

**Research & Vehicle Technology**

**“Infotainment Systems Product Development”**

**Feature – Cloud Enhanced DTE**

**APIM Infotainment Subsystem Part Specific Specification (SPSS)**

Version 1.1

**UNCONTROLLED COPY IF PRINTED**

**Version Date: October 9, 2019**

**FORD CONFIDENTIALF**

**Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Version** | **Notes** | |
| **September 30, 2019** | **1.0** | **Initial Release** |  |
|  |  |  |  |
| **October 9, 2019** | **1.1** |  | |
|  | STR-662008/B-Feature Assumptions | | ndecia: Updated feature assumptions to remove FordPass reference. |
|  | CDTE-IIR-REQ-354139/B-CloudEnhancedDTEInterfaceClient\_Tx | | ndecia: Updated structure to remove DistanceToStopover\_St as that interface is no longer utilized in CE DTE |
|  | CDTE-REQ-353233/D-Reporting Trip Status | | ndecia: Added comment that Trip Status must be updated for all trips of any type. |
|  | CDTE-REQ-353587/C-Distributing CE-DTE Payload | | ndecia: Added error handling for when any received payload value can't be translated to a valid CAN signal value within range |

**Table of Contents**

[Revision History 2](#_Toc21527247)

[1 Overview 5](#_Toc21527248)

[1.1 Feature Operation 5](#_Toc21527249)

[1.2 Feature Assumptions 5](#_Toc21527250)

[1.3 Logical Block Diagram 5](#_Toc21527251)

[1.4 Terminology and Abbreviations 5](#_Toc21527252)

[2 Architectural Design 6](#_Toc21527253)

[2.1 Physical Mapping of Classes 6](#_Toc21527254)

[2.2 CDTE-CLD-REQ-353223/A-Cloud Enhanced DTE Client 6](#_Toc21527255)

[2.3 CDTE-CLD-REQ-353783/B-Cloud Enhanced DTE Interface Client 6](#_Toc21527256)

[2.4 CDTE-CLD-REQ-353784/A-Cloud Enhanced DTE Status Client 6](#_Toc21527257)

[2.5 CDTE-CLD-REQ-353224/A-Cloud Enhanced DTE Off-Board Server1 6](#_Toc21527258)

[2.6 CDTE-CLD-REQ-353785/A-Cloud Enhanced DTE Off-Board Server2 6](#_Toc21527259)

[2.7 CDTE-CLD-REQ-357379/A-Cloud Enhanced DTE Off-Board Server3 6](#_Toc21527260)

[2.8 CDTE-CLD-REQ-353786/A-Cloud Enhanced DTE Vehicle Data Server 6](#_Toc21527261)

[2.9 CDTE-IIR-REQ-354139/B-CloudEnhancedDTEInterfaceClient\_Tx 7](#_Toc21527262)

[2.9.1 MCv3-MD-REQ-347049/A-MCPresentation\_St 7](#_Toc21527263)

[2.9.2 MCv3-MD-REQ-347050/A-MCConfirmationSelection\_Ind 7](#_Toc21527264)

[2.9.3 MD-REQ-354138/B-TripInfoStructure 8](#_Toc21527265)

[2.9.4 MD-REQ-364361/A-TripStatus 8](#_Toc21527266)

[2.9.5 MD-REQ-365949/A-ConnectorType 8](#_Toc21527267)

[2.9.6 MD-REQ-365950/A-BatteryPackType 9](#_Toc21527268)

[2.10 CDTE-IIR-REQ-354136/A-CloudEnhancedDTEInterfaceClient\_Rx 9](#_Toc21527269)

[2.10.1 MCv3-MD-REQ-347052/A-MCEventNotification\_Rq 9](#_Toc21527270)

[3 General Requirements 11](#_Toc21527271)

[3.1 REQ-333280/A-FTCP Specification References 11](#_Toc21527272)

[3.2 CDTE-REQ-353787/B-Utilization of Wireless Interface Router framework 11](#_Toc21527273)

[3.3 CDTE-REQ-353817/B-Utilization of IP Pass-Through Framework 11](#_Toc21527274)

[3.4 CDTE-REQ-353810/A-Utilizing Existing Location Services Functions 11](#_Toc21527275)

[3.5 CDTE-REQ-353788/B-Delete Token and CE DTE Data Upon Being Unsubscribed 11](#_Toc21527276)

