ContiConnect Live via API

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1. Introduction

An integration guide for connecting to ContiConnect via API. The ContiConnect external API provides the 3rd party vendors (telematic partaners) the capability to connect their systems with the ContiConnect backend. The API supports the external vendors in providing data to ContiConnect. Every service exposes an openAPI(swagger) specification via http(s).

This documentation is intended for technical team working on integrating their fleet system with ContiConnect via API.

ContiConnect Quality portal is the quality gateway in terms of testing, for APIs Partners. Only after successfully testing API against this enviornment, they shall proceed to ContiConnect PROD.

2. Prerequisites

1. Contract
2. CPC integration - *The reference document can be found here*.
3. Partner has to be added as a data provider to ContiConnect
4. Authentication key/certificate pair

After clarifying the prerequisites, one can use the following documentation to create applications pushing data to ContiConnect.

3. Security and Data handling

3.1. Authentication

All Services require authentication to serve requests. External parties using the API (users) will be authenticated using TLS mutual Authentication. Continental will create a Certificate-Key pair for every user. Users will access each API endpoint via an API-Gateway. They will authenticate using their Certificate-Key pair on this gateway.

The API Gateway creates a cc-jwt (ContiConnect Json Web Token) token for the user, which is then used to access the API Endpoint services.

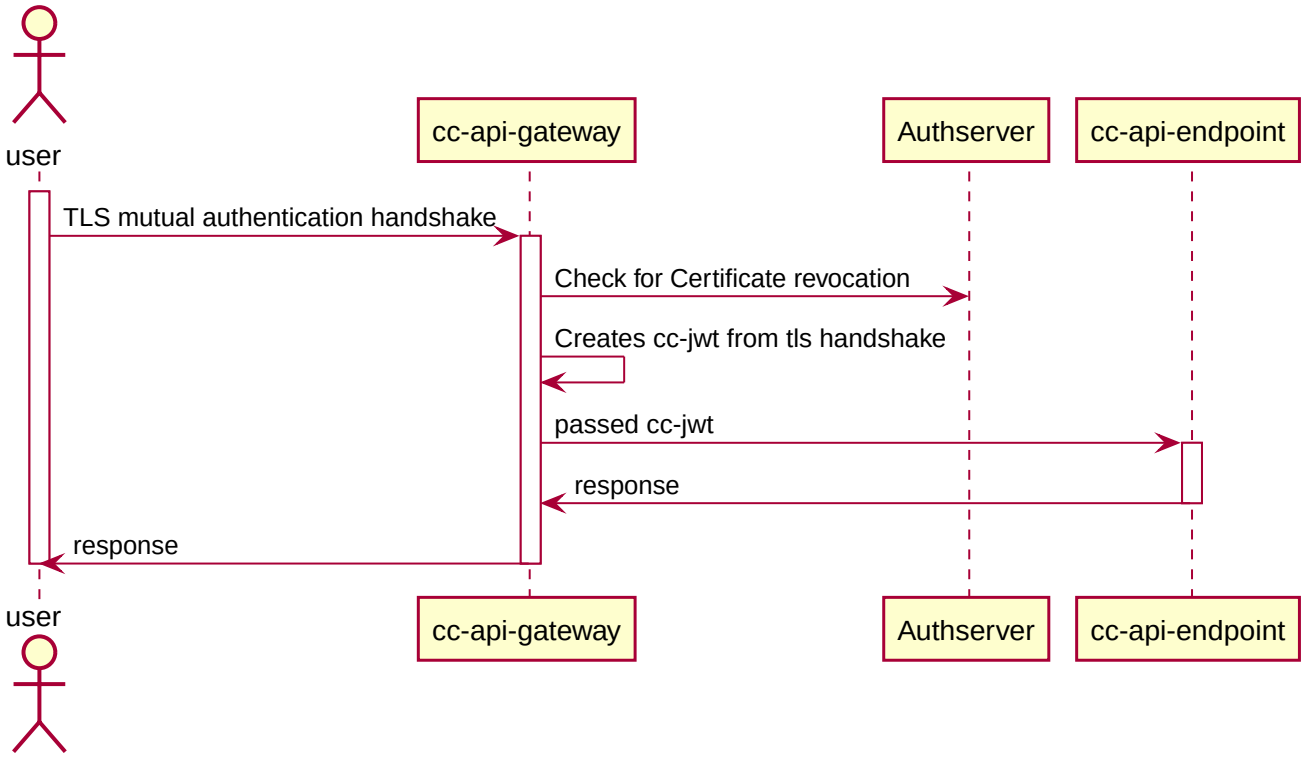

Figure 1. Bird-eye view

3.2. Authorization

The system will only accept data from authorized data providers (Api Patner). Only data for vehicles configured to use that data provider will be accepted. Invalid data will be rejected or discarded.

3.3. How data is handled

Every vehicle accessible in ContiConnect by a data provider needs to have that data provider set and an external vehicle id.

