OCPP Transactions

OBJECTIVE:

Build a CSMS system capable of handling an OCPP transaction and multiple transaction events that is linked to a transaction.

The system should be capable of maintaining the full details of the transaction and transaction events & capture all the necessary metrics.

BASIC TERMINOLOGIES:

CSMS:

Charging Station Management System. The system that manages Charging Stations and has the information for authorizing Users for using its Charging Stations.

Charging Station:

The Charging Station is the physical system where EVs can be charged. A Charging Station has one or more EVSEs.

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.

Connector:

The term Connector, as used in this specification, 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 (e.g. four-wheeled EVs and electric scooters).

SCENARIO:

Transaction Begin & Transaction Update

A transaction is the portion of a charging session that is recorded by CSMS. It is a single time frame with a start and stop time. The operator for billing can use this information.

Pre-requisite:

1. Web-Socket connection should have been established between Charging station and CSMS before the transaction begins
2. The charging station and CSMS should comply to the OCPP 2.0.1 standards

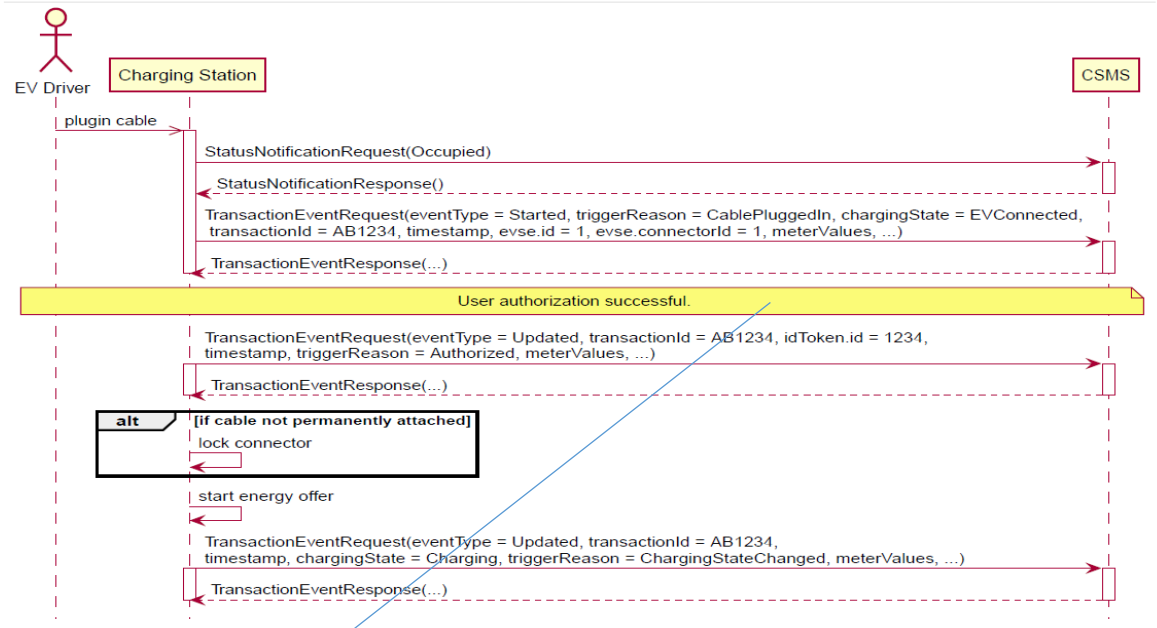
Description:

1. The EV Driver plugs in the cable at the Charging Station.

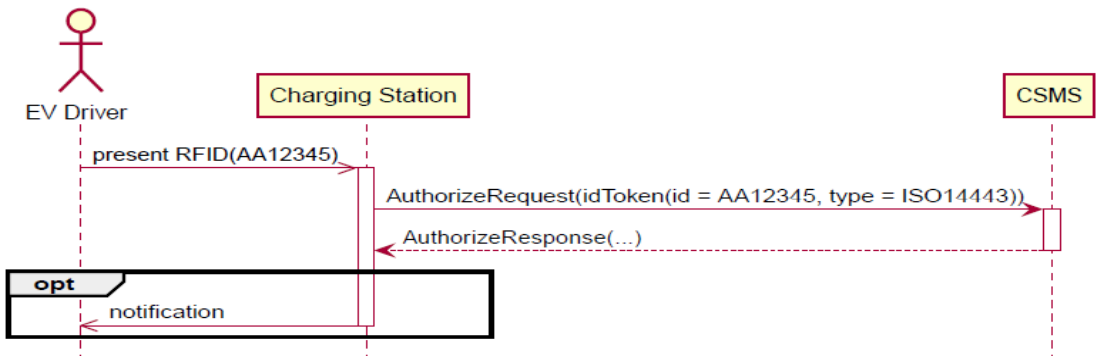
2. The Charging Station sends a StatusNotificationRequest to the CSMS to inform it about connector that became *Occupied*.
3. The Charging Station sends a TransactionEventRequest (eventType = Started) notifying the CSMS about a transaction that has started (even when the driver is not yet known.)
4. The CSMS responds with a TransactionEventResponse, confirming that the TransactionEventRequest was received.
5. The EV Driver is authorized by the Charging Station and/or CSMS.

    a. The EV Driver wants to start charging the EV and presents an RFID card.
    b. The Charging Station sends AuthorizeRequest to the CSMS to request authorization.
    c. Upon receipt of AuthorizeRequest, the CSMS responds with AuthorizeResponse. This response message indicates whether the IdToken is accepted by the CSMS.

6. The energy offer starts.
7. The Charging Station sends a TransactionEventRequest (eventType = Updated) with the authorized idToken information to the CSMS to inform about the charging status and which idToken belongs to the transaction.
8. The CSMS responds with a TransactionEventResponse to the Charging Station with the IdTokenInfo.status *Accepted*.
9. During the charging process, the Charging Stations continues to send TransactionEventRequest (Updated) messages for transaction-related notifications.



User Authorization Flow:



Note:

- The transactionId generated by the Charging Station MUST be unique for each transaction started by that Charging Station, even when the Charging Station is rebooted, repaired, firmware is updated etc, it SHALL ensure that it never generates the same TransactionId twice.

- Utmost one transaction can be active on an EVSE at any point in time.

- The Charging Station SHALL set the message's seqNo field as specified below.

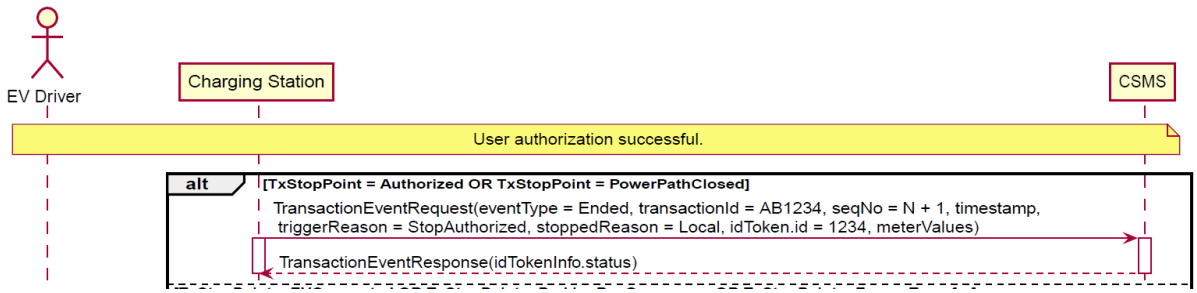
  When a transaction starts, the Charging Station SHOULD set the *seqNo* field for the TransactionEventRequest message to 0. (Implementations with a continuously increasing *seqNo* are still allowed.)
  After each TransactionEventRequest Charging Station SHALL increase the *seqNo* by 1.

Transaction End

Description:

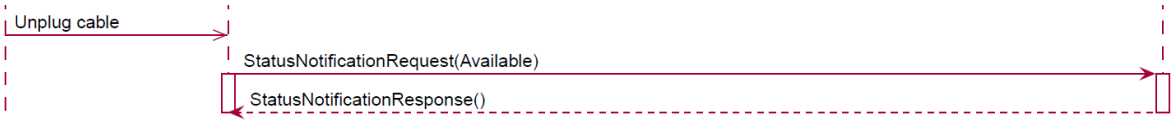
Transaction ends with triggerReason=StopAuthorized when ending authorization

1. The EV Driver presents IdToken a second time to end charging. (Refer the user authorization flow above)
2. The Charging Station sends a TransactionEventRequest (eventType = Ended) with *triggerReason* = StopAuthorized and *stoppedReason* = Local.
3. The CSMS responds with a TransactionEventResponse.
4. The Charging Station stops the energy transfer and if the cable is not permanently attached, the Charging Station unlocks the cable.