[3.6 CDTE-REQ-353692/A-Cloud Enhanced DTE CCS Requirement 11](#_Toc21527277)

[3.7 CDTE-REQ-354175/A-Signal to Represent Ignition On and Ignition Off Events 11](#_Toc21527278)

[3.8 CDTE-REQ-354177/C-Lost Connectivity with Cloud Enhanced DTE Off-Board Server1 11](#_Toc21527279)

[3.9 CDTE-REQ-353598/A-Lost Connectivity with Cloud Enhanced DTE Off-Board Server2 11](#_Toc21527280)

[3.10 CDTE-REQ-353800/B-Checking CE-DTE Subscription Status 11](#_Toc21527281)

[3.11 CDTE-REQ-357726/A-Feature HMI Notifications 12](#_Toc21527282)

[3.12 CDTE-REQ-359198/B-Reporting Application Version 12](#_Toc21527283)

[4 Functional Definition 13](#_Toc21527284)

[4.1 CDTE-FUN-REQ-353231/A-Request CE DTE Calculation When No Route is Active 13](#_Toc21527285)

[4.1.1 Requirements 13](#_Toc21527286)

[4.1.2 Use Cases 13](#_Toc21527287)

[4.1.3 White Box View 14](#_Toc21527288)

[4.2 CDTE-FUN-REQ-357811/A-Request a Navigation Route CE-DTE Calculation 15](#_Toc21527289)

[4.2.1 Requirements 15](#_Toc21527290)

[4.2.2 Use Cases 16](#_Toc21527291)

[4.2.3 White Box View 17](#_Toc21527292)

[4.3 CDTE-FUN-REQ-353586/A-Update On-Board DTE 18](#_Toc21527293)

[4.3.1 Requirements 18](#_Toc21527294)

[4.3.2 Use Cases 19](#_Toc21527295)

[4.3.3 White Box View 20](#_Toc21527296)

[5 Appendix: Reference Documents 22](#_Toc21527297)

# Overview

Cloud-Enhanced Distance to Empty (CE-DTE) is a cloud microservice to help Electric Vehicles determine the most accurate range of their vehicles. The CE-DTE microservice can be called by the vehicle or a third party navigation provider. It incorporates driving history, weather, traffic, elevation and vehicle status (as available) to return an estimated energy use for other services to more accurately calculate the Distance to Empty value.

## Feature Operation

A driver of an Electric Vehicle is presented with an HMI that displays the currently calculated Distance to Empty. This calculation can be improved by leveraging other data sources in conjunction with the on-board vehicle data that is already used to make the calculation for a resultant DTE with improved accuracy. This is done in a manner that is mostly transparent to the driver as the data is sent automatically during each drive cycle and an enhanced DTE is returned as part of this process. This can occur when a user plans a trip to generate a new route, or even when no route is active.

## Feature Assumptions

This feature is currently intended to be only available on Electric Vehicles with embedded navigation, and can only be supported on FNV2 architectures. Future versions of the feature may cover non-electric vehicles but may also require changes to this or other specifications.

The feature also requires a backend enrollment process that does not impact the vehicle ECUs. The vehicle must be authorized by the user to send data off-board.

## Logical Block Diagram

## Terminology and Abbreviations

The following table lists terminologies that are used in this document along with a brief description.

| **Term** | **Description** |
| --- | --- |
| CE-DTE | Cloud Enhanced Distance to Empty |
| FTCP | Ford Telematics Communication Protocol |
| IPPT | Internet Protocol Pass-through |
| HMI | Human Machine Interface |
| VSDN | Vehicle Service Delivery Network |
| ECG | Enhanced Central Gateway |
| APIM | Accessory Protocol Interface Module |
| FCI | Ford Cloud Interface |
| EV | Electric Vehicle |
| TCU | Telematics Control Unit |
| HPCM | Hybrid Powertrain Control Module |

# Architectural Design

## Physical Mapping of Classes

The table below shows an example of how the logical classes that make up the Cloud Enhanced DTE feature may be mapped into physical modules. This mapping example is specific to the FNV2 architecture and does not necessarily carryover to other carlines or vehicle architectures.