When vehicle master data updates are received, the change is applied to the vehicle if it has the correct data provider configured and is found. The request url contains the external vehicle id to address that vehicle as a rest resource.

When vehicle activity data is received, the data is accepted by the interface in any case. If the data came from the correct data provider and the external vehicle id matches a vehicle for that provider the data is processed in the system. If not it is discarded.

When sensor activity data is received, the data is accepted by the interface in any case. The system will check for the vehicle the sensors are assigned to, and if the data came from the data provider configured for the vehicle, the data is processed by the system. If not it is discarded.

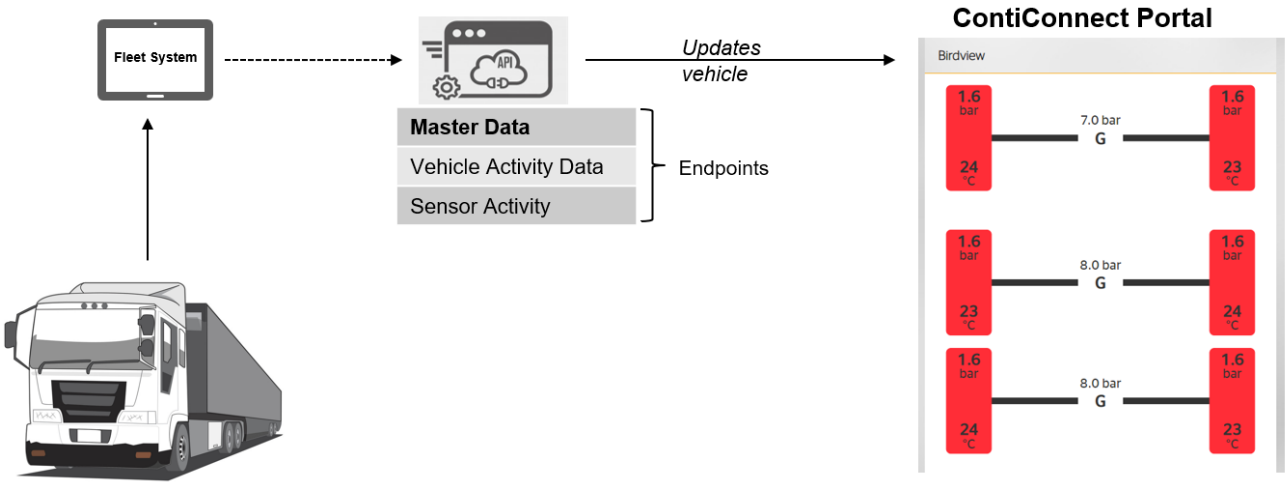

Figure 2. Overiew

4. Endpoint Descriptions

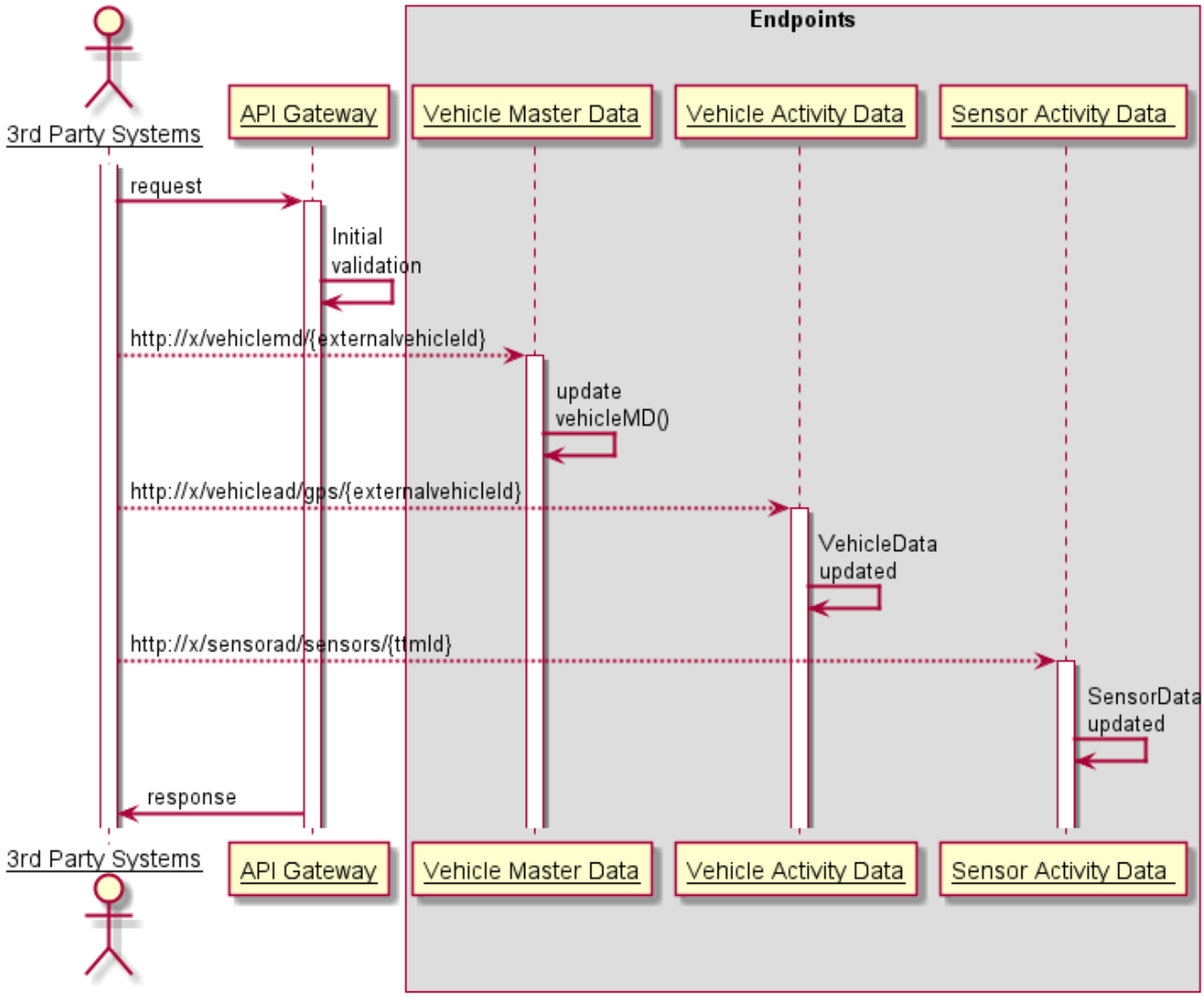

Figure 3. Sequence Diagram

Vehicle Masterdata is the primary endpoint, it should be reached beforehand. The sensor actvity data and vehicle activity data endpoints are the secondary, only reachable after masterdata.

The next three chapters explains each endpoint comprehensively.

5. Conticonnect Vehicle API

5.1. Overview

Public API to update Vehicle Masterdata for vehicle configurations from a 3rd party system. Vehicle Master Data updates are only accepted if a related vehicle was already created in ContiConnect. The VehicleMD service receives Vehicle Masterdata updates, validates them and applies them to ContiConnect using the internal ContiConnect APIs. It's the primary endpoint, receives vehicle masterdata and the assigned sensors.

URI scheme

Host : conti-connect.com
BasePath : /vehiclemd

Tags

- conflicts-controller : Conflicts Controller
- vehicle-md-controller : Vehicle Md Controller

5.2. Paths

getAxleConfigConflicts

```
GET /conflicts
```

Responses

HTTP Code	Description	Schema
200	OK	< Conflict > array
401	Unauthorized	No Content
403	Forbidden	No Content
404	Not Found	No Content

Produces

- */*

Tags

- conflicts-controller

Used to update vehicle master data, including axle configuration and sensor assignments

```
PUT /vehicles/{externalVehicleId}
```

Parameters

Type	Name	Description	Schema
