes, e.g. to check whether the EV really follows the supplied charging schedule;
3. For smart charging purposes, e.g. by using the information about battery capacity, the lowest acceptable current for charging or the remaining charging time, a smart charging schedule can be tailored to match the vehicle. For instance, when CSMS knows the value of the current below which the vehicle will stop charging (*DCCurrent.minset*), it can use this to set

the value of *minChargingRate* in an OCPP Charging Profile.

NOTE The text below is part of a proposal to formally include *ConnectedEV* as a standardized component of the device model. It is awaiting approval of the OCPP Technical Working Group of the Open Charge Alliance.

5.3. CHAdeMOCtrlr Component

The following variables that are reported for a CHAdeMO connection, are considered to be CHAdeMO-specific and are published as part of the *CHAdeMOCtrlr* component.

VARIABLE	UNIT	CORRESPONDING CHADEMO VALUE
CHAdeMOProtocolNumber	integer	CHAdeMO protocol number (H'102.0)
VehicleStatus	boolean	Vehicle status (H'102.5.3)
DynamicControl	boolean	Vehicle compatible with dynamic control (H'110.0.0)

5.4. ConnectedEV Component

Generic charging data is reported via the *ConnectedEV* component. It is not really a component of the charging station itself, but represents the electrical vehicle that is connected to a connector of the charging station.

5.4.1. Power and Current Values

The power and current values provided by CHAdeMO can be used by a charging station management system for diagnostic purposes or, for example, to verify that the charging station is correctly following limits that are given in a charging schedule.

VARIABLE	UNIT	CORRESPONDING CHADEMO VALUE
DCCurrent.minSet	A	Minimum charge current (H'100.0)
DCCurrent.target	A	Charging current request (H'102.3)
DCVoltage.minSet	V	Minimum battery voltage (H'100.2,3)
DCVoltage.maxSet	V	Maximum battery voltage (H'100.4,5)
DCVoltage.target	V	Target battery voltage (H'102.1,2)

5.4.2. Energy and State of Charge Values

The charging station management system can use the energy and state of charge values to provide information about the progress of charging to a user via a smartphone app or the data can be used to optimize a smart charging algorithm.

VARIABLE	UNIT	CORRESPONDING CHADEMO VALUE
EnergyImport.maxSet	Wh	Total capacity of traction battery * 100 (H'101.5,6)
RemainingTimeFull.maxSet	s	Maximum charging time * 60 (H'101.2)
RemainingTimeFull.actual	s	Estimated charging time * 60 (H'101.3)
StateOfCharge.maxSet	%	Charged rate reference constant (H'100.6)
StateOfCharge.actual	%	State of charge (H'102.6)

5.4.3. Status Values

The charging state indicates error situations, that may cause charging to be suspended or stopped. This information is useful for the charging station management system for diagnostic purposes.

VARIABLE	UNIT	CORRESPONDING CHADEMO VALUE
ChargingState.actual	*one or more of:*	
	BatteryOvervoltage	Battery overvoltage (H'102.4.0)
	BatteryUndervoltage	Battery undervoltage (H'102.4.1)
	ChargingCurrentDeviation	Battery current deviation (H'102.4.2)
	BatteryTemperature	High battery temperature (H'102.4.3)
	VoltageDeviation	Battery voltage deviation (H'102.4.4)

VARIABLE	UNIT	CORRESPONDING CHADEMO VALUE
	ChargingSystemError	Charging system error (H'102.5.2)
	VehicleShiftPosition	Vehicle shift position (H'102.5.1)
	VehicleChargingEnabled	Vehicle charging enabled (H'102.5.0)

5.5. Implementation Feedback Welcome

When implementers of both OCPP and CHAdeMO want to explore disclosing information about the charging parameters of the EV to the CSMS, they can do so using sections B2.2 "Configuring a Charging Station" and N2.2 "Configure Monitoring" from OCPP 2.0.1 "Part 2 - Specification" and the above-mentioned component and variable descriptions.

We encourage giving feedback on this new approach by joining the Open Charge Alliance and participating in the Open Charge Alliance Technical Working Group.