|  |  |
| --- | --- |
| **Logical Class** | **Physical Module (ECU)** |
| Cloud Enhanced DTE Client | ECG |
| Cloud Enhanced DTE Interface Client | APIM |
| Cloud Enhanced DTE Status Client | IPC |
| Cloud Enhanced DTE Off-Board Server1 | VSDN/TMS/VPOI |
| Cloud Enhanced DTE Off-Board Server2 | CE-DTE Service |
| Cloud Enhanced DTE Off-Board Server3 | Nav Cloud |
| Cloud Enhanced DTE Vehicle Data Server | HPCM |

## CDTE-CLD-REQ-353223/A-Cloud Enhanced DTE Client

The Cloud Enhanced DTE Client is responsible for requesting tokens as an IPPT client, issuing CE DTE requests, unpacking and distributing off-board generated data payloads to the vehicle, packing and transmitting on-board generated data payloads to the Cloud Enhanced DTE Server, and initiating the process of updating the on-board DTE value accordingly.

## CDTE-CLD-REQ-353783/B-Cloud Enhanced DTE Interface Client

The Cloud Enhanced DTE Interface Client is responsible for providing route status to the Cloud Enhanced DTE Client.

## CDTE-CLD-REQ-353784/A-Cloud Enhanced DTE Status Client

The Cloud Enhanced DTE Status Client is responsible for displaying the DTE status to the user and sending requests to display additional information on the Cloud Enhanced DTE Interface Client.

## CDTE-CLD-REQ-353224/A-Cloud Enhanced DTE Off-Board Server1

The Cloud Enhanced DTE Server represents backend services which are responsible for providing Enrollment Status updates, generating IP Pass-through tokens, and receiving CE-DTE related vehicle data updates.

## CDTE-CLD-REQ-353785/A-Cloud Enhanced DTE Off-Board Server2

The Cloud Enhanced DTE Server represents CE-DTE cloud service which will generate CE-DTE powertrain update payloads.

## CDTE-CLD-REQ-357379/A-Cloud Enhanced DTE Off-Board Server3

The Cloud Enhanced DTE Off-Board Server3 represents the Nav cloud service which will respond to navigation route requests.

## CDTE-CLD-REQ-353786/A-Cloud Enhanced DTE Vehicle Data Server

The Cloud Enhanced DTE Vehicle Data Server is responsible for the on-board calculation and updating of DTE and providing this to the Cloud Enhanced DTE Status Client. This Cloud Enhanced DTE Vehicle Data Server is also the primary source of the DTE vehicle data that is uploaded to the Cloud Enhanced DTE Off-Board Server1.

## CDTE-IIR-REQ-354139/B-CloudEnhancedDTEInterfaceClient\_Tx

### MCv3-MD-REQ-347049/A-MCPresentation\_St

Message Type: Status

This method is used from MessageCenter Client to MessageCenter Server to indicate current display status for an active Message Center notification.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| MsgID | - | - |  |
|  | MsgID | 0x0 – 0x7FF | The "MsgID" parameter is used to indicate which Message Center notification status is updated. (see lookup table for more information) |
| MsgStatus | - | - |  |
|  | 0x0 | Invalid | Is used to state out that MsgID & PresentationStatus do not have valid information |
|  | 0x1 | Valid | Is used to state out that MsgID & PresentationStatus do have valid information |
| PresentationStatus | - | - | The "PresentationStatus" parameter is used to indicate the current status of a Message Center notification. It is also used to indicate if a chime shall be played or stopped. |
|  | Inactive | 0x0 | "Inactive" is used if the status is unknown (e.g. at startup while booting). |
|  | ActiveGranted | 0x1 | "ActiveGranted" (new warning) is used to indicate that an active Message Center notification is presented via car HMI. |
|  | UpdateGranted | 0x2 | "UpdateGranted" (old warning) is used to indicate that an updated Message Center notification is presented via car HMI. |
|  | Deactivated | 0x3 | "Deactivated" is used to indicate that a Message  Center notification is discarded from the car HMI. |
|  | NotUsed\_1 | 0x4 | Reserved for future extensions |
|  | NotUsed\_2 | 0x5 |
|  | NotUsed\_3 | 0x6 |
|  | NotUsed\_4 | 0x7 |