Path	**externalVehicleId** *required*	externalVehicleId	string
Body	**vehicleMd** *required*	vehicleMd	VehicleMd

Responses

HTTP Code	Description	Schema
200	OK	VehicleMd
201	Created	No Content
400	Axle configuration cannot be resolved due to wrong request	VehicleApiError
401	Unauthorized	No Content
403	Forbidden	No Content
404	Not Found	No Content
500	Axle configuration cannot be resolved due to error on backend	VehicleApiError

Consumes

- `application/json`

Produces

- `application/json`

Tags

- vehicle-md-controller

5.3. Definitions

Conflict

Name	Schema
conflictType *optional*	string
creationTimestamp *optional*	integer (int64)
customerVehicleId *optional*	string
description *optional*	string
lpn *optional*	string
vehicleGuid *optional*	string
vehicleType *optional*	string

SensorMd

Name	Description	Schema
position *optional*	Graphical position of the sensor on the vehicle.	string
recommendedPressure *optional*	Recommended Pressure of the Tire in Pa.	number (double)
ttmId *optional*	Numeric Sensor ID.	string

VehicleApiError

Name	Schema
errorCode *optional*	integer (int32)

Name	Schema
errorMessage *optional*	string

VehicleMd

Name	Description	Schema
axleNumber *optional*	Number of axles on the vehicle. **Minimum value** : `1` **Maximum value** : `8`	integer (int32)
ccuId *optional*	Id of the ccu. **Length** : `0 - 12`	string
highTemperatureThreshold *optional*	Threshold for high temperature alerts in *C. **Minimum value** : `5` **Maximum value** : `300`	integer (int64)
lowPressureThreshold *optional*	Threshold for low pressure alerts in % of pressure. **Minimum value** : `5` **Maximum value** : `100`	integer (int64)
sensors *optional*		< SensorMd > array
ttmNumber *optional*	Number of sensors(ttm) on the vehicle. **Minimum value** : `0` **Maximum value** : `64`	integer (int32)
veryLowPressureThreshold *optional*	Threshold for very low pressure alerts in % of pressure. **Minimum value** : `5` **Maximum value** : `100`	integer (int64)

6. ContiConnect Vehicle Activity Data API

6.1. Overview

Public API for vehicle activity data. Vehicle Activity Data is always related to a specific Vehicle, identified by the externalVehicleID. Vehicle Activity Data should be send in a regular frequency.