This is followed by a StatusNotificationRequest from ChargingStation – CSMS intimating that the connector is Available once again

1. The Charging Station sends a StatusNotificationRequest to the CSMS to inform it about connector that became *Available*.



REQUEST AND RESPONSE POJO:

Status Notification Request & Response

StatusNotificationResponse.json

StatusNotificationRequest.json

Authorize Request & Response

AuthorizeResponse.json

AuthorizeRequest.json

Transaction Event Request & Response

TransactionEventResponse.json

TransactionEventRequest.json

REQUEST and RESPONSE SAMPLES:

StatusNotificationRequest:

```
[
    2,
    "5f62efb4-3fbe-438d-92e6-794f8c290970",
    "StatusNotification",
    {
        "timestamp":"2022-02-11T11:03:36Z",
        "connectorStatus": "Occupied",
        "evseId": 1,
        "connectorId": 1
    }
]
```

StatusNotificationResponse:

```
[
    3,
    "5f62efb4-3fbe-438d-92e6-794f8c290970",
    {}
]
```

TransactionEventRequest:

```
[
    2,
    "e6f4bd9c-0472-49e3-83f4-408d32c406b1",
    "TransactionEvent",
    {
```

```
    "eventType": "Started",
    "evse": {
        "connectorId": 1,
        "id": 1
    },
    "timestamp": "2023-08-28T09:10:00.932Z",
    "seqNo": 1,
    "triggerReason": "CablePluggedIn",
    "transactionInfo": {
        "transactionId": "4f20ae29-b167-40cf-8d90-077532bd096b",
        "chargingState": "EVConnected"
    },
    "meterValue": [
        {
            "timestamp": "2023-08-28T09:10:00.932Z",
            "sampledValue": [
                {
                    "context": "Transaction.Begin",
                    "location": "Body",
                    "measurand": "Current.Import",
                    "phase": "L1",
                    "unitOfMeasure": {
                        "multiplier": 0,
                        "unit": "A"
                    },
                    "value": 8737
                },
                {
                    "context": "Transaction.Begin",
                    "location": "Body",
                    "measurand": "Voltage",
                    "phase": "L3-N",
                    "unitOfMeasure": {
                        "multiplier": 0,
                        "unit": "V"
                    },
                    "value": 228540
                },
                {
                    "context": "Transaction.Begin",
                    "location": "Body",
                    "measurand": "Energy.Active.Import.Register",
                    "unitOfMeasure": {
                        "multiplier": -3,
                        "unit": "Wh"
                    },
                    "value": 0.0
                }
            ]
        }
    ]
}
```

```
]
```

TransactionEventResponse:

```
[
    3,
    "e6f4bd9c-0472-49e3-83f4-408d32c406b1",
    {}
]
```

Authorize Request:

```
[
    2,
    "51b464eb-f97e-49b1-a970-c4b5123cb997",
    "Authorize",
    {
        "idToken": {
            "idToken": "C93628F6-982D-4CEB-8888-107227CAF090",
            "type": "ISO14443"
        }
    }
]
```

AuthorizeResponse:

```
[
    3,
    "51b464eb-f97e-49b1-a970-c4b5123cb997",
    {
        "idTokenInfo": {
            "status": "Accepted",
            "evseId": []
        }
    }
]
```

TransactionEventRequest Update 1:

```
[
    2,
    "e6f4bd9c-0472-49e3-83f4-408d32c406b1",
    "TransactionEvent",
    {
        "eventType": "Updated",
        "evse": {
            "connectorId": 1,
            "id": 1
        },
        "timestamp": "2023-08-28T09:15:00.932Z",
```

```
        "seqNo": 2,
        "triggerReason": "Authorized",
        "transactionInfo": {
            "transactionId": "4f20ae29-b167-40cf-8d90-077532bd096b"
        },
        "idToken": {
            "idToken": "C93628F6-982D-4CEB-8888-107227CAF090",
            "type": "ISO14443"
        },
        "meterValue": [
            {
                "timestamp": "2023-08-28T09:15:00.932Z",
                "sampledValue": [
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Current.Import",
                        "phase": "L1",
                        "unitOfMeasure": {
                            "multiplier": -3,
                            "unit": "A"
                        },
                        "value": 8737
                    },
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Voltage",
                        "phase": "L3-N",
                        "unitOfMeasure": {
                            "multiplier": -3,
                            "unit": "A"
                        },
                        "value": 228540
                    },
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Energy.Active.Import.Register",
                        "unitOfMeasure": {
                            "multiplier": 0,
                            "unit": "Wh"
                        },
                        "value": 0.0
                    }
                ]
            }
        ]
    }
]
```

TransactionEventResponse Update 2:


```
[
    3,
    "e6f4bd9c-0472-49e3-83f4-408d32c406b1",
    {
        "idTokenInfo": {
            "status": "Accepted",
            "evseId": []
        }
    }
]
```


TransactionEventRequest – Update – 2


```
[
    2,
    "e6f4bd9c-0472-49e3-83f4-408d32c406b1",
    "TransactionEvent",
    {
        "eventType": "Updated",
        "evse": {
            "connectorId": 1,
            "id": 1
        },
        "timestamp": "2023-08-28T09:15:00.932Z",
        "seqNo": 3,
        "triggerReason": "ChargingStateChanged",
        "transactionInfo": {
            "transactionId": "4f20ae29-b167-40cf-8d90-077532bd096b",
            "chargingState": "charging"
        },
        "meterValue": [
            {
                "timestamp": "2023-08-28T09:15:00.932Z",
                "sampledValue": [
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Current.Import",
                        "phase": "L1",
                        "unitOfMeasure": {
                            "multiplier": 0,
                            "unit": "A"
                        },
                        "value": 8743
                    },
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Voltage",
                        "phase": "L3-N",
```

```
                        "unitOfMeasure": {
                            "multiplier": -3,
                            "unit": "A"
                        },
                        "value": 228545
                    },
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Energy.Active.Import.Register",
                        "unitOfMeasure": {
                            "multiplier": 0,
                            "unit": "Wh"
                        },
                        "value": 4.0
                    }
                ]
            }
        ]
    }
]
```


TransactionEventResponse - Update 2:


```
[
    3,
    "e6f4bd9c-0472-49e3-83f4-408d32c406b1",
    {}
]
```


User displays RFID card yet again:

Authorize Request:


```
[
    2,
    "51b464eb-f97e-49b1-a970-c4b5123cb997",
    "Authorize",
    {
        "idToken": {
            "idToken": "C93628F6-982D-4CEB-8888-107227CAF090",
            "type": "ISO14443"
        }
    }
]
```


AuthorizeResponse:


```
[
    3,
    "51b464eb-f97e-49b1-a970-c4b5123cb997",
    {
```

```
        "idTokenInfo": {
            "status": "Accepted",
            "evseId": []
        }
    }
]
```

TransactionEventRequest – Ended

```
[
    2,
    "e6f4bd9c-0472-49e3-83f4-408d32c406b1",
    "TransactionEvent",
    {
        "eventType": "Ended",
        "evse": {
            "connectorId": 1,
            "id": 1
        },
        "timestamp": "2023-08-28T09:15:00.932Z",
        "seqNo": 4,
        "triggerReason": "StopAuthorized",
        "transactionInfo": {
            "transactionId": "7f20ae29-b167-40cf-8d90-077532bd096b",
            "stoppedReason" : "Local"
        },
        "idToken": {
            "idToken": "C93628F6-982D-4CEB-8888-107227CAF090",
            "type": "ISO14443"
        },
        "meterValue": [
            {
                "timestamp": "2023-08-28T09:15:00.932Z",
                "sampledValue": [
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Current.Import",
                        "phase": "L1",
                        "unitOfMeasure": {
                            "multiplier": -3,
                            "unit": "A"
                        },
                        "value": 8747
                    },
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Voltage",
                        "phase": "L3-N",
                        "unitOfMeasure": {
```

```
                            "multiplier": -3,
                            "unit": "A"
                        },
                        "value": 228547
                    },
                    {
                        "context": "Sample.Periodic",
                        "location": "Body",
                        "measurand": "Energy.Active.Import.Register",
                        "unitOfMeasure": {
                            "multiplier": 0,
                            "unit": "Wh"
                        },
                        "value": 0.8
                    }
                ]
            }
        ]
    }
]
```


TransactionEventResponse-Ended:


```
[
    3,
    "e6f4bd9c-0472-49e3-83f4-408d32c406b1",
    {
        "idTokenInfo": {
            "status": "Accepted",
            "evseId": []
        }
    }
]
```