### MCv3-MD-REQ-347050/A-MCConfirmationSelection\_Ind

Message Type: Indication

This method is used from the MessageCenter Client to the MessageCenter Server to indicate which type of confirmation/selection the user made on the currently granted Message Center notification.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| MsgID | - | - |  |
|  | MsgID | 0x0 – 0x7FF | The "MsgID" parameter is used to indicate which Message Center notification was selected by the user (see lookup table for more information). |
| MsgStatus | - | - |  |
|  | Invalid | 0x0 | Is used to state out that MsgID & SelectionStatus do not have valid information |
|  | Valid | 0x1 | Is used to state out that MsgID & SelectionStatus do have valid information |
| SelectionStatus | - | - | The SelectionStatus is used to indicate if a warning is confirmed via OK input or if a selection has been choosen. |
|  | OK | 0x0 | “OK” is used to indicate that the user confirmed an OK input. |
|  | Choice1 | 0x1 | “Choice1-7” is used to indicate that the user made a selection on a choice element. |
|  | Choice2 | 0x2 |
|  | … | … |
|  | Choice7 | 0x7 |

### MD-REQ-354138/B-TripInfoStructure

This is a logical SOA interface containing the Trip Structure as described in the Trip Planner yaml file.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
| **Method Type** | | On-Change | | | | |
| **QoS Level** | | Default | | | | |
| **Retained** | | No | | | | |
|  | | | | | | |
| **R/O** | **Name** | | **Type** | **Literals** | **Value** | **Description** |
| **Response (\_Rsp)** | | | | | | |
| R | TripInfoStructure | | bytes | Refer to Trip Planner yaml file | - | This API contains the trip information of the active route |

### MD-REQ-364361/A-TripStatus

This is a logical SOA interface containing the Trip Status as described in the Trip Planner yaml file.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
| **Method Type** | | On-Change | | | | |
| **QoS Level** | | Default | | | | |
| **Retained** | | No | | | | |
|  | | | | | | |
| **R/O** | **Name** | | **Type** | **Literals** | **Value** | **Description** |
| **Response (\_Rsp)** | | | | | | |
| R | TripStatus | | bytes | Refer to Trip Planner yaml file | - | This API contains the status of any active or inactive trips |

### MD-REQ-365949/A-ConnectorType

This is a logical SOA interface containing the Connector Type

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
| **Method Type** | | On-Change | | | | |
| **QoS Level** | | Default | | | | |
| **Retained** | | No | | | | |
|  | | | | | | |
| **R/O** | **Name** | | **Type** | **Literals** | **Value** | **Description** |
| **Response (\_Rsp)** | | | | | | |
| R | ConnectorType | | bytes | Refer to Trip Planner yaml file | - | This API contains the type of charging connector |

### MD-REQ-365950/A-BatteryPackType

This is a logical SOA interface containing the Battery Pack Type

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
| **Method Type** | | On-Change | | | | |
| **QoS Level** | | Default | | | | |
| **Retained** | | No | | | | |
|  | | | | | | |
| **R/O** | **Name** | | **Type** | **Literals** | **Value** | **Description** |
| **Response (\_Rsp)** | | | | | | |
| R | BatteryPackType | | bytes | Refer to Trip Planner yaml file | - | This API contains the type of battery pack |

## CDTE-IIR-REQ-354136/A-CloudEnhancedDTEInterfaceClient\_Rx

### MCv3-MD-REQ-347052/A-MCEventNotification\_Rq

Message Type: Status

This method is used from MessageCenter Server to inform MessageCenter Client that a Message Center notification update occurred.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Literals** | **Value** | **Description** |
| MsgID | - | - |  |
|  | ID | 0x00 – 0x7FF | The "Message ID" parameter is used to indicate which MessageCenter notification is updated (see lookup table for more information) |
| MsgStatus | - | - | "MsgStatus" is used to indicate actual status of MessageCenter events. |
|  | Invalid | 0x0 | “Invalid” is used if data of this message is invalid e.g. if no data is available e.g. at startup or if no MessageCenter notification is active.  As well as MsgID, HighlightedChoice and DynamicData1 to 3 do not have valid information. |
| Activate | 0x1 | "Activate" (new warning) is used if a MessageCenter notification is set to active (-> allocated). |
| Update | 0x2 | “Update” (old warning) is used if a MessageCenter notification, which was “Active” before, shall be shown again. Including data update. |
| Deactivate | 0x3 | "Deactivate" is used if an active MessageCenter notification is set to inactive (->deallocated). |
| HighlightedChoice | - | - | “Highlighted Choice” is used to indicate the highlighted choice |
|  | NoChoice | 0x0 | “NoChoice” is used if no choice element is highlighted |
| Choice1 | 0x1 | “Choice 1-7” is used if one of choice 1 to 7 is highlighted. |
| Choice2 | 0x2 |
| … | … |
| Choice7 | 0x7 |
| DynamicData1 | - | - | Dynamic Data 1 with up to 2 Bytes |
|  | RAW | 2 Byte |  |
| DynamicData2 | - | - | Dynamic Data 2 with up to 2 Bytes |
|  | RAW | 2 Byte |  |
| DynamicData3 | - | - | Dynamic Data 3 with up to 2 Bytes |
|  | RAW | 2 Byte |  |