URI scheme

Host : localhost

BasePath : /

Tags

- vehicle-activity-data-controller : Vehicle Activity Data Controller

6.2. Paths

updateVehicleActivityData

```
PUT /gps/{externalVehicleId}
```

Parameters

Type	Name	Description	Schema
Path	**externalVehicleId** *required*	externalVehicleId	string
Body	**gpsData** *required*	gpsData	GpsData

Responses

HTTP Code	Description	Schema
200	OK	GpsData
201	Created	No Content
401	Unauthorized	No Content
403	Forbidden	No Content
404	Not Found	No Content

Consumes

- `application/json`

Produces

- `application/json`

Tags

- vehicle-activity-data-controller

6.3. Definitions

GpsData

Name	Description	Schema
alt *optional*	GPS altitude	number (double)
gdp *optional*	Geometric dilution of precision	number (double)
hdg *optional*	GPS heading	number (double)
hdp *optional*	Horizontal dilution of precision	number (double)
lat *optional*	GPS latitude	number (double)
lon *optional*	GPS longitude	number (double)
spd *optional*	GPS speed	number (double)
ts *optional*	Timestamp	integer (int64)

7. Conticonnect Sensor Activity Data API

7.1. Overview

Public API for sensor activity data. Sensor Readings are readings based on TTM informations. These messages are always related to to a Sensor ID. Sensor readings for sensors without vehicle relations are discarded. It requires that vehicle master data have been sent beforehand. Sensor Readings should be transmitted in regular frequency. In case of Sensor alert, Sensor reading should be transmitted immediately.

URI scheme

Host : localhost
BasePath : /

Tags

- sensor-data-controller : Sensor Data Controller

7.2. Paths

Used to send latest sensor activity data (readings)

```
PUT /sensors/{sensorId}
```

Parameters

Type	Name	Description	Schema
Path	**sensorId** *required*	sensorId	string
Body	**sensorData** *required*	sensorData	SensorData

Responses

HTTP Code	Description	Schema
200	OK	SensorData
201	Created	No Content
400	Invalid sensorID or sensor data sent	SensoradApiError
401	Unauthorized	No Content
403	Forbidden	No Content
404	Sensor not found in the system	SensoradApiError
500	Error happened on server side, failed to update sensor data	SensoradApiError

Consumes

- `application/json`

Produces

- `application/json`

Tags

- sensor-data-controller

7.3. Definitions

SensorData

Name	Description	Schema
flt *optional*	Sensor field (state encoded)	integer (int64)
lkrt *optional*	Tire leakage rate in Pa/s	number (float)
oph *optional*	Operating hours	integer (int64)
ptd *optional*	Tire pressure threshold detect (state encoded)	integer (int64)
rssi1 *optional*	Signal Strength Indicator 1	integer (int64)
rssi2 *optional*	Signal Strength Indicator 2	integer (int64)
rssi3 *optional*	Signal Strength Indicator 3	integer (int64)
rssi4 *optional*	Signal Strength Indicator 4	integer (int64)
rssi5 *optional*	Signal Strength Indicator 5	integer (int64)

Name	Description	Schema
rssi6 *optional*	Signal Strength Indicator 6	integer (int64)
ses *optional*	Sensor enable status	integer (int64)
shr *optional*	Sensor hit rate	integer (int64)
sid *optional*	SensorID	string
styp *optional*	Sensor type	integer (int64)
tprs *optional*	Tire pressure in Pa	number (float)
ts *optional*	Timestamp	integer (int64)
tst *optional*	Tire status (state encoded)	integer (int64)
ttmpr *optional*	Tire temperature in *C	number (float)

SensoradApiError

Name	Schema
errorCode *optional*	integer (int32)
errorMessage *optional*	string

8. Vehicle creation in ContiConnect

To create a vehicle in ContiConnect QUAL portal, one should have login and added as telematics partner after fulfilling the Prerequisites.

On main page:

1. Click on **MyFleet**
2. Click on plus (+) sign

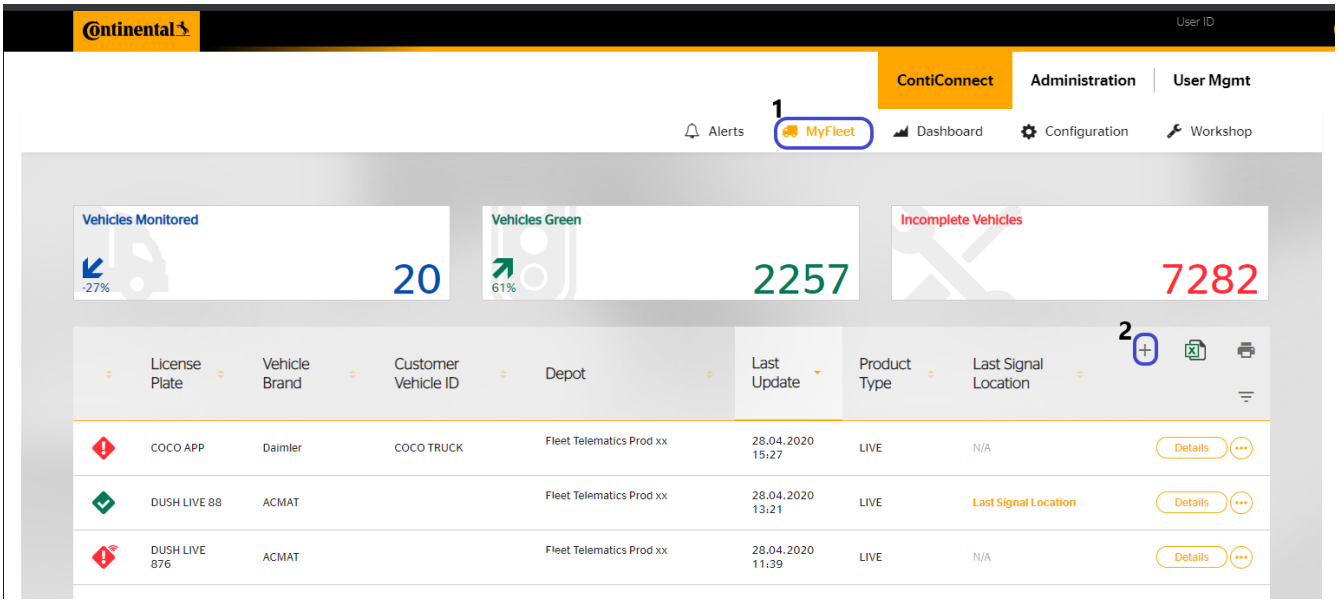

Figure 4. ContiConnect Main Page

If you are not creating a trailer, click **Continue without HHT [1] file**.

On vehicle creation page, scroll down to *Fleet/Depot Information* section:

3. Select the fleet and depot from drop-down-list.Your Fleet/Depot shall have the *Live* functionality activated.

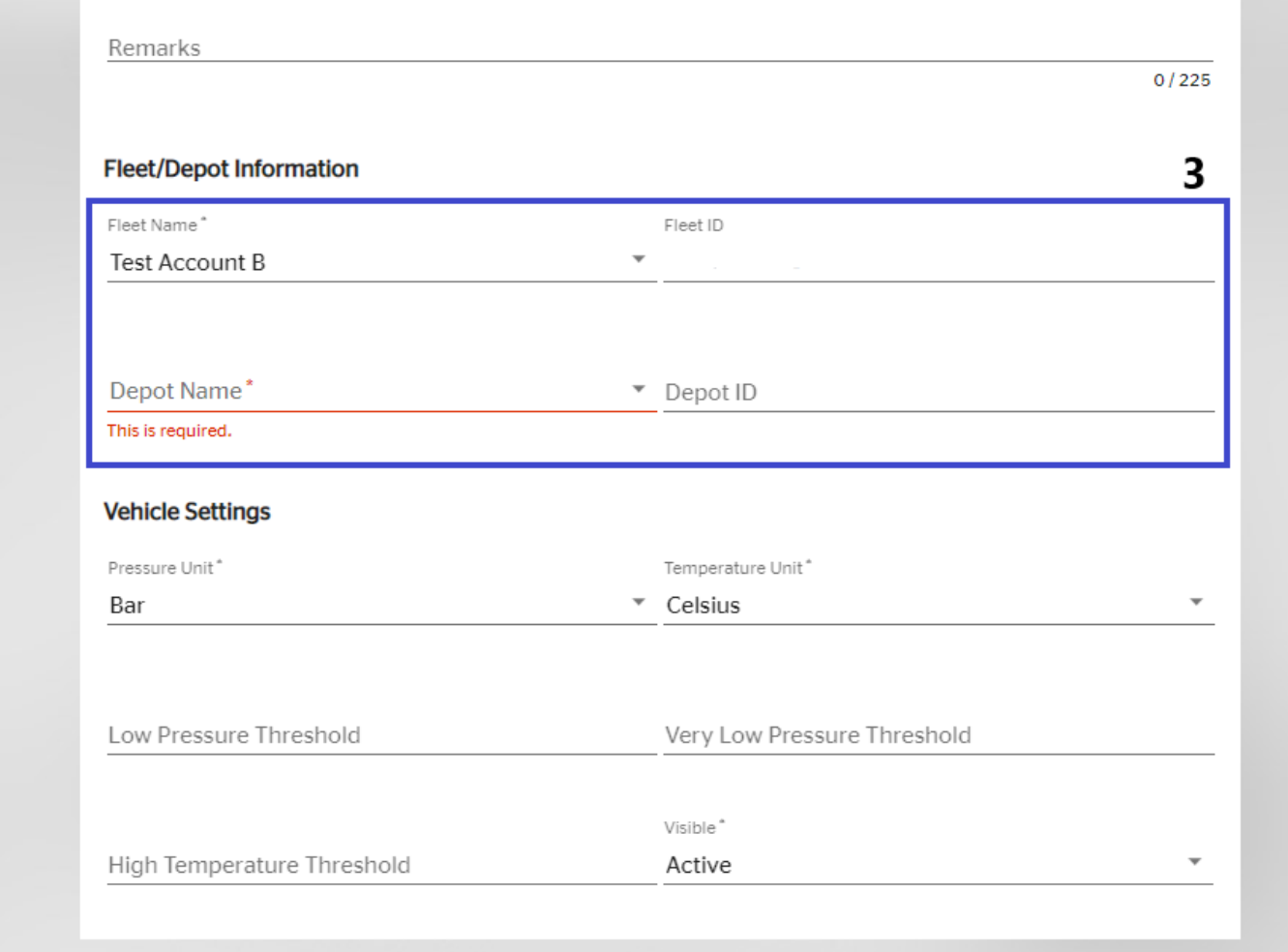

Figure 5. Select Fleet and Depot

Scroll-up, after filling in the fields i.e. license plate, country and CVID etc.

4. Select **LIVE** as Product Type
5. Select **3rd Party Telematics** as Live connectivity type from the drop-down-list
6. Select your company name e.g. ABC telematics.

Fill-in the external-id and other relevant details.

7. Save the vehicle.

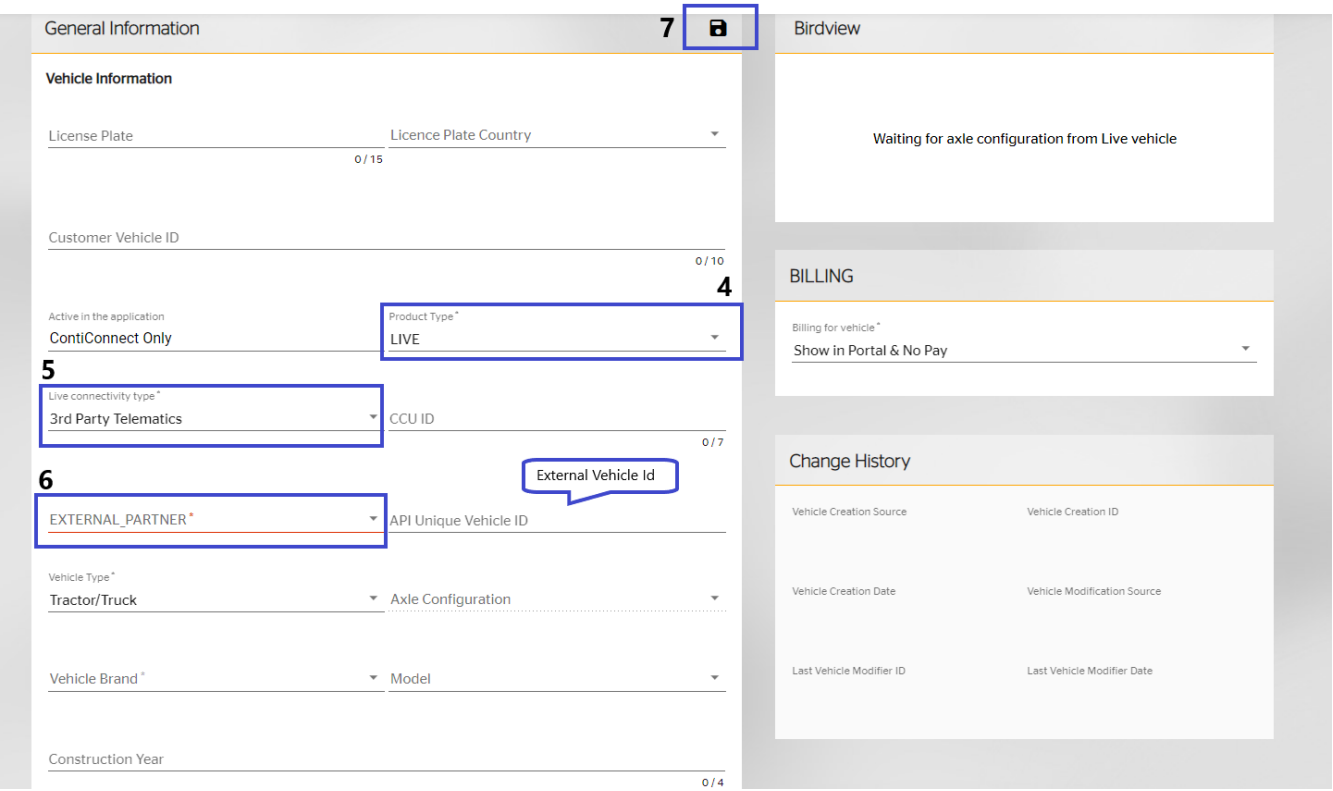

Figure 6. Filling mandatory fields

After saving the vehicle, you are good for testing, start testing by reaching vehicleMD endpoint. VehicleMD payload includes CCU-ID and External-Vehicle ID.

CKU's (Central Key Users) are responsible for vehicle creation.

9. Usage of External-Vehicle ID

The *API unique Vehicle Id* or *External-Vehicle Id* is the **unique identifier** for the vehicles of Telematics Partners. The vehicles which are setup in ContiConnect to receive Live data via API. The maximum value for external vehicle id is **64 character string**. Each vehicle is identified by ExternalVehicle Id.

VehcileMD and VehicleAD endpoints use the externalVehicleID to reach the vehicle.How data is handled.

VehcileMD endpoint is used for updating the vehicle master data and it uses ExternalVehicle ID to reach the vehicle in CoCo portal.

```
PUT /vehicles/{externalVehicleId}
```

VehicleAD endpoint is used to update the vehicle activity data i.e. GPS and it also uses ExternalVehicle ID data to update the vehicle in portal.

```
PUT /gps/{externalVehicleId}
```

10. Sample cURL commands

If all the pre-conditions are met, the telematics partner can test the integration. The following cURL commands can be used as reference to reach the test vehicle in ContiConnect Qual portal.

Scenario: The vehicle has been created in ContiConnect Qual portal, which has external ID - **testapi1** belonging to telematics partner. You have been already provided, username and password for testing. One can test the update of vehicle master data by as shown in sample command.

Replace the sample field's data with your test vehicle data.

Vehicle Master data endpoint

```
curl -u username:password -i -X PUT -H "Content-Type: application/json" -d '
{
"axleNumber": 2,
"ttmNumber": 4,
"ccuId":"3211",
"highTemperatureThreshold":100,
"lowPressureThreshold": 85,
"veryLowPressureThreshold": 75,
"sensors": [
  {
   "position":"13",
   "recommendedPressure": 8.3,
   "ttmId": "1002202001"
  },{
   "position":"1B",
   "recommendedPressure": 8.3,
   "ttmId": "1002202002"
  },{
   "position":"33",
   "recommendedPressure": 8.3,
   "ttmId": "1002202003"
  },{
   "position":"3B",
   "recommendedPressure": 8.3,
   "ttmId": "1855957348"
  }
 ]
}
' http://www.qa.c2tires.conti.com/vehiclemd/vehicles/testapi1
```

For testing the SensorAD endpoint in following command we update the tire on position "3B":

Sensor Activity Data endpoint

```
curl -u username:password -i -X PUT -H "Content-Type: application/json" -d '
{
"flt": 0,
"lkrt": 0,
"ptd": 4,
"rssi1": 111,
"rssi2": 113,
"rssi3": 112,
"rssi4": 0,
"rssi5": 0,
"rssi6": 0,
"ses": 1,
"shr": 3,
"tprs": 136,
"ts": 1585766325000,
"tst": 0,
"ttmpr": 9024,
"sid": "1855957348",
"styp": 1
}
' http://www.qa.c2tires.conti.com/sensorad/sensors/1855957348
```

To update the GPS data of the vehicle, one can test with following command.

Vehicle Activity Data endpoint

```
curl -i -X PUT -H "Content-Type: application/json" -d '
{
    "ts": 1581329908000,
    "lat": 50,
    "lon": 8,
    "alt": 300,
    "spd": 10,
    "hdp": 0,
    "gdp": 0,
    "hdg": 90
}
' http://www.qa.c2tires.conti.com/vehiclead/gps/testapi1
```

Please inform Conti before testing and cross-check the endpoint url with your contact person.

11. Alerts types

Alerts	Explanation
Fast pressure loss	Continous, fast pressure loss. Tire damage and tire destruction will occur
Very low pressure	Tire pressure falls below recommended alarm threshold value. Tire damage or even tire destruction is possible
Sensor loose / flipped	The tire sensor is no longer properly fixed or flipped. Sensor needs to be exchanged.
Low pressure	The tire pressure falls below the recommended warning threshold value. Tire damage or even tire destruction is possible.
High temperature	The measured temperature in the tire exceeds xx°C. The tire sensor no longer functions at 120°C
Sensor defect	Tire sensor is defective
Sensor missing	No signal has been received from sensor >= 18 minutes while the vehicle is operating
Low battery	Low battery
Slow leak	Slow leak identified

The alerts are generated via CPC and passed-on in payload.

12. API Versioning

The API versioning is only for endpoints on the PROD. The version of the API uses calendar versioning format (2020.1.0), so it looks as follows:

```
YEAR.MINOR.MICRO
```

Year: This denotes the year of version.

Minor: It’s an incremental number, starting from 0 each year. It signifies the major changes.

Micro: This denotes patches.

13. Appendix

Appendix A: Mapping Document

API - J1939

Endpoints	Field	J1939 Standard
Vehicle Master Data	axlesNumber	Is SPN 6949 from PGN 64583 (MTI)
	ccuId	PGN 64965 / SPN 2902 Length is always 7 decimal digits
	highTemperatureThreshold	Is SPN 6984 from PGN 64579 (TCSI). Only one value per vehicle/CCU.
	lowPressureThreshold	Is SPN 6981 from PGN 64579 (TCSI). Only one value per axle.
	sensor.position	Is PGN 65284 / Graphical Position
	sensor.recommendedPressure	use PGN 64579 / SPN 6980
	sensor.ttmId	Is SPN 6966 from PGN 64582 (TSIS). It’s the same as TTM ID in PGN 65284. Length is always 8 hexadecimal digits.
	ttmNumber	Is SPN 6964 from PGN 64582 (TSIS) - (Without ATL). With ATL: After ATL has finished and trailer tires were found, the trailer tires were added to PGN 65280, but not to PGN 64582. (Not used for "Vehicle Master Data")
	veryLowPressureThreshold	Is SPN 6982 from PGN 64579 (TCSI) Only one value per axle.

Endpoints	Field	J1939 Standard
Sensor Activity Data	SensorID	Is SPN 6966 from PGN 64582 (TSIS). It's the same as TTM ID in PGN 65284 Length is always 8 hexadecimal digits.
	SensorType	*Not available on CAN*
	Timestamp	Epoch UTC + ms
	Tire Pressure	PGN 64578 / SPN 6988
	Tire Temperature	Is SPN 242 from PGN 65268 (TIRE1).
	ttm_enable_status	Is SPN 242 from PGN 65268 (TIRE1).
	tire_status	Is SPN 242 from PGN 65268 (TIRE1).
	ttm_elec_fault	Is SPN 242 from PGN 65268 (TIRE1).
	tire_leakage_rate	Is SPN 242 from PGN 65268 (TIRE1).
	tire_pressure_threshold_detect	Is SPN 242 from PGN 65268 (TIRE1).
	rssi[1..6]	PGN 65290
	TTM_Hitrate	Number of RSSI values <> 0 (received RF frames)

Appendix B: Endpoints Abbreviation and unit of measurement

Endpoint	Field Name	Field Description	unit of measurement
SensorAD	sid	SensorID	
SensorAD	styp	Sensor Type	
SensorAD	ttmpr	Tire Temperature	°C

Endpoint	Field Name	Field Description	unit of measurement
SensorAD	ses	ttm enable status	
SensorAD	flt	ttm fault	State Encoded
SensorAD	tst	Tire Status	State Encoded
SensorAD	lkrt	leakage rate	Pa/s
SensorAD	ptd	tire pressure threshold detect	State Encoded
SensorAD	shr	TTM Hit Rate	
SensorAD	rssi1..rss6	Signal Strength (for each sensor per tire i.e. rss2, rss3 etc.)	
SensorAD	tprs	Tire Pressure	Pa
SensorAD & VehicleAD	ts	Time Stamp (UTC)	
VehicleAD	lat	GPS latitude	
VehicleAD	lon	GPS longitude	
VehicleAD	alt	GPS Altitude	
VehicleAD	spd	GPS Speed	
VehicleAD	hdp	GPS - Horizontal dilution of precision	
VehicleAD	gdp	GPS - Geometric dilution of precision	
VehicleAD	hdg	GPS Heading	
VehicleMD& VehicleAD	externalVehicleId	external ID	
VehicleMD	ccuId	ID of CCU	
VehicleMD	axlesNumber	Number of Axles on Vehicle	Count
VehicleMD	lowPressureThreshold	low Pressure Threshold	%
VehicleMD	veryLowPressureThreshold	very low Pressure Threshold	%
VehicleMD	highTemperatureThreshold	High Temperature Threshold	°C
VehicleMD	ttmId	Numeric Sensor ID	
VehicleMD	ttmNumber	Number of sensors(ttm) on the vehicle	Count
VehicleMD	position	Graphical position of the sensor on the vehicle	

Endpoint	Field Name	Field Description	unit of measurement
VehicleMD	recommendedPressure	Recommended Pressure of the Tire	Pa

Appendix C: Sample Test cases

If all the requirements fulfilled, following tests can be performed;

- Analyze vehicles (truck, married and trailer)
  - In CoCo Portal
- Match vehicle via API unique externalVehicleId (incl. User Experience, e.g. was the matching successful or not?)
  - Initial
  - Change / edit
  - Remove matching
- Check vehicle configuration & sensor configuration match (incl. RCP and thresholds) for truck, married and trailer
  - Initial
  - Update / edit (incl. modification of vehicle configuration, RCP and thresholds)
- Check measurement data (incl. frequency of measurement / transactional data) for truck, married and trailer
  - Tire pressure
  - Tire temperature
  - GPS
- Check alerts (incl. open, close and instant alert triggering- incl. notifications) for truck, married and trailer
  - Vehicle Generated
    - Low pressure
    - Very low pressure
    - High temperature
    - Fast pressure loss
    - Missing sensor
    - Sensor loose / flipped
    - Low battery

[1] Handheld tool