

Bi-directional Vehicle Communication Information Report -  
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Use Cases

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1.1. Scope

Bi-directional vehicle communication is integral in the field of fleet management across vehicle segments, passenger vehicles, light-heavy duty vehicles. However, vehicle communication standards are yet to keep pace with the industry, including the development of new forms of mobility platforms driven by data interoperability

Fleet managers face significant challenges when operating mixed fleets, with multiple OEMs, vehicle models and years. Each vehicle has varying levels of data architecture, data formats, parameter sets, and access, making it increasingly difficult to develop standard data practices across mixed fleets. Similarly, non-integrated vehicles are typical in the heavy-duty space as tier one components are provided from various suppliers.

This document highlights a sample of cross-section of use cases of bi-directional communication of vehicles requested by the industry today and ones in the stages of development. We anticipate the number of applications to increase in the coming years, creating a requirement for industry standards for bi-directional interoperability communication between vehicles.

## 1.2 Use Cases

### 1.2.1 ECU OTA Updates

Why HD trucks that are not vertically integrated as components are provided from different tier 1 (engine, transmission, body control) suppliers, that require an on-board telematics to receive OTA updates, especially in the case of legacy vehicles. The service can conceptually be provided by the HD truck OEM. However, there is natural competition between the OEM vertically integrated HD truck engines and tier 1 suppliers. It is considered impractical and redundant for each HD truck component to provide a telematics solution. Therefore, naturally an alternative independent provider of OTA for the OEMs is required.

What firmware is an integral part of the operation of all major HD truck components. As a result, updates are required both to add new services, and patch existing services. For example, to patch a security vulnerability discovered after product deployment. OTA updates is the method to apply firmware updates to vehicles while in operation, without requiring a visit to an authorized service site.

### 1.2.2 Remapping engine for large changes in elevation and terrain

Why HD long haul trucks that cross the mountains, undergo large changes in elevation and corresponding air density. Often ICE (internal combustion engine) trucks are configured to operate at sea-level, and not for other terrain and vice versa.

What the 'engine mapping', as set by the vehicle 'parameters' need to be adjusted as elevations changes to reduce both emissions and fuel consumption. As noted above, for non-vertically integrated HD trucks, it is important to have a non-OEM solution option to safely and securely provide OTA updates. This type of consideration is dependant on the type of road the truck is driving can be applied in real-time.

### 1.2.3 Dynamic space change for platooning

Why platooning allows vehicles to operate in close proximity and increase traffic capacity. However, road/weather conditions can change the spacing of platooning vehicles which may need to be dynamically adjusted to accommodate the conditions.

What HD truck platooning is an 'virtual' linking of trucks to maintain a separation distance between the vehicles small enough that facilitates less wind resistance for the trucks, in comparison to traditional operating distance . Effective platooning can reduce fuel costs and vehicle emissions.

#### 1.2.4 Reset of vehicle infotainment, windows, radio to neutral

Why vehicles that are 'shared' either through rental, leasing or ride-sharing platforms will need to be reset or adjusted to accommodate the new driver.

What these applications in particular require is a remote 'system reset' to neutral state when the driver returns the vehicle. For example, turn the music system down/off, fan/off, are the windows up? And, doors locked? This use case reduces/eliminates the need for people to manually re-adjust these features, and increase vehicle safety in-case of previous driver oversight.

#### 1.2.5 Car-sharing: remote 'key transfer' to permit unlocking of doors/ engine start

Why for car-sharing platforms to work they requires the transfer of keys to drivers. Hence, providing access to the next driver who has booked the vehicle, while also then disabling/transferring possession of the keys when a driver has completed the use of a vehicle. Without this feature, a vehicle must be picked up and dropped off manually at a fixed site and the key transfer facilitated by a service representative resulting in an inconvenience to the customers.

What a mobile device (typically a smartphone) that can be enabled/authorized/authenticated to bi-directionally communicate with the vehicle to unlock doors and start/operate the vehicle.

#### 1.2.6a Hybrids: disabling ICE function in certain emission controlled zones

Why clean air zones are prominent in the UK to help control air quality in city centres. The zone restricts which vehicles can enter based on emissions standards. If the vehicle does not meet these standards a charge is applied on the vehicle to enter the zone. For hybrids, that have both a combustion and electric engine, the ability to switch the engine mode to electric in the restricted zone ensures fleets are compliant and therefore no additional cost is imposed. Example of an emission zone, London Ultra Low Emission Zone.

What the ability to disable a vehicles combustion engine upon entering a specified geographic zone or geofence. The designated zones, defined as the (LEZ/ULEZ) Low and Ultra Low Emissions Zones respectively, set the emission based standards for vehicles within a designated area. The implemented solution should ensure that the engine cannot be enabled while the vehicle remains in the designated area, thus the solution enforces the use of electric only propulsion. Upon entering a LEZ/ULEZ, an exception event rule will be triggered, broadcasting an "Engine Operation Disallowed" command which will directly interface with

the vehicle's Engine Control Module will ensure 'electric only' operation for the designated zones.

via the device's auxiliary output port. This ensures the entirety of the vehicle's trip within the designated zones.

1.2.6b Resetting engine/vehicle modes of operation for specific purpose including, noise and emission controlled areas.

Why some cities (currently in Europe) monitor the air quality at road level and if it exceeds a certain threshold - then only non-emitting (EV's) electric vehicles are permitted to operate in the city. This can also apply to noise from ICE engines and exhaust pipes in certain areas. In these cases, a hybrid vehicle may be authorized to enter the city if its operation is restricted to EV mode only. In cases with a mixed OEM fleet of vehicles - there is a need for this functionality to be included in the vehicle fleet management service.

What Bi-directional communication with the hybrid vehicle that changes a vehicle parameter to restrict use to only the EV propulsion.

1.2.7 Geofencing: truck travel between the US and Canada, change HD truck parameters to meet regulatory compliance. Use case was raised by Volvo Truck - Joakim Pauli (to discuss).

1.2.8 Truck trailer remote OTA

Why truck trailers are often fitted with IoT devices to track the trailer and need a secured means for OTA updates.

What secured OTA of trailer IoT devices. Also refer to case 1.2.1: ECU OTA Updates

1.2.9 OEM/Rental House: Remote diagnosis and self check

Why rental houses need a way to easily troubleshoot a piece of equipment remotely without introducing human error into the inspection process. Human error is typically introduced when a customer, who is unfamiliar with the equipment, must inspect on behalf of a technician from the rental house. Rental houses may also send a technician down to the site to troubleshoot, which would guarantee inspection quality but comes with labor costs and financial burden.

What commands are sent remotely to the equipment controller to go through a predefined set of actions. Results of completion and possible failures are sent back to the cloud for feedback and review.

1.2.10 Sensor setting changes

Why sensor manufacturers need to change settings on their equipment for various reasons. Sensors will need to be recalibrated depending on certain events or on changes in the sensor's environment and operating conditions.

What sensor calibration and settings changes can be done via commands sent from the cloud and confirmation feedback and measurements quantifying the efficacy of the changes are sent back to the remote operator.

### 1.3 Future Requirement Cases

1.3.1 Triggering controller functions or circuits from cloud based exception logic

1.3.2 Driver feedback and routing assistance

### 1.5 Acronyms

OTA - Over the air

TSP - Telematic service provider

ECU - Electronic control unit

ICE - Internal combustion engine

HD - Heavy duty

LEZ/ULEZ - Low and ultra low emission zone

EVs - Electric vehicles