# General Requirements

## REQ-333280/A-FTCP Specification References

The following FTCP specifications define the FTCP alerts/commands mentioned in this SPSS, as well as the protocol used to transmit them via the OffBoardGateway (for FNV2):

* Ford Telematics Communication Protocol Specification
* FNV2-FCI Protocol SPSS

## CDTE-REQ-353787/B-Utilization of Wireless Interface Router framework

The Cloud Enhanced DTE Client shall utilize the Wireless Interface Router framework to facilitate the establishment of connectivity with any off-board services. Please see the Wireless Interface Router SPSS for further details on this framework.

## CDTE-REQ-353817/B-Utilization of IP Pass-Through Framework

The Cloud Enhanced DTE Client shall leverage the IP Pass-Through framework to issue a token request and facilitate communication with the Cloud Enhanced DTE Off-Board Servers. Refer to the latest IP Pass-Through SPSS for further details on this framework.

## CDTE-REQ-353810/A-Utilizing Existing Location Services Functions

For the purposes of this feature, the Cloud Enhanced DTE Client is utilizing existing functions from the Location Service SPSS to collect data on the vehicle’s location and current time. Refer to the Location Service SPSS for further details on how this data is can be collected.

## CDTE-REQ-353788/B-Delete Token and CE DTE Data Upon Being Unsubscribed

Upon being unsubscribed via CCS, the Cloud Enhanced DTE Client shall delete any stored IPPT tokens and Cloud Enhanced DTE related data.

## CDTE-REQ-353692/A-Cloud Enhanced DTE CCS Requirement

The Cloud Enhanced DTE feature is impacted by Customer Connectivity Settings. For details on how this is impacted, please refer to the Customer Connectivity Settings Manager SPSS for further detail.

## CDTE-REQ-354175/A-Signal to Represent Ignition On and Ignition Off Events

For the purposes of this document, the Powerpack\_St signal shall be used to represent Ignition Events. The Powerpack\_St signal being set to 0x0 (PwPckOff\_TqNotAvailable) shall be treated as an Ignition Off event and the Powerpack\_St signal being set to 0x1(PwPckOn\_TqNotAvailable), 0x2(StartInPrgrss\_TqNotAvail), or 0x3(PwPckOn\_TqAvailable) shall be treated as an Ignition On event.

## CDTE-REQ-354177/C-Lost Connectivity with Cloud Enhanced DTE Off-Board Server1

If vehicle connectivity is lost or if there is a malfunction with the Cloud Enhanced DTE Off-Board Server1, the Cloud Enhanced DTE Client shall utilize any existing FTCP retry strategies when attempting to re-establish a connection.

## CDTE-REQ-353598/A-Lost Connectivity with Cloud Enhanced DTE Off-Board Server2

If vehicle connectivity is lost or if there is a malfunction with the Cloud Enhanced DTE Off-Board Server1, the Cloud Enhanced DTE Client shall try to reestablish a connection every 5 minutes for data sent via IPPT protocols until a connection is reestablished or the vehicle is turned off.

## CDTE-REQ-353800/B-Checking CE-DTE Subscription Status

The Cloud Enhanced DTE Client shall always verify the feature enrollment/subscription status via CCS prior to executing any other CE-DTE related functions.

## CDTE-REQ-357726/A-Feature HMI Notifications

The Cloud Enhanced DTE HMI has message notifications/pop-ups which require the use of the functions and interfaces defined in the Message Center Client v3 SPSS. These notifications/pop-ups can occur when the HMI has to indicate additional information to the user such as a reason for why the DTE value has been updated. For additional detail, please refer to the Cloud Enhanced DTE HMI specs and the Message Center Client v3 SPSS.

## CDTE-REQ-359198/B-Reporting Application Version

The Cloud Enhanced DTE Client shall report its Cloud Enhanced DTE Application version when sending either of the CEDTENoRouteAPI\_Rq or CEDTENewRouteAPI\_Rq requests.

# Functional Definition

## CDTE-FUN-REQ-353231/A-Request CE DTE Calculation When No Route is Active

### Requirements

#### CDTE-REQ-353232/B-IPPT Token Requests

The Cloud Enhanced DTE Client shall request for any IPPT tokens, if no valid tokens exist already, to initiate communication with the Cloud Enhanced DTE Off-Board Server2.

#### CDTE-REQ-353233/D-Reporting Trip Status

The Cloud Enhanced DTE Interface Client shall report the status of an active route via the TripStatus interface. This interface shall be timestamped by the Cloud Enhanced DTE Interface Client and sent for all trips of any type.

#### CDTE-REQ-353234/B-Determining Active Route from Trip Status

The Cloud Enhanced DTE Client shall read the value of TripStatus and assume a value of “New”, “Planned”, “Completed”, or an empty field, indicates that no route is currently active.

#### CDTE-REQ-353235/B-Generating and Transmitting CE-DTE No Route Request

Upon receiving an initial update after a transition to Ignition On with TripStatus set to a value of “New”, “Planned”, “Completed”, or an empty field, the Cloud Enhanced DTE Client shall generate and transmit a CE-DTE request (CEDTENoRouteAPIRq) to the Cloud Enhanced DTE Off-Board Server2 which contains the data elements CabinAirTemp\_St, TracBatteryAvailable\_St, and Location1.

Note: If TripStatus is reported as one of the above values later in the drive cycle, the Cloud Enhanced DTE Client shall not transmit a CE-DTE request (CEDTENoRouteAPIRq) to the Cloud Enhanced DTE Off-Board Server2.

#### CDTE-REQ-353693/A-Distributing CE-DTE Data Payload

Upon receiving a response payload (CEDTENoRouteAPI\_Rsp) which contains the Cloud Enhanced DTE Powertrain Update data payload, the Cloud Enhanced DTE Client shall unpack and parse this payload to be sent to the Cloud Enhanced DTE Vehicle Data Server.

### Use Cases

#### CDTE-UC-REQ-353236/A-Request CE DTE Calculation When No Route is Active

|  |  |
| --- | --- |
| **Actors** | Cloud Enhanced DTE Interface Client, Cloud Enhanced DTE Client, Cloud Enhanced Off-Board Server2 |
| **Pre-conditions** | No navigation route is planned or active |
| **Scenario Description** | The Cloud Enhanced DTE Client requests a CE DTE update from Cloud Enhanced DTE Off-Board Server2. |
| **Post-conditions** | The on-board DTE value is updated. |
| **List of Exception Use Cases** | Lost Connectivity with Cloud Enhanced DTE Off-Board Server |
| **Interfaces** |  |

#### CDTE-UC-REQ-354180/B-Lost Connectivity with Cloud Enhanced DTE Off-Board Server

|  |  |
| --- | --- |
| **Actors** | Cloud Enhanced DTE Client, Cloud Enhanced Off-Board Server1/2 |
| **Pre-conditions** | A connection is attempting to be established with the Cloud Enhanced DTE Off-Board Server1/2 |
| **Scenario Description** | The Cloud Enhanced DTE Client determines that connectivity has been lost with the Cloud Enhanced DTE Off-Board Server1/2 |
| **Post-conditions** | The Cloud Enhanced DTE Client attempts to reestablish the connection per the defined retry strategies. The Cloud Enhanced DTE Vehicle Data Server filters back to using the on-board DTE value until a connection is reestablished. |
| **List of Exception Use Cases** |  |
| **Interfaces** |  |

### White Box View

#### CDTE-ACT-REQ-353237/A-Request CE-DTE Calculation When No Route is Active

Activity Diagram



#### CDTE-SD-REQ-353238/A-Request CE DTE Calculation When No Route is Active

Scenarios

Normal Usage

The Cloud Enhanced DTE Client requests a CE DTE update from Cloud Enhanced DTE Off-Board Server2

Constraints

Pre-condition

No navigation route is planned or active

Post-condition

The on-board DTE value is updated

Sequence Diagram



## CDTE-FUN-REQ-357811/A-Request a Navigation Route CE-DTE Calculation

### Requirements

#### CDTE-REQ-357812/A-IPPT Token Requests

The Cloud Enhanced DTE Client shall request for any IPPT tokens to initiate communication with the Cloud Enhanced DTE Off-Board Server2.

#### CDTE-REQ-353233/D-Reporting Trip Status

The Cloud Enhanced DTE Interface Client shall report the status of an active route via the TripStatus interface. This interface shall be timestamped by the Cloud Enhanced DTE Interface Client and sent for all trips of any type.

#### CDTE-REQ-366609/A-Generating and Reporting the TripInfoStructure Payload

The Cloud Enhanced DTE Interface Client shall generate and send the TripInfoStructure payload to the Cloud Enhanced DTE Client via the TripInfoStructure interface. This TripInfoStructure payload shall be generated and sent to the Cloud Enhanced DTE Client for all trips of any type. This interface shall be timestamped by the Cloud Enhanced DTE Interface Client.

#### CDTE-REQ-353811/B-Passing-through the Trip Info to the CE-DTE Off-Board Server2

Upon receiving the TripInfoStructure payload from the Cloud Enhanced DTE Interface Client, the Cloud Enhanced DTE Client shall pass through the TripInfoStructure payload as part of CEDTENewRouteAPI\_Rq to the Cloud Enhanced DTE Off-Board Server2.

#### CDTE-REQ-366608/A-Reporting Battery Pack and Connector Type

The Cloud Enhanced DTE Interface Client shall report the status the Battery Pack and Connector Type via the BatteryPack and ConnectorType logical SOA interfaces. These interfaces shall be timestamped by the Cloud Enhanced DTE Interface Client.

#### CDTE-REQ-357813/B-Generating and Transmitting a New Route API Request

Upon receiving an update with TripStatus set to “Ongoing” anytime during the drive cycle, the Cloud Enhanced DTE Client shall generate and transmit a CE-DTE request via CEDTENewRouteAPI\_Rq to the Cloud Enhanced DTE Off-Board Server2 which contains the data elements TripInfoStructure payload, TripStatus, CabinAirTemp\_St, TracBatteryAvailable\_St, TracBatteryMaximum\_St, DistanceToEmpty\_St, AverageRangePerCharge\_St, ConnectorType, BatteryPackType, and Location1.

#### CDTE-REQ-357815/A-Distributing New Route CE-DTE Data Payload

Upon receiving a response payload (CEDTENewRouteAPI \_Rsp) which contains the Cloud Enhanced DTE Powertrain Update data payload, the Cloud Enhanced DTE Client shall unpack and parse this payload to be sent to the Cloud Enhanced DTE Vehicle Data Server.

### Use Cases

#### CDTE-UC-REQ-357816/A-Request a Nav Route CE-DTE Calculation

|  |  |
| --- | --- |
| **Actors** | Cloud Enhanced DTE Interface Client, Cloud Enhanced DTE Client, Cloud Enhanced Off-Board Server2 |
| **Pre-conditions** | A navigation route is planned but not active |
| **Scenario Description** | User starts the active route. The Cloud Enhanced DTE Interface Client indicates that a route is currently active. The Cloud Enhanced DTE Client transmits the CEDTENewRouteAPI\_Rq to the Enhanced Off-Board Server2. |
| **Post-conditions** | The result is returned to the Cloud Enhanced Client which extracts the CE-DTE Payload and parses it. |
| **List of Exception Use Cases** |  |
| **Interfaces** |  |

### White Box View

#### CDTE-ACT-REQ-357817/A-Request a Nav Route CE-DTE Calculation

Activity Diagram



#### CDTE-SD-REQ-357818/A-Request a Nav Route CE-DTE Calculation

Scenarios

Normal Usage

User starts the active route. The Cloud Enhanced DTE Interface Client indicates that a route is currently active. The Cloud Enhanced DTE Client transmits the CEDTENewRouteAPI\_Rq to the Enhanced Off-Board Server2.

Constraints

Pre-condition

A navigation route is planned but not active

Post-condition

The on-board DTE value is updated

Sequence Diagram



## CDTE-FUN-REQ-353586/A-Update On-Board DTE

### Requirements

#### CDTE-REQ-353587/C-Distributing CE-DTE Payload

The Cloud Enhanced DTE Client shall distribute the CE-DTE Powertrain Update data payload elements via the PowertrainUpdate\_St method to the Cloud Enhanced DTE Vehicle Data Server for the purposes of updating the on-board DTE value. This requires translating the numerical values from the data payload to the corresponding signal values for each PowertrainUpdate\_St signal.

This process requires reporting all sets of the data values in a cyclical fashion. To this, the Cloud Enhanced DTE Client shall set the DTECloudAcceptData\_Rq signal to Yes and begin to report each Powertrain Update data value in the array with the initial segment ID for all values. It shall then increment the segment ID value while reporting the next set of Powertrain Update data values. This process continues until all 32 segment arrays have been reported. Once all 32 sets of values have been reported the Cloud Enhanced DTE Client shall set the DTECloudAcceptData\_Rq signal to No.

Note: If not all 32 segment arrays have been received from the Cloud Enhanced DTE Off-Board Server2, then PowertrainUpdate\_St shall not be sent to the Vehicle Data Server. Likewise, if any of the values received as part of the payload cannot be translated to a valid value within the defined range of any of the PowertainUpdate\_St signals, then PowertrainUpdate\_St shall not be sent to the Vehicle Data Server.

#### CDTE-REQ-353588/B-Displaying Additional Information Related to the Updated DTE Value

As requested from the Cloud Enhanced DTE Status Client via the MCEventNotificaiton\_Rq signal, the Cloud Enhanced DTE Interface Client shall indicate to the user via the HMI any additional information related to the updated DTE value which may include its offset and reason for the change.

Upon receiving this request, the Cloud Enhanced DTE Interface Client shall also provide back a status of the HMI via MCPresentation\_St signal. For more details on this interface please refer to the Message Center Client v3 SPSS.

#### CDTE-REQ-359196/A-Feature Operating Modes

The Cloud Enhanced DTE Client shall be able to support two operating modes, Mode 1 and Mode 2. The Cloud Enhanced DTE Client shall switch between operating modes as instructed by the Cloud Enhanced Off-Board Server 2, via a parameter embedded within the CE-DTE Data Payload (as part of the CEDTENoRouteAPI\_Rsp & CEDTENewRouteAPI\_Rsp interfaces.).

In Mode 1, the Cloud Enhanced DTE Client shall execute all Cloud Enhanced DTE functions except for this function to distribute the CE-DTE Data Payload. This means that the on-board DTE value will not be updated when operating in Mode 1.

In Mode 2, the Cloud Enhanced DTE Client shall execute all Cloud Enhanced DTE functions including this function to distribute the CE-DTE Data Payload. This means that the on-board DTE value will be updated when operating in Mode 2. Thus the Cloud Enhanced DTE Client shall validate the operating mode is set to Mode 2 prior to executing the Update On-Board DTE function.

### Use Cases

#### CDTE-UC-REQ-353591/B-Update On-Board DTE

|  |  |
| --- | --- |
| **Actors** | Cloud Enhanced DTE Interface Client, Cloud Enhanced DTE Client, Cloud Enhanced DTE Status Client, Cloud Enhanced Vehicle Data Server |
| **Pre-conditions** | An updated CE-DTE Data Payload has been received  Cloud Enhanced DTE Client is in operating Mode 2 |
| **Scenario Description** | The Cloud Enhanced DTE Client distributes the CE-DTE Data Payload to the Cloud Enhanced DTE Vehicle Data Server |
| **Post-conditions** | The user is informed of the update to DTE value by the Cloud Enhanced DTE Interface Client. |
| **List of Exception Use Cases** |  |
| **Interfaces** |  |

### White Box View

#### CDTE-ACT-REQ-353592/A-Update On-Board DTE

Activity Diagram



#### CDTE-SD-REQ-353593/A-Update On-Board DTE

Scenarios

Normal Usage

The Cloud Enhanced DTE Client distributes the updated DTE value to the Cloud Enhanced DTE Vehicle Data Server, Cloud Enhanced DTE Status Client, and Cloud Enhanced DTE Interface Client

Constraints

Pre-condition

An update DTE value has been calculated

Post-condition

The user is informed of the update to DTE by the Cloud Enhanced DTE Interface Client.

Sequence Diagram



# Appendix: Reference Documents

|  |  |
| --- | --- |
| Reference # | Document Title |
| 1 | IP Passthrough Client SPSS |
| 2 | EV Trip Planner SPSS |
| 3 | Customer Connectivity Settings SPSS |
| 4 | Ford Telematics Communications Protocol Specification |
| 5 | Message Center Client v3 SPSS |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |