Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Plug and Charge

Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.7

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Version Date: June 28, 2021

FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
August 31, 2018	**0.1**	**Draft**	
October 5, 2018	**1.0**	**Initial Release**	
February 12, 2019	**1.1**		
	PNC-STR-575726/B-Overview		rpaquet2 - Updated diagram
	PNC-STR-575727/B-Logical Signal Mapping		rpaquet2 - Update CAN Signal names ChrgrPncEnble_D_Rq and _st
	PNC-IIR-REQ-324736/B-PNC Onboard Server_Tx		rpaquet2 - Added 337333, 343026, 343489 removed 326483
	MD-REQ-326487/B-setPlugAndChargeStatus		rpaquet2 - Update PnCStatus and EVSE Fault to state is uses the VIM process removed IndicatePNCInfo and put it in setStationInfo API
	MD-REQ-326578/B-setVehicleChargeInfo		rpaquet2 - Updated to Total Time Plugged In
	MD-REQ-326685/B-setStationInfo		rpaquet2 - Updated encoding added IndicateONCInfo to this API
	MD-REQ-337333/A-ChargerPnCSustain_Rq		rpaquet2 - new
	MD-REQ-343026/A-ChargeStationID_Rq		rpaquet2 - new
	PNC-IIR-REQ-324737/B-PNC Onboard Server_Rx		rpaquet2 - Added 343488, 337016
	MD-REQ-326486/B-PnCStat_St		rpaquet2 - Update the encodings
	MD-REQ-326502/B-ChargeStationID_St		rpaquet2 - added new paramete TLS status
	MD-REQ-326689/B-DigitalCommFault_St		rpaquet2 - Updated the encoding table
	MD-REQ-337016/B-ChargeStationSchedule_St		rpaquet2 - Update the Time interval size and restructured the vector
	PNC-IIR-REQ-326492/B-PNC Onboard HMI Client_Tx		rpaquet2 - Added Reset_Rq, 343488
	PNC-IIR-REQ-326494/B-PNC Onboard Client 2_Tx		rpaquet2 - 337016
	PNC-IIR-REQ-326495/B-PNC Onboard Client 2_Rx		rpaquet2 - Added 343489
	PNC-STR-575730/B-Functional Definition		rpaquet2 - Added 334896
	PNC-REQ-326839/B-Customer Connectivity Settings Impact		rpaquet2 - Updated table
	PNC-REQ-330363/B-Installing Certificate Payload in Vehicle		rpaquet2 - Updated requirement text per feature owner
	PNC-REQ-326844/B-Plug And Charge On Confirmation		rpaquet2 - Updated requirement content per feature owner
	PNCv1-UC-REQ-320370/B-Onboarding Success - Contract Certificate Installation is Completed and PnC is Enabled		rpaquet2 - removed signal names
	PNCv1-UC-REQ-320371/B-Onboarding Success – Vehicle HMI not Active		rpaquet2 - removed signal names
	PNCv1-UC-REQ-320375/B-Onboarding failure, No Cloud to Vehicle Connectivity		rpaquet2 - Chagned TMC to VSDN
	PNCv1-UC-REQ-324759/B-Onboarding failure, Downstream Module Error		rpaquet2 - updated text and removed signal name references
	PNC-ACT-REQ-326382/B-Enabling PnC		rpaquet2 - Updated command /alert names
	PNC-ACT-REQ-326383/B-Enabling Disabling Or Certification In Vehicle failure		rpaquet2 - Updated diagram
	PNC-SD-REQ-326490/B-Onboarding and Enabling Plug and Charge		rpaquet2 - Updating command/alert names
	PNC-SD-REQ-326533/B-Onboarding or Enabling-Disabling Failures		rpaquet2 - Updated the alert/command names
	PNC-STR-575738/B-Requirements		rpaquet2 - Added 337332
	PNC-REQ-331117/B-Plug and Charge Authorization In Progress		rpaquet2 - Updated requirement content per feature owner
	PNC-REQ-326845/B-Charge Begin Unsuccessful		rpaquet2 - Added note to Reason for Error
	PNC-REQ-330368/B-Disabling or Re-Enabling PnC due to failure		rpaquet2 - Updated requirement content per feature owner
	PNC-REQ-330365/B-Notifications at Public Stations		rpaquet2 - Updated text per feature owner

PNC-REQ-330366/B-PnC Off	rpaquet2 - Updated requirement content per feature owner
PNC-REQ-330367/B-EVSE ID and Station Charge Schedule Information	rpaquet2 - Updated alert name and added note.
PNC-REQ-337332/A-Sending whether Vehicle is Charging using TLS or No TLS	rpaquet 2- New
PNC-REQ-330369/B-ISO/In network HMI error	rpaquet2 - Updated alert names and text
PNC-REQ-330370/B-PnC or non PnC Charging	rpaquet2 - Updated alert names and text per feature owner
PNC-REQ-330371/B-Payment or Backend issues	rpaquet2 - Updated the command name per feature owner
PNC-REQ-330373/B-EVSE or vehicle failure in charging setup process (e.g. certificate rejected by EVSE)	rpaquet2 - Updated alert names and text per feature owner
PNC-REQ-330374/B-Clearing charging related errors	rpaquet2 - Updated text per feature owner
PNC-STR-575739/B-Use Cases	rpaquet2 - Added 335765, 335766, 335767, 335768 removed 324844, 325361, 325366, 325365, 324846, 325362
PNCv1-UC-REQ-324838/B-User is Authorized to Charge - Charge Begin is Successful	rpaquet2 - Stated Vehcile configured for NA or EU region
PNCv1-UC-REQ-324839/B-User Plugs into Network ISO station and Plug and Charge is Disabled (EU)	rpaquet2 - added Vehicle Configured for EU region
PNCv1-UC-REQ-325319/B-User Plugs into Network ISO station and Plug and Charge is Disabled (NA)	rpaquet2 - added vehicle configured for NA region
PNCv1-UC-REQ-324843/B-User Plugs into Network ISO station and EVSE Failure in Charging Authentication and Authorization Process (EU)	rpaquet2 - added vehicle configured for EU region and changed requirement name
PNCv1-UC-REQ-325360/B-User Plugs into Network ISO station and EVSE Failure in Charging Authentication and Authorization Process (NA)	rpaquet2 - added vehicle configured for NA region and changed requirement name
PNCv1-UC-REQ-324847/B-User Plugs into ISO, Out of Network Station	rpaquet2 - Added not about No display at known Charge location
PNCv1-UC-REQ-325364/B-User Plugs into Non ISO, Out-of-Network Station	rpaquet2 - Added note about no dispaly at known charge location
PNCv1-UC-REQ-324848/B-User Plugs into an In-Network, Non ISO Station (EU)	rpaquet2 - added vehicle configured for EU region
PNCv1-UC-REQ-325363/B-User Plugs into an In-Network, Non ISO Station (NA)	rpaquet2 - added vehicle configured for NA region
PNCv1-UC-REQ-335765/A-User Plugs into an Out of Network, ISO Station when PnC is disabled	rpaquet2 - new
PNCv1-UC-REQ-335766/A-User Plugs into an Non-ISO, Out of network when PnC is disabled	rpaquet2 - new
PNCv1-UC-REQ-335767/A-User Plugs into an Non-ISO, In Network (NA) when PnC is disabled	rpaquet2 - new
PNCv1-UC-REQ-335768/A-User Plugs into an Non-ISO, In Network (EU) when PnC is disabled	rpaquet2 - new
PNCv1-UC-REQ-320378/B-Failure Corrected, Then Charging Begins Successfully While Centerstack is off	rpaquet2 - Updated post condition
PNC-ACT-REQ-326583/B-Plug In and Plug and Charge is Disabled	rpaquet2 - Updated diagram
PNC-ACT-REQ-330591/B-Charge Station Network and ISO Errors	rpaquet2 - Updated diagram
PNC-ACT-REQ-330592/B-Enable PnC Once Vehicle is Shifted Out of Park	rpaquet2 - Updated diagram
PNC-ACT-REQ-330593/B-Plug In and EVSE Failure	rpaquet2 - Updated diagram
PNC-ACT-REQ-330594/B-Plugged In and Charging Has Not Begun Transmit EVSEid	rpaquet2 - Updated diagram
PNC-SD-REQ-330599/B-Plugged In and Charging Has Not Started Transmit EVSEid	rpaquet2 - Updated Alert name
PNC-SD-REQ-326579/B-Plugged in and Charging	rpaquet2 - Updated alert name
PNC-SD-REQ-326580/B-Plug in and Charge Failed to Begin	rpaquet2 - Updated alert name
PNC-SD-REQ-326584/B-Plug In and Plug and Charge is Disabled	rpaquet2 - Updated Alert name
PNC-SD-REQ-329239/B-Plug In and Plug Authorization Failures	rpaquet2 - Update command/alert name
PNC-SD-REQ-330597/B-Charge Station ISO and Network Errors	rpaquet2 - Update Command/alert name
PNC-SD-REQ-330598/B-Enable PnC Once Vehicle is Shifted Out of Park	rpaquet2 - Updated diagram new logic

PNC-REQ-326850/B-Charge Complete - In Vehicle	rpaquet2 - Update the command or alert name per feature owner
PNC-REQ-326852/B-Trip and Charge Log Updated	rpaquet2 - Updated To Total time PLugged In
PNCv1-UC-REQ-324852/B-Charging Completed Successfully	rpaquet2 - Updated Post condition
PNCv1-UC-REQ-324853/B-Cloud Fails to Send Cost Information Once Charging is Complete	rpaquet2 - Added Total time plugged in
PNCv1-UC-REQ-330860/B-PnC Charge Summary Delay	rpaquet2 - Updated Total ime Plugged In
PNC-ACT-REQ-326582/B-Charging Complete	rpaquet2 - Updated diagram
PNC-SD-REQ-326575/B-Charge Complete	rpaquet2 - Updated alert name Payment logic
PNC-REQ-330377/B-Disabling PnC	rpaquet2 - Update command/alert name and updated signal name
PNC-REQ-330378/B-Re-Enabling PnC	rpaquet2 - Update command/alert name and updated signal nam
PNCv1-UC-REQ-324854/B-Plug and Charge Re-Enabling	rpaquet2 - update command /alert names
PNCv1-UC-REQ-324857/B-Plug and Charge Re-Enabled - Downstream Module Error	rpaquet2 - Updated post condition
PNCv1-UC-REQ-325313/B-Plug and Charge is Disable (EU)	rpaquet2 - update command name
PNCv1-UC-REQ-325314/B-Plug and Charge is Disable (NA)	rpaquet2 - updated command name
PNCv1-UC-REQ-325318/B-Plug and Charge is Disable - Downstream Module Error	rpaquet2 - Updated post condition
PNC-ACT-REQ-326554/B-Disabling Plug and Charge	rpaquet2 - Updated diagram
PNC-ACT-REQ-326555/B-Re-Enabling Plug and Charge	rpaquet2 - Updated diagram
PNC-SD-REQ-326553/B-Disabling Plug and Charge	rpaquet2 - Updated comamnd/alert name
PNC-SD-REQ-326556/B-Re-Enabling Plug and Charge	rpaquet2 - Updated diagram logic
PNC-REQ-330379/B-Managing Expired Contract Certificates	rpaquet2 - Updated text and command/alert name per feature owner
PNCv1-UC-REQ-320374/B-Deletion of Expired Contract Cert's and Install New Contract Cert's	rpaquet2 - updated command/alert names
PNC-ACT-REQ-326781/B-Delete Expiring Contract Certifications And Reinstall	rpaquet2 - Updated diagram
PNC-SD-REQ-326782/B-Delete Expiring Certs and Installing New Cert	rpaquet2 - Updated logic and alert name
PNC-REQ-330380/B-Master Reset	rpaquet2 - updated command/alert name and text per feature owner
PNCv1-UC-REQ-325271/B-Master Reset Initiated from APIM	rpaquet2 - updated command names and removed signal reference
PNCv1-UC-REQ-325272/B-Last User Removes Vehicle from Mobile App	rpaquet2 - removed signal reference and updated command name
PNC-ACT-REQ-326783/B-Master Reset from PnC Onboard HMI Client	rpaquet2 - Update diagram
PNC-ACT-REQ-330600/B-Last User has Removed Vehicle from App	rpaquet2 - Updated Diagram
PNC-SD-REQ-326837/B-Master Reset	rpaquet2 - Update logic in diagram
PNC-SD-REQ-330601/B-Last User has Removed Vehicle from App	rpaquet2 - Update logic in diagram
PNC-STR-582143/B-Requirements	rpaquet2 - New
PNC-REQ-335761/A-OBCC Swap Detection	rpaquet2 - new
PNC-REQ-335762/A-Deleting Certificates in New OBCC Module	rpaquet2 - new
PNC-REQ-335763/A-Installing New Certificates in New OBCC Module	rpaquet2 - new
PNCv1-UC-REQ-326621/B-Installing New Certification after OBCC Swap	rpaquet2 - updated command name and removed signal reference
PNC-ACT-REQ-326765/B-Install New Certification After Module Swap	rpaquet2 - Updated diagram
PNC-SD-REQ-326779/B-Installing New Cert After Module Swap	rpaquet2 - Update logic
PNC-FUN-REQ-334896/A-Wake Up Strategy	new
PNC-STR-602039/A-Requirements	rpaquet2 - New
PNC-REQ-334897/A-OBCC-BCCM Wakeup Strategy	rpaquet2 - New
SCG-REQ-343878/A-Static List Locations	rpaquet2 - New

	PNC-REQ-334898/A-Time Limit for Wakeup Strategy		rpaquet2 - New
	PNC-STR-602040/A-Use Cases		rpaquet2 - New
	PNCv1-UC-REQ-334895/A-Wake Up for PnC Enable-Disable and Cert installs		rpaquet2 - New
June 14, 2019	**1.2**		
	PNC-STR-575727/C-Logical Signal Mapping		rpaquet2 - Updated two signal names to match database
	PNC-IIR-REQ-324736/C-PNC Onboard Server_Tx		rpaquet2 - removed 326578 and 326685 as the content was moved to 326684
	MD-REQ-326487/C-setPlugAndChargeStatus		rpaquet2 - no change
	MD-REQ-326684/B-SoaHmiPncMessage		rpaquet2 - Changed name of MD and combined setPaymentInfo, setStationInfo and setVehiclechargeInfo into this SOA API deleted the display disable at plugin
	MD-REQ-343489/B-DgtlCommPnc_Rq		rpaquet2 - Updated md name and the encodings
	MD-REQ-326486/C-PnCStat_St		rpaquet2 - Updated the last encoding
	PNC-IIR-REQ-326493/B-PNC Onboard HMI Client_Rx		rpaquet2 - removed 326578 and 326685 as the content was moved to 326684
	MD-REQ-326487/C-setPlugAndChargeStatus		rpaquet2 - no change
	MD-REQ-326684/B-SoaHmiPncMessage		rpaquet2 - Changed name of MD and combined setPaymentInfo, setStationInfo and setVehiclechargeInfo into this SOA API deleted the display disable at plugin
	MD-REQ-343489/B-DgtlCommPnc_Rq		rpaquet2 - Updated md name and the encodings
	PNC-REQ-326839/C-Customer Connectivity Settings Impact		Rpaquet2 - Added content for Disabling
	PNC-REQ-326844/C-Plug And Charge On Confirmation		rpaquet2 - Updated In Vehicle Notification part
	PNCv1-UC-REQ-320370/C-Onboarding Success - Contract Certificate Installation is Completed and PnC is Enabled		rpaquet2 - Updated to add PAAK FI
	PNC-STR-575738/C-Requirements		rpaquet2 - removed 331117, 330366 per feature owner
	PNC-REQ-326845/C-Charge Begin Unsuccessful		Rpaquet2 - Updated table
	PNC-REQ-330369/C-ISO/In network HMI error		rpaquet2- Updated per feature owner
	PNC-REQ-330373/C-EVSE or vehicle failure in charging setup process (e.g. certificate rejected by EVSE)		rpauet2 - Updated APIM part
	PNC-STR-575739/C-Use Cases		rpaquet2- removed 324839, 325319, 326620 per feature owner
	PNCv1-UC-REQ-325364/C-User Plugs into Non ISO, Out-of-Network Station		rpaquet2 - Updated per feature owner
	PNCv1-UC-REQ-324848/C-User Plugs into an In-Network, Non ISO Station (EU)		rpaquet2 - Update per feature owner
	PNCv1-UC-REQ-325363/C-User Plugs into an In-Network, Non ISO Station (NA)		rpaquet2 - Updated per feature owner
	PNCv1-UC-REQ-335765/B-User Plugs into an Out of Network, ISO Station when PnC is disabled		rpaquet2- Updated per feature owner
	PNCv1-UC-REQ-335766/B-User Plugs into an Non-ISO, Out of network when PnC is disabled		rpaquet2 - Updated per feature owner
	PNCv1-UC-REQ-335767/B-User Plugs into an Non-ISO, In Network (NA) when PnC is disabled		rpaquet2 - Updated per feature owner
	PNCv1-UC-REQ-335768/B-User Plugs into an Non-ISO, In Network (EU) when PnC is disabled		rpaquet2 - Updated per feature owner
	PNC-STR-575741/B-Activity Diagrams		rpaquet2- removed 326583 per feature owner
	PNC-STR-575742/B-Sequence Diagrams		rpaquet2 - removed 326584 per feature owner
	PNC-SD-REQ-330597/C-Charge Station ISO and Network Errors		rpaquet2 - Removed Non PNC Supported In/Out of network scenarios
	PNC-REQ-326850/C-Charge Complete - In Vehicle		rpaquet2- Updated PlgActv signal name
	PNC-STR-575749/B-Use Cases		rpaquet2 - removed 324853 per feature owner
	PNCv1-UC-REQ-330860/C-PnC Charge Summary Delay/Failed		rpaquet2 - Updated Scenario and Post Condition and requirement name
	PNC-REQ-330759/B-Notifications for Plug and Charge Status Change		rpaquet2 - Updae per feature owner
	PNC-REQ-330377/C-Disabling PnC		rpaquet2 - Updated APIM part
	PNC-REQ-330378/C-Re-Enabling PnC		rpaquet2 - Updated APIM part

	PNC-STR-582019/B-Requirements	rpaquet2 - removed 330379 and put content into 326853
	PNC-REQ-326853/B-Managing Expired Contract Certifications - Success	rpaquet2 - added requirement info from 330379 as that requirement goes away
	PNCv1-UC-REQ-320376/B-Failed to Delete Expired Contract Cert's and Install New Contract Cert's	rpaquet2 - took vehicle HMI out of post condition
	PNC-REQ-330380/C-Master Reset	rpaquet2 - Updated per feature owner
	PNC-SD-REQ-326837/C-Master Reset	rpaquet2 - Updated alerts in the diagram per feature owner
	PNC-SD-REQ-330601/C-Last User has Removed Vehicle from App	rpaquet2 - Updated alerts in the diagram per feature owner
	PNC-REQ-335761/B-OBCC Swap Detection	rpaquet2 - Updated per feature owner
	PNC-REQ-335762/B-Deleting Certificates in New OBCC Module	rpaquet2 - Updated per feature owner
	PNCv1-UC-REQ-326621/C-Installing New Certification after OBCC Swap	rpaquet2 - Update per feature owner
	PNC-SD-REQ-326779/C-Installing New Cert After Module Swap	rpaquet2 - Updated alerts in the diagram per feature owner
	PNC-REQ-334897/B-OBCC-BCCM Wakeup Strategy	rpaquet2 - removed 343878 per feature owner
	PNC-REQ-334898/B-Time Limit for Wakeup Strategy	rpaquet2 - Updated Rule
	PNCv1-UC-REQ-334895/B-Wake Up for PnC Enable-Disable and Cert installs	rpaquet2 - Updated per feature owner
	PNC-STR-575737/B-Appendix B: Reference Documents	rpaquet2 - Added Peripheral Provisioning SPSS
August 5, 2019	**1.3**	
	MD-REQ-343489/C-DgtlCommPnc_Rq	rpaquet2 - Update 0x3 value
	PNC-REQ-330380/D-Master Reset	rpaquet2 - Updated content
	PNCv1-UC-REQ-325271/C-Master Reset Initiated from APIM	rpaquet2 - Update post condition
	PNCv1-UC-REQ-325272/C-Last User Removes Vehicle from Mobile App	rpaquet2 - Updated post condition
	PNC-SD-REQ-330601/D-Last User has Removed Vehicle from App	rpaquet2 - Updated DgtlCommPnc to state delete all
December 18, 2019	**1.4**	
	PNC-STR-575730/C-Functional Definition	rpaquet2 - added 369804
	PNC-REQ-326839/D-Customer Connectivity Settings Impact	rpaquet2 - Updated Content per feature owner
	PNCv1-UC-REQ-320370/D-Onboarding Success - Contract Certificate Installation is Completed and PnC is Enabled	rpaquet2 - updated pre condition
	PNC-STR-575738/D-Requirements	rpaquet2 - removed 330370 added 372234
	PNC-REQ-326845/D-Charge Begin Unsuccessful	rpaquet2 - Updated table per feature owner
	PNC-REQ-330367/C-EVSE ID and Station Charge Schedule Information	rpaquet2 - update signal states
	PNC-REQ-337332/B-Sending whether Vehicle is Charging using TLS or No TLS	rpaquet2 - updated signal states
	PNC-REQ-372234/A-Send GPS Signal in PnCChargingStationInfoAlert	rpaquet2 - New
	PNC-REQ-330369/D-ISO/In network HMI error	rpaquet2 - updated signal states
	PNC-STR-575742/C-Sequence Diagrams	rpaquet2 - removed 326579
	PNC-STR-575748/B-Requirements	rpaquet2 - removed 326851 and 326852 per feature owner
	PNC-REQ-326850/D-Charge Complete - In Vehicle	rpaquet2 - Updated per feature owner
	PNC-REQ-330378/D-Re-Enabling PnC	rpaquet2 - corrected spelling error
	PNC-FUN-REQ-369804/A-V2G Certificate Delivery upon OBCC Being Provisioned	new
	PNC-STR-704666/A-Requirements	rpaquet2 - New
	PNC-REQ-369816/A-V2G Certificate Process	rpaquet2 - New
	PNC-STR-704667/A-Use Cases	rpaquet2 - New
	PNCv1-UC-REQ-369805/A-Install V2G Certificates	new
	PNC-STR-704668/A-White Box Views	rpaquet2 - New
	PNC-STR-704670/A-Sequence Diagrams	rpaquet2 - New

	PNC-SD-REQ-369778/A-V2G Certufucate Delivery once OBCC Provisioned	rpaquet2 - New
August 5, 2020	**1.5**	
	MD-REQ-326684/C-SoaHmiPncMessage	rpaquet2 - Updated encoding for Dispaly_Station Type and Display Payment Info
	MD-REQ-326679/B-ChargeInPowerMode_St	rpaquet2 - Updated table with 2 new encodings
	MD-REQ-326681/B-ChargerReady_St	rpaquet2 - Update Literal name no content change
	PNC-STR-575730/D-Functional Definition	rpaquet2 - added 395797
	PNC-REQ-330371/C-Payment or Backend issues	rpaquet2 - Updated encoding information
	PNC-FUN-REQ-395797/A-China GBT Charger Data to the Cloud	new
	PNC-STR-789412/A-Requirements	rpaquet2 - New
	PNC-REQ-395798/A-China Specific Charge Station Info and Shifted Data	rpaquet2 - New
	PNC-REQ-395799/A-Alerts Needed for China	rpaquet2 - New
	PNC-REQ-395801/A-Commands Needed for China	rpaquet2 - New
January 21, 2021	**1.6**	
	PNC-REQ-326850/E-Charge Complete - In Vehicle	rpaquet2 - Updated ECG Rule section
	PNC-REQ-369816/B-V2G Certificate Process	rpaquet2 - Updated EOL Config content
	PNC-SD-REQ-369778/B-V2G Certificate Delivery once OBCC Provisioned	rpaquet2 - Corrected spelling in req name
	PNC-REQ-395798/B-China Specific Charge Station Info and Shifted Data	rpaquet2 - Updated content
	PNC-REQ-395799/B-Alerts Needed for China	rpaquet2 - removed BatteryChargeStateChange
June 28, 2021	**1.7**	
	PNC-REQ-326839/E-Customer Connectivity Settings Impact	rpaquet2 - Updated to add Location Sharing
	PNC-STR-575748/C-Requirements	rpaquet2 - Added new requirement for Alerts
	PNC-REQ-425922/A-Charge Complete Alert Monitor	rpaquet2 - New
	PNCv1-UC-REQ-324854/C-Plug and Charge Re-Enabling	rpaquet2 - Updated Post Condition

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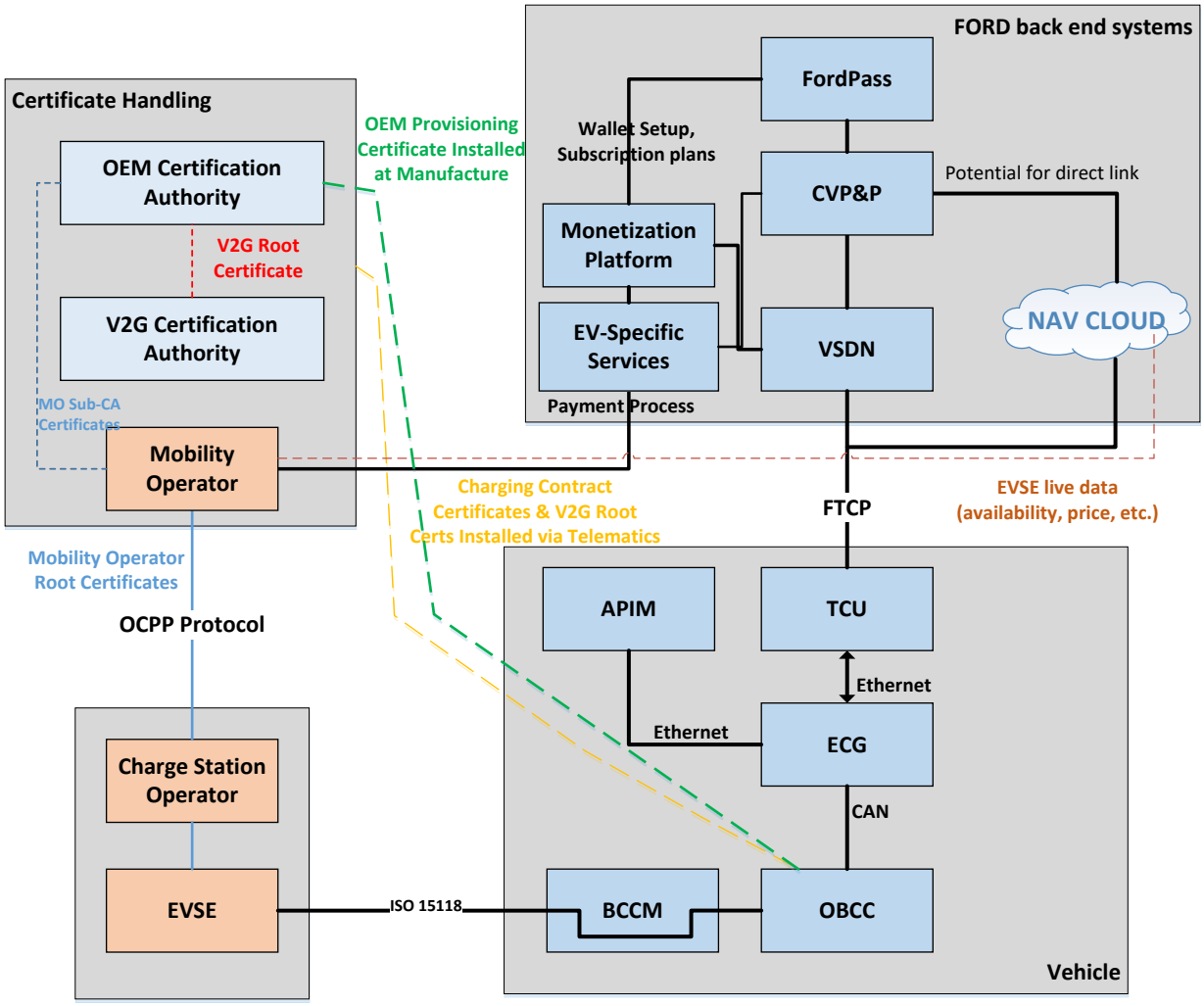
1 Architectural Design

1.1 Overview

Plug and Charge provides an effortless charging experience for the owner of Ford BEV when a user plugs their vehicle at charging station that support PnC Functionality i.e. ISO 15118.2 and charge station in Ford network (cf. Ford Network Charging Stations below).
When the user plugs in:

- A secure handshake takes place between the vehicle and the charge station after which Certificates transfer begins. This allows for seamless vehicle identification and billing to take place behind the scenes
- Charging will begin automatically and the user will able to see this on the app and in-vehicle

Below is a detailed view of the Plug & Charge architecture; the main pieces are the Cloud, the Vehicle, the Charging station and the Certificate handling authorities.



1.2 Physical Mapping of Classes

The table below shows an example of how the logical classes may be mapped into physical modules. This mapping example is specific to CX727 FNV2.

Logical Class	Physical Module (ECU)
PNC Offboard HMI Client	Ford Pass
PNC Offboard Server	SDN
PNC Offboard Gateway	TCU
PNC Onboard Server	ECG
PNC Onboard HMI Client	APIM
PNC Onboard Client 2	OBCC(DCGM)
PNC Onboard Client 3	BCCM/HPCM

1.3 PNC-CLD-REQ-324730/A-PNC On Board Server

Responsible for determining when alerts will be sent to the vehicle HMI and backend.

1.4 PNC-CLD-REQ-324731/A-PNC On Board HMI Client

Responsible for displaying Plug and Charge status information to the user in the Vehicle HMI.

1.5 PNC-CLD-REQ-324732/A-PNC On Board Client 3

Responsible for providing plug status Charger information.

1.6 PNC-CLD-REQ-324734/A-PNC On Board Client 2

Responsible for starting payment process and sending vehicle charging status.

1.7 PNC-CLD-REQ-324735/A-PNC Off Board HMI Client

Responsible for providing a user interface to Plug and Charge from outside the vehicle.

1.8 PNC-CLD-REQ-326384/A-PNC Off Board Server

Responsible for verifying certification approval.

1.9 PNC-CLD-REQ-326385/A-PNC Off Board Gateway

Responsible for providing a modem to transmit data into and out of the vehicle.

1.10 Logical Signal Mapping

Each logical name used in this document is mapped to its corresponding CAN signal. Please refer to the following mapping:

Logical name	CAN signal name
PnCStat_St	DgtlCommPnc_D_Stat
DigitalCommGtwyMode_Rq	DgtlCommGtwyMde_D_Rq
DigitalCommGtwyMode_St	DgtlCommGtwyMde_D_Stat
DCCharge_St	DcChrgRdy_D_Stat
ChargeInPowerMode_St	ChrgrInPwMde_D_Actl
BatterySystemReady_St	BattChrgRdyStat_D_Actl
ChargerReady_St	ChrgrRdyStat_D_Actl
ChargingSystem_St	ChrgStat_D2_Dsply
DCChargeService_Rq	DcChrgSrvcRqd_B_Rq
DigitalCommFault_St	DgtlCommGtwy_D_Falt
EVSEDcChargeISO_St	EvseDcChrgIso_D_Stat

PlugStatus_St	PlgActvArb_B_Actl
BatteryStateOfCharge_St	BattTracSoc_Pc_Dsply
VehicleRange_St	VehElRnge_L2_Dsply
ChargerPnCSustain_Rq	ChrgrPncSustn_B_Rq
Reset_Rq	FactoryReset_Rq
ModemReset_Rq	ModemReset_D_Rq
DgtlCommPnc_Rq	DgtlCommPnc_D_Rq
ChargeStationID_Rq	See TP SPSS
ChargeStationID_St	See TP SPSS
ChargeStationSchedule_St	See TP SPSS
setPaymentInfo	SoaHmiPncMessage - API
setStationInfo	SoaHmiPncMessage - API
setVehicleChargeInfo	SoaHmiPncMessage - API
setPlugAndChargeStatus	setPlugAndChargeStatus - API

1.11 PNC OnboardServer Interface

1.11.1 PNC-IIR-REQ-324736/C-PNC Onboard Server_Tx

1.11.1.1 MD-REQ-326487/C-setPlugAndChargeStatus

Method Type	On Change
QoS Level	Default
Retained	Yes

R/O	Name	Type	Literals	Value	Description
Request (_St)					
O	PNCstatus	ENUM	-	-	To indicate the state of Plug and Charge. This parameter uses the VIM process and will be pulled into it's own SOA-API
			Null	0x0	
			NoContractsInstalled	0x1	
			Disable	0x2	
			Enable	0x3	
			NotUsed	0x4	
			NotUsed	0x5	
			NotUsed	0x6	
			Faulty	0x7	
O	EVSE Fault	ENUM	-	-	Indicates EVSE is Faulted. This parameter uses the VIM process and will

					be pulled into it's own SOA-API
			No Fault	0x0	
			Fault	0x1.. 0x40	Any value will result in same fault indication. Reference DgtlCommGtwy_D_Fault for literal values

1.11.1.2 MD-REQ-326684/C-SoaHmiPncMessage

Method Type	On Change
QoS Level	Default
Retained	Yes

R/O	Name	PncRequest Type	Literals	Value	Description
Request (_St)					
O	DISPLAY_STATION_TYPE	0	PnC Supported, Out of Network	0x1	
O	DISPLAY_AUTHORIZATION_ERROR	1	Payment subscription balance is low	0x0	
			Payment balance has run out	0x1	
			Charging account is overdue, but charging is still allowed (post-pay account)	0x2	
			Charging account is overdue and charging is suspended (post-pay account)	0x3	
			Payment method issue for variable fees or monthly subscription fees	0x4	
			Backend System Error	0x5	
O	DISPLAY_PAYMENT_INFO	2	State of Charge (SOC)	0x1	Float
			Total Time Plugged-in	0x2	Int32
			Total Distance Added	0x3	Float
			Total Cost	0x4	Float
			Balance In Subscription	0x5	Float
			Currency Type	0x6	String
			Payment status - PaymentInfo_Available = 0 - PaymentInfo_NotAvailable = 1		

1.11.1.3 MD-REQ-337333/A-ChargerPnCSustain_Rq

Message Type: Request

This signal is used to request that wake up stay active or not.

Name	Literals	Value	Description
Type	-	-	
	Inactive	0x0	
	Active	0x1	

1.11.1.4 MD-REQ-343026/A-ChargeStationID_Rq

Message Type: request

This signal is used to request the Charge Station information.

Name	Literals	Value	Description
RequestData	-	-	
	No Request	0x00	
	Request Charge Station ID	0x01	

1.11.1.5 MD-REQ-343489/C-DgtlCommPnc_Rq

Message Type: Request

Command from ECG to OBCC to reset PnC Feature and Disable the feature when CCS settings are disabled

Literals	Value	Description
No Request	0x0	
Reset	0x1	
Disable	0x2	
DeleteAll	0x3	
NotUsed	0x4	
NotUsed	0x5	
NotUsed	0x6	
NotUsed	0x7	

1.11.2 PNC-IIR-REQ-324737/B-PNC Onboard Server_Rx

1.11.2.1 MD-REQ-326486/C-PnCStat_St

Message Type: status

This signal is used to indicate the state of Plug and Charge.

Name	Literals	Value	Description
Type	-	-	
	Null	0x0	
	NoContractsInstalled	0x1	
	Disable	0x2	
	Enable	0x3	

	NotUsed	0x4	
	NotUsed	0x5	
	NotUsed	0x6	
	Faulty	0x7	

1.11.2.2 MD-REQ-326502/B-ChargeStationID_St

Message Type: status

This signal is used to provide the Charge Station information.

Name	Literals	Value	Description
TLS Status	-	-	
	No TLS	0x00	
	TLS	0x01	
Charge Station ID	-	-	Max. 37 bytes Variable Raw Data

1.11.2.3 MD-REQ-326679/B-ChargeInPowerMode_St

Message Type: status

This signal is used to indicate the operational mode of EVSE(Electrical Vehicle Supply Equipment).

Name	Literals	Value	Description
Type	-	-	
	EvseNotDetected	0x0	
	EvsePaused	0x1	
	DigitalCommDetected	0x2	
	AcBasic	0x3	
	AcDigital	0x4	
	DcCharging	0x5	
	IcCharging	0x6	
	EvseNotCompatible	0x7	
	EvseFault	0x8	
	DigitalCommEnd	0x9	
	DcBpt	0xA	

1.11.2.4 MD-REQ-326682/A-ChargingSystem_St

Message Type: status

Indicates the high voltage charging system status..

Name	Literals	Value	Description
Type	-	-	
	NotReady	0x0	
	FaultInsideCar	0x1	
	FaultOutsideCar	0x2	
	EvseNotCompatible	0x3	
	EvseNotDetected	0x4	

	EvsePaused	0x5	
	ChargeScheduled	0x6	
	ChargingAC	0x7	
	ChargingDCFastCharge	0x8	
	ChargingInductive	0x9	
	ChargingSystemMaintain	0xA	
	CabinPreconditioning	0xB	
	DriveConditioning	0xC	
	ChargeTargetReached	0xD	

1.11.2.5 MD-REQ-326683/A-DCChargeService_Rq

Message Type: request

DCGM Service Request, Warning Light.

Name	Literals	Value	Description
Type	-	-	
	Off	0x0	
	On	0x1	

1.11.2.6 MD-REQ-326689/B-DigitalCommFault_St

Message Type: status

Indicates EVSE error.

Name	Literals	Value	Description
Type	-	-	
	No fault	0x0	
	EvseStatShutdown	0x1	
	EvseStatUtilityIntrpt	0x2	
	EvseEmergencyShutdown	0x3	
	EvseMalfunction	0x4	
	EvseStopNotification	0x5	
	EvseSlaacErr	0x6	
	EvseUdpErr	0x7	
	EvseTcpCnnctFail	0x8	
	EvseTlsFail	0x9	
	EvseTlsUnexpectedMsg	0xA	
	EvseTlsBadRecordMac	0xB	
	EvseTlsDecryptFail	0xC	
	EvseTlsHandshakeFail	0xD	
	EvseTlsBadCert	0xE	
	EvseTlsCertExpired	0xF	
	EvseTlsUnknownCa	0x10	
	EvseMsgTimeout	0x11	
	EvseCommSetupTimeout	0x12	
	EvseCableCheckTimeout	0x13	
	EvsePreChargeTimeout	0x14	
	EvseResFailed	0x15	

	EvseResSeqErr	0x16	
	EvseResSignErr	0x17	
	EvseResUnknownSession	0x18	
	EvseResServiceIDInvld	0x19	
	EvseResPymt SelecInvld	0x1A	
	EvseResCertExp	0x1B	
	EvseResCertRvk	0x1C	
	EvseResCertNoCertAvail	0x1D	
	EvseResCertChainErr	0x1E	
	EvseResContrCancel	0x1F	
	EvseResChlgInvld	0x20	
	EvseResWrongEnTransMde	0x21	
	EvseResWrongChrgParam	0x22	
	EvseResChargPfInvld	0x23	
	EvseResTrfSelecInvld	0x24	
	EvseResPwrDelNotApplied	0x25	
	EvseResMetSignNotVld	0x26	
	EvseResNoChrgSvcSelec	0x27	
	EvseResContrErr	0x28	
	EvseResCertNotAllowed	0x29	
	EvseResNoSuppAppProt	0x2A	
	EvseResContrNotAccept	0x2B	
	EvseResMoUnknown	0x2C	
	EvseResOemProvCertRev	0x2D	
	EvseResOemSubCa1CertRev	0x2E	
	EvseResOemSubCa2CertRev	0x2F	
	EvseResMoProvCertRev	0x30	
	EvseResMoSubCa1CertRev	0x31	
	EvseResMoSubCa2CertRev	0x32	
	EvseResRootCaCertRev	0x33	
	EvseResCpsProvCertRev	0x34	
	EvseResSubCA1CertRev	0x35	
	EvseResSubCA2CertRev	0x36	
	EvseResCpsRootCaCertRev	0x37	
	EvseGbtCstEvseOverTemp	0x38	
	EvseGbtCstEVSEConnectorFalt	0x39	
	EvseGbtCstEInternalOverTemperature	0x3A	
	EvseGbtCstEnergyTransrFalt	0x3B	
	EvseGbtCstEEmergShutdown	0x3C	
	EvseGbtCstOtherFalt	0x3D	
	EvseGbtCstChrgCurrntMismtch	0x3E	
	EvseGbtCstChrgVoltMismtch	0x3F	
	EvseGbtCommTimeOut	0x40	

1.11.2.7 MD-REQ-028126/A-PlugStatus_St (TcSE ROIN-221127-1)

Message Type: Status

Represents the Plug Status.
Indicates if vehicle is plugged in or not.

Name	Literals	Value	Description
Type	-	-	Indicates if vehicle is plugged in or not.
	OffPlug	0x0	
	OnPlug	0x1	

1.11.2.8 MD-REQ-326835/A-BatteryStateOfCharge_St

Message Type: Status

Represents the current level of charge.
Status used to indicate the current level of vehicle charge.

Name	Literals	Value	Description
Type	-	-	This signal indicates the current level of charge. Units:Precent Resolution:0.5 Offset:0
	Minimum	0x0	
	Maximum	0xFF	

1.11.2.9 MD-REQ-326836/A-VehicleRange_St

Message Type: Status

Represents the distance to empty.

Name	Literals	Value	Description
Type	-	-	This signal indicates the distance to empty.
	Unknown	0xFFE	
	Faulted	0xFFF	

1.11.2.10 MD-REQ-326838/A-Reset_Rq

Message Type: Request

Signal sent by the Master Reset Client to initiate a Master Reset

Literals	Value	Description
Inactive	0x0	
ResetFactoryDefaults	0x1	

1.11.2.11 MD-REQ-326678/A-DCCharge_St

Message Type: status

PNC Onboard Client 2 status to support digital communication based charging.

Name	Literals	Value	Description
Type	-	-	
	Not Ready	0x0	
	Initialization	0x1	
	ChargeReady	0x2	
	WeldCheck (Cable Check)	0x3	

	PreCharge	0x4	
	Charging	0x5	
	ChargeComplete	0x6	
	GBT PreCharge	0x7	
	EVSE Paused	0x8	
	EVSE Not Compatible	0x9	
	EVSE Fault	0xA	

1.11.2.12 MD-REQ-326677/A-DigitalCommGtwyMode_St

Message Type: status

The status of the digital communications regarding discovered charging services reported.

Name	Literals	Value	Description
Type	-	-	
	Not Detected	0x0	
	DC EIM	0x1	
	DC PnC	0x2	
	DC EIM/PnC	0x3	
	AC EIM	0x4	
	AC PnC	0x5	
	AC EIM/PnC	0x6	
	Restart Request	0x7	
	Inactive	0x8	

1.11.2.13 MD-REQ-326674/A-DigitalCommGtwyMode_Rq

Message Type: request

This signal is used to request the mode to use.

Name	Literals	Value	Description
Type	-	-	
	No Dgtl Communication	0x0	
	Attempt Dgtl Communication	0x1	
	DC EIM	0x2	
	DC PnC	0x3	
	AC EIM	0x4	
	AC PnC	0x5	

1.11.2.14 MD-REQ-343488/A-ModemReset_Rq

Message Type: Request

Signal used to initiate a Brand Reset

Literals	Value	Description
Null	0x0	
WifiHotspotReset	0x1	
PaaKReset	0x2	
OnlineTrafficReset	0x3	

CCSReset	0x4	
BrandConnectReset1	0x5	
BrandConnectReset2	0x6	
NotUsed_1	0x7	
NotUsed_2	0x8	
NotUsed_3	0x9	
NotUsed_4	0xA	
NotUsed_5	0xB	
NotUsed_6	0xC	
NotUsed_7	0xD	
NotUsed_8	0xE	
NotUsed_9	0xF	

1.11.2.15 MD-REQ-337016/B-ChargeStationSchedule_St

Message Type: status

This signal is used to provide the schedule for the connected Charge Station

Name	Literals	Value	Description
Schedule ID	-	-	
	ID 1	0x1	
	ID 254	0xFF	
Schedule Index	-	-	This parameter shall increment for every messsage payload sent until all data is transferred. When sending data for new Schedule ID the index shall start at 1 again
	ID 1	0x1	
	ID 254	0xFF	
Number Of Items Transmittied	-	-	Indicates the number of schedule inputs sent in current payload. Max number of items to be sent in a gvien Schedule Index is 800
	1	0x0001	
	…		
	800	0x0320	
	Reserved	0x0321-0xFFFF	
Power Value	-	-	15 bits Fixed Units: Watts Resolution: 50 Watts
Time Interval	-	-	25 bits Fixed Units: Time Resolution: Seconds

1.12 PNC Onboard HMI Client Interface

1.12.1 PNC-IIR-REQ-326492/B-PNC Onboard HMI Client_Tx

1.12.1.1 MD-REQ-326838/A-Reset_Rq

Message Type: Request

Signal sent by the Master Reset Client to initiate a Master Reset

Literals	Value	Description
Inactive	0x0	
ResetFactoryDefaults	0x1	

1.12.1.2 MD-REQ-343488/A-ModemReset_Rq

Message Type: Request

Signal used to initiate a Brand Reset

Literals	Value	Description
Null	0x0	
WifiHotspotReset	0x1	
PaaKReset	0x2	
OnlineTrafficReset	0x3	
CCSReset	0x4	
BrandConnectReset1	0x5	
BrandConnectReset2	0x6	
NotUsed_1	0x7	
NotUsed_2	0x8	
NotUsed_3	0x9	
NotUsed_4	0xA	
NotUsed_5	0xB	
NotUsed_6	0xC	
NotUsed_7	0xD	
NotUsed_8	0xE	
NotUsed_9	0xF	

1.12.2 PNC-IIR-REQ-326493/B-PNC Onboard HMI Client_Rx

1.12.2.1 MD-REQ-326487/C-setPlugAndChargeStatus

Method Type	On Change
QoS Level	Default
Retained	Yes

R/O	Name	Type	Literals	Value	Description
Request (_St)					

O	PNCstatus	ENUM	-	-	To indicate the state of Plug and Charge. This parameter uses the VIM process and will be pulled into it's own SOA-API
			Null	0x0	
			NoContractsInstalled	0x1	
			Disable	0x2	
			Enable	0x3	
			NotUsed	0x4	
			NotUsed	0x5	
			NotUsed	0x6	
			Faulty	0x7	
O	EVSE Fault	ENUM	-	-	Indicates EVSE is Faulted. This parameter uses the VIM process and will be pulled into it's own SOA-API
			No Fault	0x0	
			Fault	0x1.. 0x40	Any value will result in same fault indication. Reference DgtlCommGtwy_D_Fault for literal values

1.12.2.2 MD-REQ-326682/A-ChargingSystem_St

Message Type: status

Indicates the high voltage charging system status..

Name	Literals	Value	Description
Type	-	-	
	NotReady	0x0	
	FaultInsideCar	0x1	
	FaultOutsideCar	0x2	
	EvseNotCompatible	0x3	
	EvseNotDetected	0x4	
	EvsePaused	0x5	
	ChargeScheduled	0x6	
	ChargingAC	0x7	
	ChargingDCFastCharge	0x8	
	ChargingInductive	0x9	
	ChargingSystemMaintain	0xA	
	CabinPreconditioning	0xB	
	DriveConditioning	0xC	

	ChargeTargetReached	0xD	

1.12.2.3 MD-REQ-326684/C-SoaHmiPncMessage

Method Type	On Change
QoS Level	Default
Retained	Yes

R/O	Name	PncRequest Type	Literals	Value	Description
Request (_St)					
O	DISPLAY_STATION_TYPE	0	PnC Supported, Out of Network	0x1	
O	DISPLAY_AUTHORIZATION_ERROR	1	Payment subscription balance is low	0x0	
			Payment balance has run out	0x1	
			Charging account is overdue, but charging is still allowed (post-pay account)	0x2	
			Charging account is overdue and charging is suspended (post-pay account)	0x3	
			Payment method issue for variable fees or monthly subscription fees	0x4	
			Backend System Error	0x5	
O	DISPLAY_PAYMENT_INFO	2	State of Charge (SOC)	0x1	Float
			Total Time Plugged-in	0x2	Int32
			Total Distance Added	0x3	Float
			Total Cost	0x4	Float
			Balance In Subscription	0x5	Float
			Currency Type	0x6	String
			Payment status - PaymentInfo_Available = 0 - PaymentInfo_NotAvailable = 1		

1.13 PNC Onboard Client 2 Interface

1.13.1 PNC-IIR-REQ-326494/B-PNC Onboard Client 2_Tx

1.13.1.1 MD-REQ-326502/B-ChargeStationID_St

Message Type: status

This signal is used to provide the Charge Station information.

Name	Literals	Value	Description
TLS Status	-	-	
	No TLS	0x00	
	TLS	0x01	
Charge Station ID	-	-	Max. 37 bytes Variable Raw Data

1.13.1.2 MD-REQ-326677/A-DigitalCommGtwyMode_St

Message Type: status

The status of the digital communications regarding discovered charging services reported.

Name	Literals	Value	Description
Type	-	-	
	Not Detected	0x0	
	DC EIM	0x1	
	DC PnC	0x2	
	DC EIM/PnC	0x3	
	AC EIM	0x4	
	AC PnC	0x5	
	AC EIM/PnC	0x6	
	Restart Request	0x7	
	Inactive	0x8	

1.13.1.3 MD-REQ-326678/A-DCCharge_St

Message Type: status

PNC Onboard Client 2 status to support digital communication based charging.

Name	Literals	Value	Description
Type	-	-	
	Not Ready	0x0	
	Initialization	0x1	
	ChargeReady	0x2	
	WeldCheck (Cable Check)	0x3	
	PreCharge	0x4	
	Charging	0x5	
	ChargeComplete	0x6	
	GBT PreCharge	0x7	
	EVSE Paused	0x8	
	EVSE Not Compatible	0x9	
	EVSE Fault	0xA	

1.13.1.4 MD-REQ-326690/A-EVSEDcChargeISO_St

Message Type: status

Isolation monitoring result of the EVSE reported by PNC Onboard Client 2.

Name	Literals	Value	Description
Type	-	-	
	Invalid	0x0	
	Valid	0x1	
	Warning	0x2	
	Not Used	0x3	
	Not Used	0x4	
	Not Used	0x5	
	No Data Exists	0x6	
	Faulty	0x7	

1.13.1.5 MD-REQ-326683/A-DCChargeService_Rq

Message Type: request

DCGM Service Request, Warning Light.

Name	Literals	Value	Description
Type	-	-	
	Off	0x0	
	On	0x1	

1.13.1.6 MD-REQ-326689/B-DigitalCommFault_St

Message Type: status

Indicates EVSE error.

Name	Literals	Value	Description
Type	-	-	
	No fault	0x0	
	EvseStatShutdown	0x1	
	EvseStatUtilityIntrpt	0x2	
	EvseEmergencyShutdown	0x3	
	EvseMalfunction	0x4	
	EvseStopNotification	0x5	
	EvseSlaacErr	0x6	
	EvseUdpErr	0x7	
	EvseTcpCnnctFail	0x8	
	EvseTlsFail	0x9	
	EvseTlsUnexpectedMsg	0xA	
	EvseTlsBadRecordMac	0xB	
	EvseTlsDecryptFail	0xC	
	EvseTlsHandshakeFail	0xD	
	EvseTlsBadCert	0xE	
	EvseTlsCertExpired	0xF	

	EvseTlsUnknownCa	0x10	
	EvseMsgTimeout	0x11	
	EvseCommSetupTimeout	0x12	
	EvseCableCheckTimeout	0x13	
	EvsePreChargeTimeout	0x14	
	EvseResFailed	0x15	
	EvseResSeqErr	0x16	
	EvseResSignErr	0x17	
	EvseResUnknownSession	0x18	
	EvseResServiceIDInvld	0x19	
	EvseResPymt SelecInvld	0x1A	
	EvseResCertExp	0x1B	
	EvseResCertRvk	0x1C	
	EvseResCertNoCertAvail	0x1D	
	EvseResCertChainErr	0x1E	
	EvseResContrCancel	0x1F	
	EvseResChlgInvld	0x20	
	EvseResWrongEnTransMde	0x21	
	EvseResWrongChrgParam	0x22	
	EvseResChargPfInvld	0x23	
	EvseResTrfSelecInvld	0x24	
	EvseResPwrDelNotApplied	0x25	
	EvseResMetSignNotVld	0x26	
	EvseResNoChrgSvcSelec	0x27	
	EvseResContrErr	0x28	
	EvseResCertNotAllowed	0x29	
	EvseResNoSuppAppProt	0x2A	
	EvseResContrNotAccept	0x2B	
	EvseResMoUnknown	0x2C	
	EvseResOemProvCertRev	0x2D	
	EvseResOemSubCa1CertRev	0x2E	
	EvseResOemSubCa2CertRev	0x2F	
	EvseResMoProvCertRev	0x30	
	EvseResMoSubCa1CertRev	0x31	
	EvseResMoSubCa2CertRev	0x32	
	EvseResRootCaCertRev	0x33	
	EvseResCpsProvCertRev	0x34	
	EvseResSubCA1CertRev	0x35	
	EvseResSubCA2CertRev	0x36	
	EvseResCpsRootCaCertRev	0x37	
	EvseGbtCstEvseOverTemp	0x38	
	EvseGbtCstEVSEConnectorFalt	0x39	
	EvseGbtCstEInternalOverTemperature	0x3A	
	EvseGbtCstEnergyTransrFalt	0x3B	
	EvseGbtCstEEmergShutdown	0x3C	
	EvseGbtCstOtherFalt	0x3D	
	EvseGbtCstChrgCurrntMismtch	0x3E	
	EvseGbtCstChrgVoltMismtch	0x3F	
	EvseGbtCommTimeOut	0x40	

1.13.1.7 MD-REQ-337016/B-ChargeStationSchedule_St

Message Type: status

This signal is used to provide the schedule for the connected Charge Station

Name	Literals	Value	Description
Schedule ID	-	-	
	ID 1	0x1	
	ID 254	0xFF	
Schedule Index	-	-	This parameter shall increment for every messsage payload sent until all data is transferred. When sending data for new Schedule ID the index shall start at 1 again
	ID 1	0x1	
	ID 254	0xFF	
Number Of Items Transmittied	-	-	Indicates the number of schedule inputs sent in current payload. Max number of items to be sent in a gvien Schedule Index is 800
	1	0x0001	
	…		
	800	0x0320	
	Reserved	0x0321-0xFFFF	
Power Value	-	-	15 bits Fixed Units: Watts Resolution: 50 Watts
Time Interval	-	-	25 bits Fixed Units: Time Resolution: Seconds

1.13.2 PNC-IIR-REQ-326495/B-PNC Onboard Client 2_Rx

1.13.2.1 MD-REQ-326674/A-DigitalCommGtwyMode_Rq

Message Type: request

This signal is used to request the mode to use.

Name	Literals	Value	Description
Type	-	-	
	No Dgtl Communication	0x0	
	Attempt Dgtl Communication	0x1	
	DC EIM	0x2	
	DC PnC	0x3	
	AC EIM	0x4	

	AC PnC	0x5	

1.13.2.2 MD-REQ-326679/B-ChargeInPowerMode_St

Message Type: status

This signal is used to indicate the operational mode of EVSE(Electrical Vehicle Supply Equipment).

Name	Literals	Value	Description
Type	-	-	
	EvseNotDetected	0x0	
	EvsePaused	0x1	
	DigitalCommDetected	0x2	
	AcBasic	0x3	
	AcDigital	0x4	
	DcCharging	0x5	
	IcCharging	0x6	
	EvseNotCompatible	0x7	
	EvseFault	0x8	
	DigitalCommEnd	0x9	
	DcBpt	0xA	

1.13.2.3 MD-REQ-326680/A-BatterySystemReady_St

Message Type: status

Status of the Battery system for charge.

Name	Literals	Value	Description
Type	-	-	
	Not Ready	0x0	
	Charge Wait	0x1	
	Battery Charge Ready	0x2	
	Charging	0x3	
	Charging Completed	0x4	
	Faulted	0x5	
	Not Used	0x6	

1.13.2.4 MD-REQ-326681/B-ChargerReady_St

Message Type: status

Charger Ready status indicator.

Name	Literals	Value	Description
Type	-	-	
	Not Ready	0x0	
	Charger Ready	0x1	
	ChargeFault	0x2	
	Charging	0x3	

1.13.2.5 MD-REQ-343489/C-DgtlCommPnc_Rq

Message Type: Request

Command from ECG to OBCC to reset PnC Feature and Disable the feature when CCS settings are disabled

Literals	Value	Description
No Request	0x0	
Reset	0x1	
Disable	0x2	
DeleteAll	0x3	
NotUsed	0x4	
NotUsed	0x5	
NotUsed	0x6	
NotUsed	0x7	

2 Functional Definition

2.1 PNC-FUN-REQ-324756/A-Onboarding and Enabling Plug and Charge

2.1.1 Requirements

2.1.1.1 PNC-REQ-326839/E-Customer Connectivity Settings Impact

The CCS feature provides the ability for a user to opt-in/opt-out from connectivity settings within the vehicle. This will allow the user to enter a customized connectivity mode such as privacy mode or to prevent data sharing such as GPS location. Customer connectivity settings (CCS) is enabled or disabled from the vehicle HMI.

1. When the customer turns off any of the following customer connectivity settings in the vehicle HMI, Plug and Charge feature will be disabled in both vehicle and cloud (CVPODS).
    a. Vehicle Connectivity
    b. Vehicle Data
    c. Location Sharing
2. Before the ECG app shutdown, ECG shall turn OFF PnC feature by broadcast DgtlCommPnc_D_Rq = Disable to OBCC
3. When the user initiates Master Reset/Brand connect Reset in the SYNC after CCS settings are Disabled, ECG Platform application shall handle these requirements by sending DgtlCommPnc_D_Rq = **Reset** to OBCC to delete all contract certificates.
4. When the user initiates "Last user removes VIN from FordPass app" that triggers clear user setting command from the cloud after Vehicle data CCS setting is disabled, ECG Platform application shall handle these requirements by sending DgtlCommPnc_D_Rq = **DeleteAll** to OBCC to delete all contract certificates.

OBCC:
OBCC shall disable the PnC feature and send DgtlCommPnc_D_Stat with 0x2: Disable to BCCM and ECG

The Plug & Charge experience will be impacted based on CCS settings as shown below.

CCS Impact on Requirements	Vehicle Connectivity Disabled	Vehicle Data Disabled	Location Sharing Disabled	Driving Characteristics Disabled
PnC toggle on available	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Yes
PnC toggle off available	N/A (PnC is off already)	N/A (PnC is off already)	Yes	Yes
Charging begins when using PnC after plugged in (assuming no other errors)	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Yes
Charging in progress status shown in vehicle/app	Follows overall charging approach	Follows overall charging approach	Follows overall charging approach	Follows overall charging approach
Vehicle data available in Trip & Charge log	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Partial availability – total distance added will not be available
Ability for contract certs to	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Yes

be replaced after expiration				
Notifications				
Plug & Charge setup, re-enable or disable notifications in app/vehicle	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Yes
Any payment related error shown in vehicle	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Yes
EVSE or vehicle failure in authorization process (e.g. certificate rejected by EVSE) shown in app/vehicle	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Yes
Charge event summary (cost + vehicle data) shown in vehicle	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Partial availability – total distance added will not be available
"Charging Receipt" notification shown in app	Yes – doesn't come from vehicle	Yes – doesn't come from vehicle	Yes	Yes
Issue with expired certificate removal and reinstall in app	No – PnC ECG app is turned off in vehicle	No – PnC ECG app is turned off in vehicle	Yes	Yes

2.1.1.2 PNC-REQ-326840/A-Contract Certificate Installation

Using the vehicle VIN#, Ford can retrieve the OEM Provisioning Certificate and corresponding OEM Provisioning Public Key installed in the OBCC module of the customer vehicle. Using these files, along with additional files supplied by the Ford Mobility Operator partner, Ford will create a Charging Contract Certificate and associated data files.
Contract Certificates are unique for each mobility operator authorizing payment for charging station operators in various markets (e.g., EU and US).
A Contract Certificate Data Package is comprised of several data elements:

- Module FESN (of the target OBCC)
- Charging Contract Certificate
- Charging Contract Private Key
- Mobility Operator Sub-CA Certificate Chain
- eMobility Account ID (EMAID)

The eMAID, encoded as the Subject field of the Charging Contract Certificate, is sent to the charging station by the vehicle OBCC when starting a charging session. The eMAID is needed by the back-end billing and payment system of the Mobility Operator to identify and authorize payment on a valid Plug & Charge agreement.

2.1.1.3 PNC-REQ-326841/A-Contract Data Package Delivery

- The Contract Certificate Data Package will be encrypted using the OEM Provisioning Certificate Public Key installed in the vehicle OBCC module. Additionally, the Data Package will be signed using a separate Private Key provided by Ford IVSS.

- The Contract Data Package is sent to the vehicle via the Ford Telematics system. The Data Package is received by the vehicle Telematics Control Unit (TCU), routed to the OBCC module through the Enhanced Communication Gateway (ECG) via Ethernet and then authenticated by the OBCC module using a pre-installed IVSS Public Key.
- The OBCC then retrieves the OEM Provisioning Private Key stored in the Hardware Security Module (HSM), decrypts the Contract Data Package, and extracts various data elements. The OBCC module installs the Charging Contract Certificate in non-volatile RAM (NVR) and the Contract Private Key in the HSM.

2.1.1.4 PNC-REQ-326842/A-V2G Root Certificate Delivery

V2G Root Certificates are issued by a Certificate Authority designated for a given global region. They are used as the basis for checking other derived PnC certificates to ensure they are genuine and trustworthy.

In order to use the Plug and Charge feature, a complement of (2 – 10) V2G Root Certificates must be installed in the OBCC modules of vehicles operating in that a given global region.
The vehicle OBCC module uses V2G Root Certificates to authenticate charging stations using the ISO 15118-2 standard protocol and establish a secure, encrypted communication session. Which complement of V2G Root Certificates are needed will be determined by the Charging Contract Certificates created and sent to the vehicle upon user activation of the PnC feature.

Using a mechanism similar to that used to install Charging Contract Certificates via the Telematics system, the compliment of V2G Root Certificates needed by the vehicle to operate in that given region.

2.1.1.5 PNC-REQ-326843/A-Storing Setting in the Cloud

After the vehicle enables Plug & Charge, a confirmation is sent to the Cloud. The expiration date of the contract cert and the VIN to ESN mapping for the OBCC are also stored by the cloud. The PnC element stored in the cloud is now enabled.

2.1.1.6 PNC-REQ-330363/B-Installing Certificate Payload in Vehicle

Cloud:
If user enables PnC and correct certs are not already installed in the vehicle (cloud logic)
THEN send PnCManageCertificate Command with SyncP Payload to ECG

ECG:
Sends SyncP Payload to OBCC Module by using SyncPRequest Diagnostic Routine

Response from OBCC:
After completing the certificate Service request by SyncP Request, OBCC shall send a Positive Diagnostic Routine to the control Routine with a Payload of a SyncP packet.

ECG:
ECG receives SyncP response signed with OBCC SyncP key from OBCC module and sends SyncP response as an "PnCManageCertificatestatus Alert" to the Cloud

Retry Strategy:
ECG shall do Retry 3 times if SyncP Request Diagnostic Routine timeout or fail to Receive Command Response after 10 sec and 10s will be calibrated value.

Enabling PnC:
OBCC:
After Certificates are Successful Installed, OBCC Enable the PnC Feature and send status to BCCM and ECG

2.1.1.7 PNC-REQ-326844/C-Plug And Charge On Confirmation

Once Plug & Charge has successfully been enabled, a notification will be sent to the user via FordPass and in vehicle indicating that they are set to use PnC.
If for any reason there is a failure in enabling Plug & Charge, only a FordPass notification will be sent.

SUCCESS
ECG:
If state of signal changes from DgtlCommPnc_D_Stat = NoContractsInstalled to Enable, indicating PnC is now enabled In-Vehicle
THEN send PnCFeatureStatus alert to the cloud
(FordPass notification: Plug & Charge enabled)

Non-Correlated Alert:
ECG sends PnCFeatureStatus alert as non-correlated Alert if there is any state change in OBCC Module

In-Vehicle HMI Notification:
- If signal changes from DgtlCommPnc_D_Stat = NoContractsInstalled to Enable, indicating PnC is now enabled in-vehicle SYNC shall detect Signal Change and display PnC has been enabled successfully Message in Vehicle HMI by subscribing to the ECG's VIM CAN signals directly.
(Vehicle HMI notification: Plug & Charge enabled)
- SYNC shall Persist last received CAN Signal value and compare with new incoming CAN Signal value upon every vehicle Key-on events.

2.1.2 Use Cases

2.1.2.1 PNCv1-UC-REQ-320369/A-Enabling PnC while CCS is Turned Off

Actors	User
Pre-conditions	CCS is turned off
Scenario Description	User enables Plug and Charge
Post-conditions	User is prompted in Ford Pass to turn on CCS for best user experience.
List of Exception Use Cases	
Interfaces	Phone HMI

2.1.2.2 PNCv1-UC-REQ-320370/D-Onboarding Success - Contract Certificate Installation is Completed and PnC is Enabled

Actors	FordPass user
Pre-conditions	1. User registers for FordPass app 2. User has Authorized Vehicle 3. User sets up wallet 4. User selects subscription in FordPass 5. CCS settings are enabled 6. Cloud Connectivity is Available 7. Vehicle is key on and Center Stack is Activated
Scenario Description	The Customer Enable Plug and Charge in FordPass
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Cloud will Check Whether Contract Cert's are installed in the Vehicle 3. If No, PAAK FI will Sends request to IVSS for Contract Certificate 4. IVSS Creates Charging Contract Data associated with VIN# 5. IVSS Sends eMAID to Mobility Operator to Create Customer Account 6. IVSS Package Secure Payload for Telematics Delivery

	7. IVSS Sends Secure Payload data to PAAK FI 8. PAAK FI Sends Payload Data to VSDN 9. VSDN Sends Payload Data to Vehicle's ECG 10. ECG Shall Sends Diagnostic Routine Command to OBCC with Payload Data 11. OBCC Install the Certificates and Enable the PnC Feature 12. OBCC Sends Diagnostic Command Response and PnC Feature status Signal to ECG 13. ECG Sends PnCManageCertificatestatus Alert to Cloud 14. ECG Sends PnCFeatureStatus alert to the cloud 15. Message on Centerstack tells the user "Plug & Charge is now active on this vehicle. Charging will now start automatically when you plug in to a Plug & Charge-enabled station in the Ford network, and your account will be billed." 16. User receives a Notification in FordPass that tells "Plug & Charge is now active on this vehicle. Charging will now start automatically when you plug in to a Plug & Charge-enabled station in the Ford network, and your account will be billed."
List of Exception Use Cases	
Interfaces	Vehicle interface, Centerstack HMI, Offboard HMI, Offbaord interface

2.1.2.3 PNCv1-UC-REQ-320371/B-Onboarding Success – Vehicle HMI not Active

Actors	FordPass user
Pre-conditions	1. User registers for FordPass app 2. User has Authorized Vehicle 3. User sets up wallet 4. User selects subscription in FordPass 5. CCS are Enabled 6. Cloud Connectivity is Available 7. Vehicle is key off and Center Stack is deactivated (User must clear notification, disappears if ignored during current key cycle)
Scenario Description	The Customer Enable Plug and Charge in FordPass
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Cloud will Check Whether Contract Cert's are installed in the Vehicle 3. If No, SDN will Sends request to IVSS for Contract Certificate 4. IVSS Creates Charging Contract Data associated with VIN# 5. IVSS Sends eMAID to Mobility Operator to Create Customer Account 6. IVSS Package Secure Payload for Telematics Delivery 7. IVSS Sends Secure Payload data to SDN 8. SDN Sends Payload Data to VSDN 9. VSDN Sends Payload Data to Vehicle's ECG 10. ECG Shall Sends Diagnostic Routine Command to OBCC with Payload Data 11. OBCC Install the Certificates and Enable the PnC Feature 12. OBCC Sends Diagnostic Command Response and PnC Feature status Signal to ECG 13. ECG Sends PnCManageCertificatestatus Alert to Cloud 14. ECG Sends PnCFeatureStatus alert to the cloud

	15. Message on Centerstack tells the user “Plug & Charge is now active on this vehicle. Charging will now start automatically when you plug in to a Plug & Charge-enabled station in the Ford network, and your account will be billed.” 16. User receives a Notification in FordPass that tells “Plug & Charge is now active on this vehicle. Charging will now start automatically when you plug in to a Plug & Charge-enabled station in the Ford network, and your account will be billed.”
List of Exception Use Cases	
Interfaces	Vehicle interface, Centerstack HMI, Offboard HMI, Offbaord interface

2.1.2.4 PNCv1-UC-REQ-320372/A-Onboarding success – vehicle authorization message is displayed along with PnC enabled message

Actors	User
Pre-conditions	User has registered for FordPass User has authorized vehicle Wallet is set up CCS are enabled User has not turned on vehicle since authorization User has enabled Plug and Charge
Scenario Description	User keys on and dismisses vehicle authorization message
Post-conditions	PnC enabled message is displayed in center stack
List of Exception Use Cases	
Interfaces	Vehicle Interface, Offboard Interface, Centerstack HMI

2.1.2.5 PNCv1-UC-REQ-320373/A-Onboarding failure, When the SDN fails to Send request to IVSS for Contract Certificates

Actors	FordPass user
Pre-conditions	1. User registers for FordPass app 2. User has Authorized Vehicle 3. User sets up wallet 4. User selects subscription in FordPass 5. CCS are Enabled 6. Cloud Connectivity is Available
Scenario Description	Onboarding failure, When the SDN fails to Send request to IVSS for Contract Certificates
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Cloud will Check Whether Contract Cert’s are installed in the Vehicle 3. If No, SDN will Sends request to IVSS for Contract Certificate 4. SDN fails to Sends Request to IVSS for Contact Certificates 5. User receives a PnC Failure Notification in FordPass

List of Exception Use Cases	
Interfaces	Offboard interface, Offboard HMI

2.1.2.6 PNCv1-UC-REQ-320375/B-Onboarding failure, No Cloud to Vehicle Connectivity

Actors	FordPass user
Pre-conditions	1. User registers for FordPass app 2. User has Authorized Vehicle 3. User sets up wallet 4. User selects subscription in FordPass 5. CCS are Enabled
Scenario Description	Onboarding failure, No Cloud to Vehicle Connectivity
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Cloud will Check Whether Contract Cert's are installed in the Vehicle 3. If No, SDN will Sends request to IVSS for Contract Certificate 4. IVSS Creates Charging Contract Data associated with VIN# 5. IVSS Sends eMAID to Mobility Operator to Create Customer Account 6. IVSS Package Secure Payload for Telematics Delivery 7. IVSS Sends Secure Payload data to SDN 8. SDN Sends Payload Data to VSDN 9. VSDN Shall fails to Send Contract Cert's Payload data and PnC Enable Command to ECG 10. VSDN retries X time to Connect the Vehicle 11. User receives a PnC Failure Notification in FordPass
List of Exception Use Cases	
Interfaces	Offboard interface, Offboard HMI

2.1.2.7 PNCv1-UC-REQ-324759/B-Onboarding failure, Downstream Module Error

Actors	FordPass user
Pre-conditions	1. User registers for FordPass app 2. User has Authorized Vehicle 3. User sets up wallet 4. User selects subscription in FordPass 5. CCS are Enabled 6. Cloud Connectivity is Available
Scenario Description	Onboarding failure, Downstream Module Error
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Cloud will Check Whether Contract Cert's are installed in the Vehicle 3. If No, SDN will Sends request to IVSS for Contract Certificate 4. IVSS Creates Charging Contract Data associated with VIN# 5. IVSS Sends eMAID to Mobility Operator to Create Customer Account 6. IVSS Package Secure Payload for Telematics Delivery 7. IVSS Sends Secure Payload data to SDN 8. SDN Sends Payload Data to VSDN

	9. VSDN Sends Payload Data to Vehicle's ECG 10. ECG Shall Sends Diagnostic Routine Command to OBCC with Payload Data 11. ECG Fails to Send or OBCC fails to Process Diagnostic Routine Command 12. ECG will do 3 Retry if command failed or timeout 13. User receives a PnC Failure Notification in FordPass
List of Exception Use Cases	
Interfaces	Vehicle interface, Offboard interface, Offboard HMI

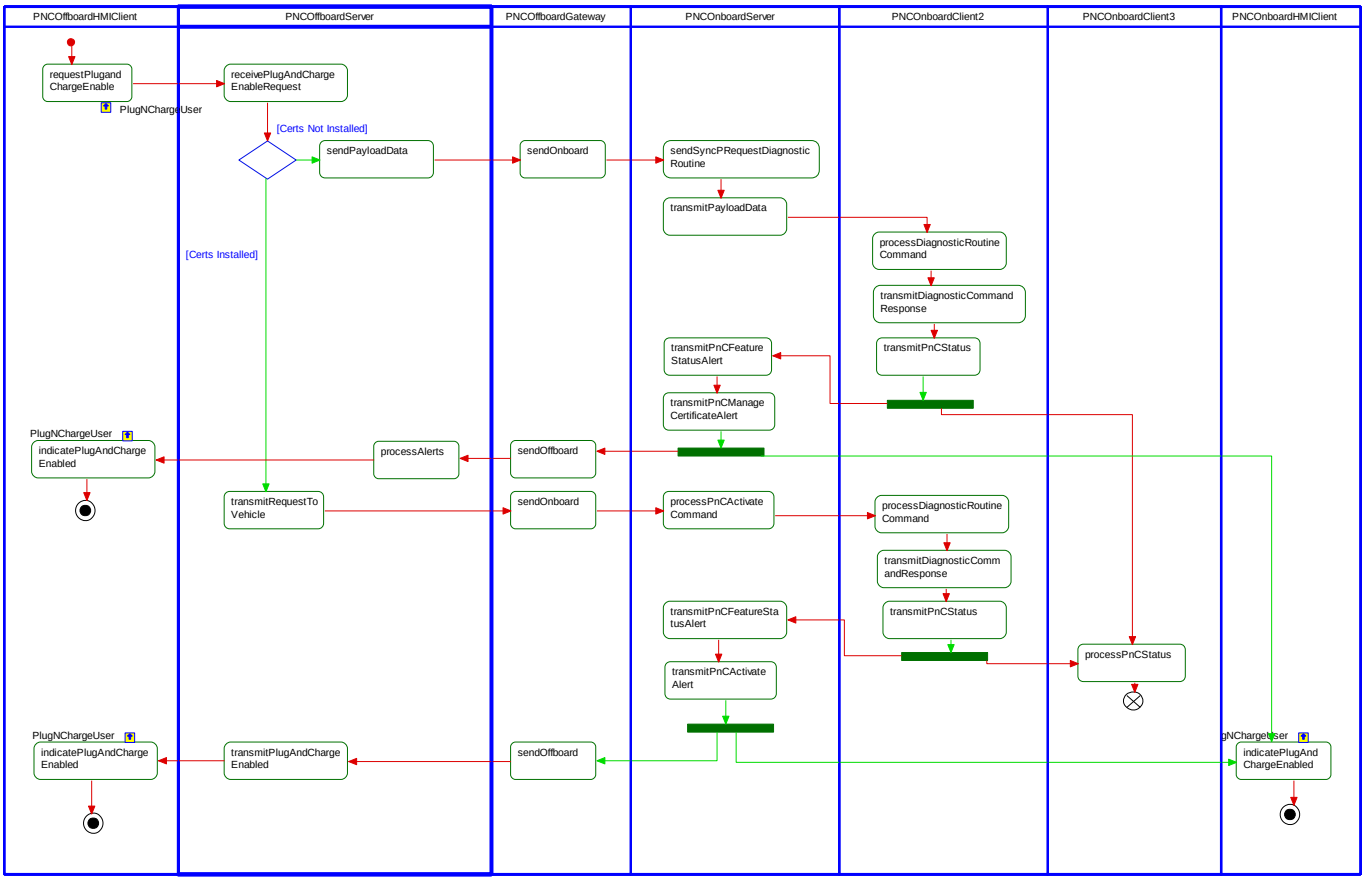
2.1.2.8 PNCv1-UC-REQ-324836/A-Onboarding failure, when No FordPass to Cloud Connectivity

Actors	FordPass user
Pre-conditions	1. User registers for FordPass app 2. User has Authorized Vehicle 3. User sets up wallet 4. User selects subscription in FordPass 5. CCS are Enabled
Scenario Description	Onboarding failure, when No FordPass to Cloud Connectivity
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Command in Progress for 120 sec in FordPass 3. FordPass shows PnC enable failure Notification
List of Exception Use Cases	
Interfaces	Offboard interface, Offboard HMI

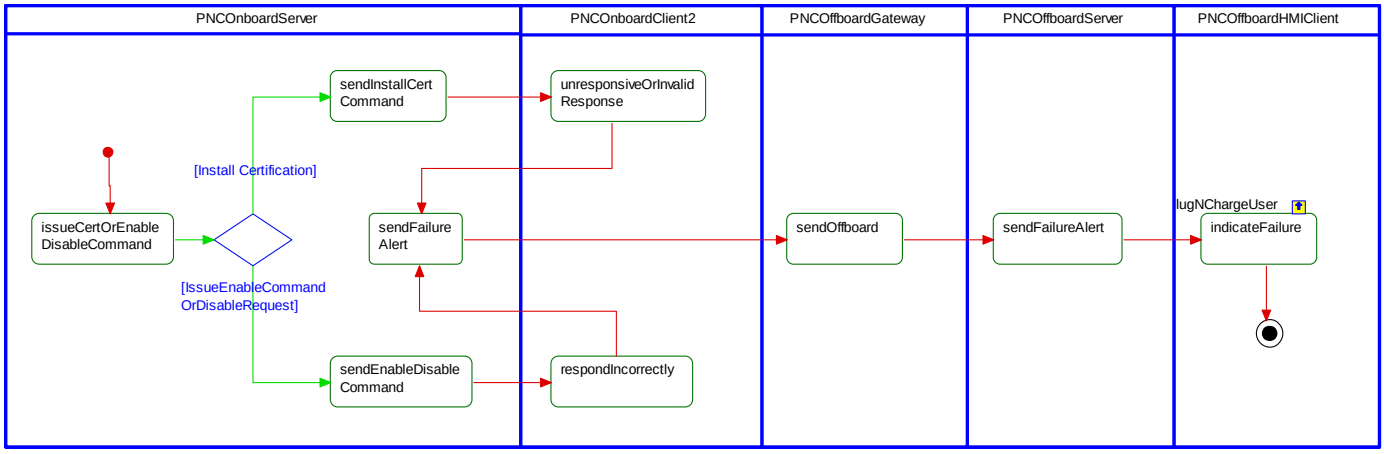
2.1.3 White Box Views

2.1.3.1 Activity Diagrams

2.1.3.1.1 PNC-ACT-REQ-326382/B-Enabling PnC

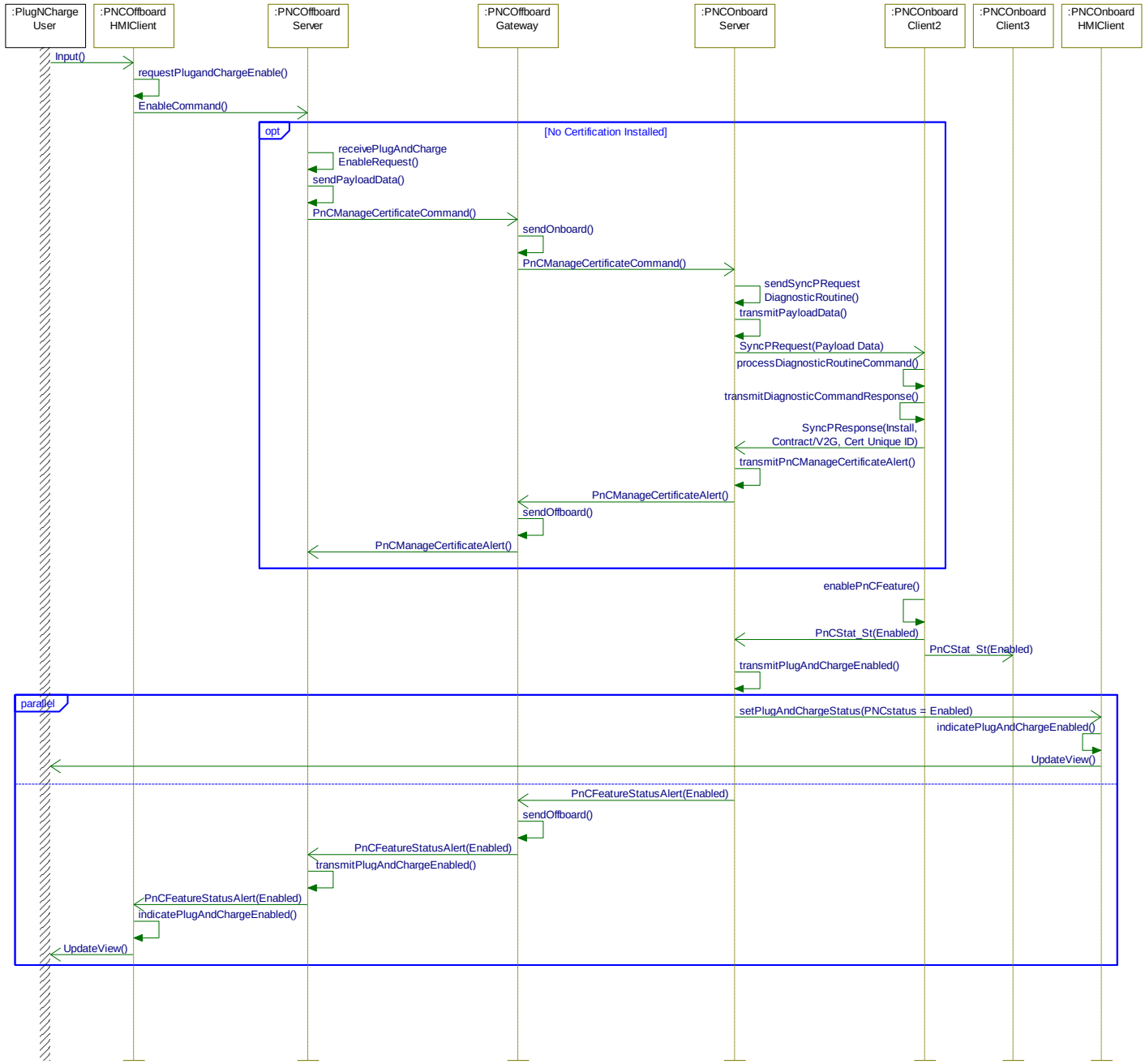


2.1.3.1.2 PNC-ACT-REQ-326383/B-Enabling Disabling Or Certification In Vehicle failure

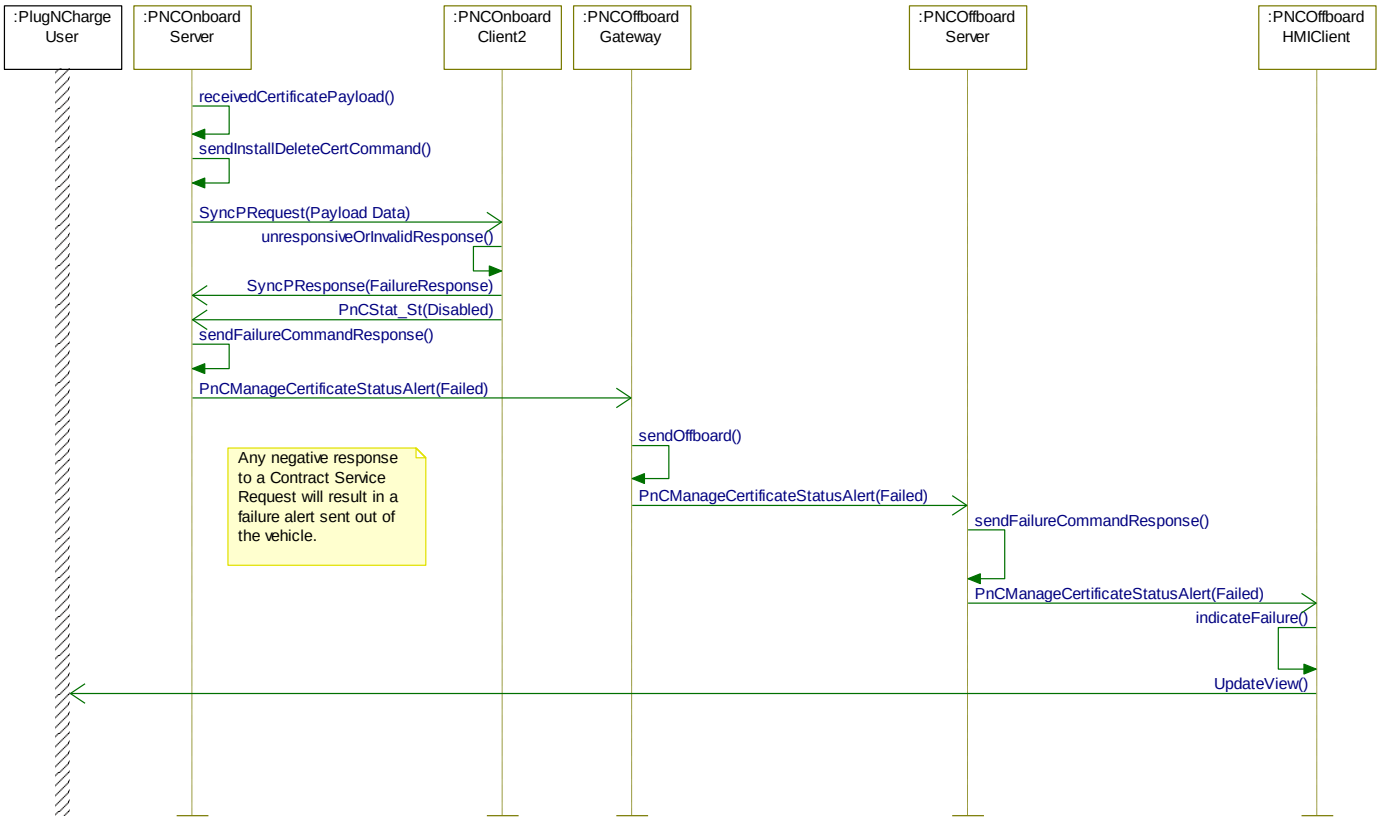


2.1.3.2 Sequence Diagrams

2.1.3.2.1 PNC-SD-REQ-326490/B-Onboarding and Enabling Plug and Charge



2.1.3.2.2 PNC-SD-REQ-326533/B-Onboarding or Enabling-Disabling Failures



2.2 PNC-FUN-REQ-324739/A-Warm Welcome

2.2.1 Requirements

2.2.1.1 PNC-REQ-326855/A-Warm Welcome/Geofencing

A Warm Welcome occurs when the driver navigates to one of the following using the in-vehicle Nav HMI:

- A charging station
- ANY destination with a charging station within X meters, where X is a configurable value

When the user gets close to the station, the Nav HMI will guide the user to charge by displaying useful information such as how much it will cost to charge and what stations are available. This feature will be an enhancement to the existing welcome feature Nav currently offers.
The flowchart below displays the process of receiving a Warm Welcome when approaching a charge station.

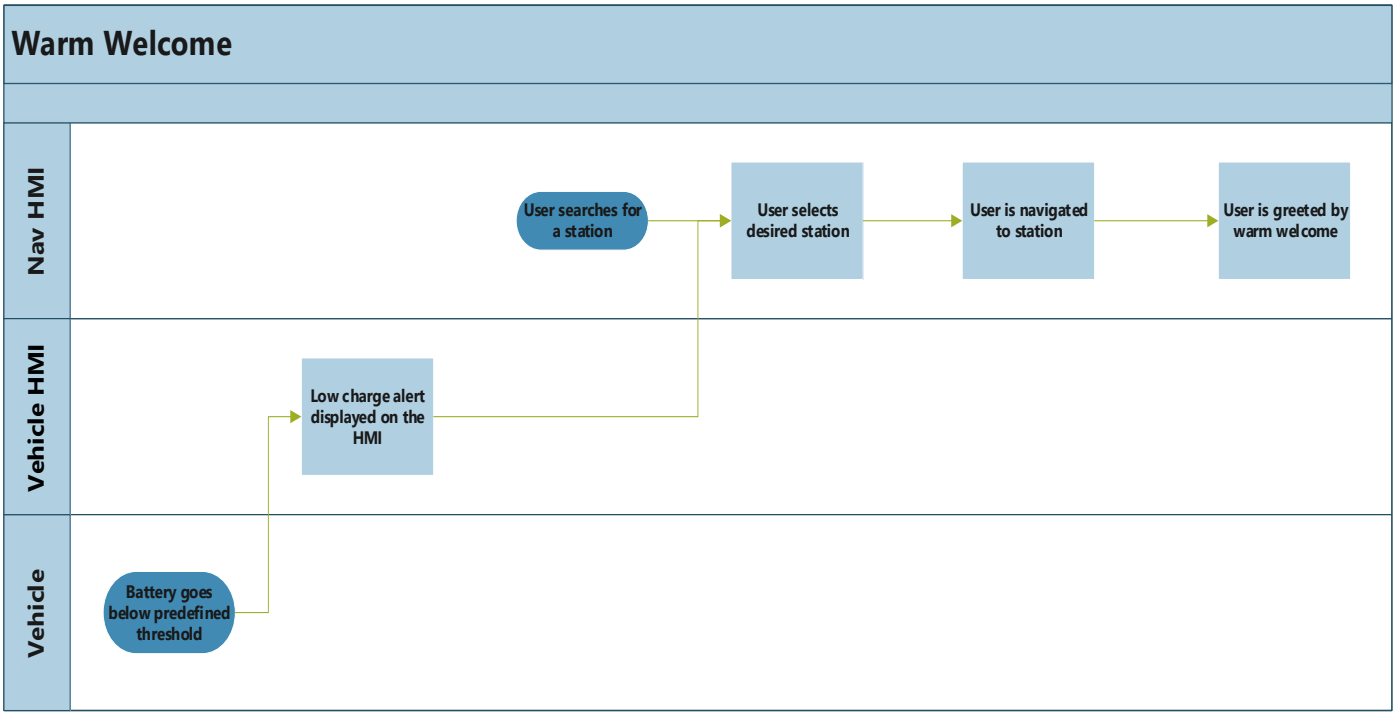


Figure 1: How User Can Receive Warm Welcome

2.2.1.2 PNC-REQ-326856/A-Receiving Warm Welcome

When the user is within a predefined distance of the station, they will be prompted with the Warm Welcome. A Warm Welcome will be received regardless of whether the station type is Plug & Charge capable. The user will receive a warm welcome when navigating to a station. If the user is not using in-vehicle navigation to get to a station, he/she will not see the warm welcome screen.
When the user is within the defined distance from the station, the following will occur:

1. Mobility operator sends charge station information to Nav cloud
2. Nav cloud sends charge station information to Nav HMI via IP pass through
3. Nav HMI displays relevant information, as detailed in the next section

2.2.1.3 PNC-REQ-326857/A-Warm Welcome Display Content

The Warm Welcome will display the following information in the HMI:

- Which station is available
- Charger speed
- Connector Type
- EV Charger-based pricing
- Estimated time to full charge, which will be based on the charger speed information provided (if user is on an active EV trip planner route, also display estimated charge time to target SOC required by EV trip planner to reach next waypoint, and target SOC %)
- Charging speed
- Plug & Charge capable
- In-network versus out of network

2.2.2 Use Cases

2.2.2.1 PNCv1-UC-REQ-329369/A-Customer wants charge location information to automatically appear at destination arrival

Actors	Vehicle Occupant
Pre-conditions	Electric Vehicle Ignition switch is in RUN / Accessory Infotainment system is ON Navigation application equipped **Navigation route is active** Connectivity available Current vehicle range, “DTE” Maximum vehicle range when fully fueled
Scenario Description	User plans a route and arrives at charge Station POI
Post-conditions	At x distance before destination, the system displays warm welcome screen to include the following information: - Station availability (hours of operation) - Charger speed - Connector Type - EV Charger-based pricing - Estimate time to full charge, which we be based on the charger speed - Charging speed - Plug & Charge capable - In-network versus out of network
List of Exception Use Cases	E1- No charging station data available E2- Non Charge Station POI E3- x distance is not detected due to errors in map
Interfaces	Connection Manager TCU/Ford Mobility Cloud interface Premium data provider in Cloud Navigation services G-HMI (Graphic HMI) Map data Voice services

2.2.2.2 PNCv1-UC-REQ-329370/A-E1 - No Charge Station Data Available

Actors	Vehicle Occupant
Pre-conditions	Same as normal use case
Scenario Description	Same as normal use case
Post-conditions	Welcome screen information will not be displayed
List of Exception Use Cases	n/a
Interfaces	Same as normal use case

2.2.2.3 PNCv1-UC-REQ-329371/A-E2 - Non Charge Station POI

Actors	Vehicle occupant
Pre-conditions	Same as normal use case
Scenario Description	Same as normal use case
Post-conditions	Welcome screen information will not be displayed
List of Exception Use Cases	n/a
Interfaces	Same as normal use case

2.2.2.4 PNCv1-UC-REQ-329372/A-E3 - X Distance is Not Detected Due to Errors in Map

Actors	Vehicle occupant
Pre-conditions	Same as normal use case
Scenario Description	Same as normal use case
Post-conditions	Welcome screen information will not be displayed
List of Exception Use Cases	n/a
Interfaces	Same as normal use case

2.3 PNC-FUN-REQ-324745/A-Plug In and Charge Begin

2.3.1 Requirements

2.3.1.1 PNC-REQ-326846/A-Plug And Charge Begin

When the user plugs in, a certificate exchange will occur in the background and once the process has successfully completed, charging will begin. The process between plugging in and charge beginning will take no more than 5 seconds. The assessment of whether charging should be permitted needs to be completed before charging begins based on business rules that need to be defined later.

When Plug & Charge is on, after the user plugs into a P&C capable charging station, the following can occur:

1. Charge begin is successful
2. Charge begin is unsuccessful

2.3.1.2 PNC-REQ-326848/A-Vehicle Trust of EVSE

The vehicle must first authenticate the EVSE through the following steps:

- The Vehicle's OBCC Authenticates the EVSE leaf Certificate and Validity of the public key by checking the signature with the V2G Root Certificate authority (note: a message encrypted with a public key can only be decrypted using its private key)
- The Vehicle's OBCC checks signatures of the Leaf Provisioning Certificate against the V2G Root certificates stored onboard the Vehicle

- After authenticating the vehicle can trust that this part of the message element originated from an Authorized Counterpart

The vehicle time signals will ensure that the charging station certificate expiration date will be compared against an accurate time and date.

2.3.1.3 PNC-REQ-326845/D-Charge Begin Unsuccessful

After the user plugs in the vehicle, if charging does not immediately begin, the user will receive a notification on FordPass and will see a charging status display in the vehicle. See below for list of possible errors.

8 second auto-dismiss messages (no sound alert)

Reason for Error	**Auth. Types**	**Region (NA/EU/Both)**	**In Vehicle status/notification (center stack HMI)**	**Sample Copy**
ISO, out of network station	P&C	Both	Message displayed (Show only when the Feature is Enabled in the Vehicle)	This charging station is out of the Ford network. To charge here, please plug in again and follow the instructions on the station.
Non-ISO, out of network station	App, RFID	Both	No In-Vehicle Notification	This charging station is out of the Ford network. To charge here, please follow instructions on the station.
Non-ISO station, in network station	P&C	EU	No In-Vehicle Notification	To charge here, please use the FordPass app or your RFID card.
Non-ISO station, in network station	P&C	NA	No In-Vehicle Notification	To charge here, please use the FordPass app.
Backend system failures	P&C, App, RFID	EU	Error message displayed on screen	Something went wrong. To charge here, please plug in again and use the FordPass app or your RFID card. If this continues, follow the instructions on the station to start charging.
Backend system failures	P&C, App	NA	Error message displayed on screen	Something went wrong. To charge here, please plug in again and use the FordPass app. If this continues, follow the instructions on the station to start charging.
EVSE or vehicle failure in authorization process (e.g. certificate	P&C	EU	Error message displayed on screen telling user to use other means to authenticate	Something went wrong. To charge here, please plug in again and use the FordPass app or your RFID card.

rejected by EVSE)				
EVSE or vehicle failure in authorization process (e.g. certificate rejected by EVSE)	P&C	NA	Error message displayed on screen telling user to use other means to authenticate	Something went wrong. To charge here, please plug in again and use the FordPass app.

The logic for notifications above is detailed in the sections below.

2.3.1.4 PNC-REQ-330368/B-Disabling or Re-Enabling PnC due to failure

Plug & Charge is disabled if there are any failure states reported by the charging station (EVSE) so that the user can utilize external means of payment.

OBCC:
1. OBCC Reports EVSE fault to ECG via DgtlCommGtwy_D_Falt does not equal to No Fault State
2. OBCC Disable the feature and Send DgtlCommPnc_D_Stat = Faulty Status to BCCM and ECG

ECG:
ECG Receives DgtlCommPnc_D_Stat = Faulty Status Signal from OBCC

No alert sent to the cloud and the user is not notified in the vehicle HMI and FordPass that PnC has been disabled.
Re-enabling PnC:

OBCC:
1. When TrnRng_D_Rq changes state from 0x0: Park, to any other state Considering Vehicle moves from the Current Charging Station.
2. OBCC Re-enable the PnC Feature and Sends DgtlCommPnc_D_Stat = Enable Status to ECG and BCCM

ECG:
ECG Receives DgtlCommPnc_D_Stat = Enable Status Signal from OBCC

APIM:
If DgtlCommPnc_D_Stat Signal Changes from faulty to enable don't show any Notification on Vehicle HMI

No alert sent to the cloud and the user is not notified in the vehicle HMI and FordPass App that PnC has been enabled

2.3.1.5 PNC-REQ-330365/B-Notifications at Public Stations

The notification logic for the following notifications will only occur if the user plugs into a station that is contained by the VPOI data.

- PnC capable, in network
- PnC capable, out of network
- Non PnC capable, in network
- Non PnC capable, out of network

2.3.1.6 PNC-REQ-330367/C-EVSE ID and Station Charge Schedule Information

The vehicle will capture EVSE ID and deliver it to the Cloud when the user plugs into any type of digital charging station regardless of whether PnC is on.
Rule:

ECG shall monitor ChrgrInPwMde_D_Actl CAN Signal with 0x4= AcDigital, 0x5= DcCharging and send Request ChargeStationID_Rq TP signal to OBCC Module and OBCC Module shall sends ChargeStationID_St TP Signal with EVSE ID and TLS charging info and ChargeStationSchedule_St TP Signal with Station Schedule information to ECG. ECG sends PnCChargingStationInfo alert which includes the ChargeStationID_St and ChargeStationSchedule_St TP Messages.

2.3.1.7 PNC-REQ-337332/B-Sending whether Vehicle is Charging using TLS or No TLS

When the user plugged In at EVSE which supports digital communication the OBCC shall report to the ECG, whether or not each connection to an EVSE is using TLS using ChargeStationID_St TP

ECG Logic:
ECG shall monitor ChrgrInPwMde_D_Actl CAN Signal with 0x4= AcDigital, 0x5= DcCharging and send Request ChargeStationID_Rq TP signal to OBCC Module and OBCC Module shall sends ChargeStationID_St TP Signal with EVSE ID and TLS charging info and ChargeStationSchedule_St TP Signal with Station Schedule information to ECG. ECG sends PnCChargingStationInfo alert which includes the ChargeStationID_St and ChargeStationSchedule_St TP Messages.

2.3.1.8 PNC-REQ-372234/A-Send GPS Signal in PnCChargingStationInfoAlert

When ECG triggers “PnCChargingStatioInfoAlert" has planned need to include latest GPS coordinate signals as additional enumeration in this alert payload.

2.3.1.9 PNC-REQ-330369/D-ISO/In network HMI error

The vehicle HMI and FordPass will display an error message when the user plugs into a station that is not both ISO compliant and in-network.

ECG shall monitor ChrgrInPwMde_D_Actl CAN Signal with 0x4= AcDigital, 0x5= DcCharging and DgtlCommGtwyMde_D_Stat = 0x2: DC PnC OR 0x5: AC PnC OR 0x3: DC EIM/PnC OR 0x6: AC EIM/PnC, all of which signify ISO stations and Send a "PnCChargingStationInfo" alert with this Encoder states to the cloud.
And Station is out of network, as determined by Nav VPOI data then cloud shall send PnCStationType command to the Vehicle.
AND ChrgLocIDCurnt_D_SAV and ChrgLocIdCurnt_D_Uns do not return a number between 1 and 10, indicating user is NOT at a recent or saved location and DgtlCommPnc_D_Stat = 0x3: Enable then ECG sends SoaHmiMessage “DISPLAY_STATION_TYPE = 0x0: PnC Supported, Out of Network” to APIM then SYNC shall display "ISO, Out of network station" notification.

ECG shall monitor ChrgrInPwMde_D_Actl CAN Signal with 0x4= AcDigital, 0x5= DcCharging and DgtlCommGtwyMde_D_Stat = 0x1: DC EIM OR 0x4: AC EIM, both of which signify non PnC stations and Send a "PnCChargingStationInfo" alert with this Encoder states to the cloud.

ECG shall monitor ChrgrInPwMde_D_Actl CAN Signal with 0x4= AcDigital, 0x5= DcCharging and DgtlCommGtwyMde_D_Stat = 0x1: DC EIM OR 0x4: AC EIM, both of which signify non PnC stations and Send a "PnCChargingStationInfo" alert with this Encoder states to the cloud.

If you receive Non PNC Supported In Network or Non PNC Supported Out Of Network ECG shall ignore these command encoding types from the Cloud.

2.3.1.10 PNC-REQ-330371/C-Payment or Backend issues

When there is a Payment error Cloud shall send PnCAuthorizationError command to the vehicle indicating the failure type. When the Vehicle Receives the PnCAuthorizationError Command, the Ethernet message relays the same failure information to the APIM.

- 0x0: Payment subscription balance is low
- 0x1: Payment balance has run out
- 0x2: Charging account is overdue, but charging is still allowed (post-pay account)
- 0x3: Charging account is overdue and charging is suspended (post-pay account)

- 0x4: Payment method issue for variable fees or monthly subscription fees
- 0x5: Backend system failure has occurred

2.3.1.11 PNC-REQ-330373/C-EVSE or vehicle failure in charging setup process (e.g. certificate rejected by EVSE)

APIM:
- IF DgtlCommGtwy_D_Falt does not equal 0x0: no fault
SYNC shall detect Signal Change and display "EVSE or vehicle failure in charging set up" error message in vehicle HMI by subscribing to the ECG's VIM CAN signals directly.
- SYNC shall Persist last received CAN Signal value and compare with new incoming CAN Signal value upon every vehicle Key-on events.

ECG:
IF DgtlCommGtwy_D_Falt does not equal 0x0: no fault
THEN send PnCChargeStationFault alert to the cloud indicating failure reason
(FordPass notification: "EVSE or vehicle failure in charging set up")

2.3.1.12 PNC-REQ-330374/B-Clearing charging related errors

Any vehicle HMI error message related to charging will be cleared in the center stack if charging successfully begins before the user turns on the vehicle.

APIM:
IF ChrgStat_D2_Dsply changes from 0x0: Not ready
TO
0x7: Charging – AC, 0x8: Charging – DC, 0x9: Charging - Inductive, or 0xA: Charging – System Maintain, before next ignition cycle
THEN SYNC shall cleared error notifications in Vehicle HMI

2.3.2 Use Cases

2.3.2.1 PNCv1-UC-REQ-324838/B-User is Authorized to Charge - Charge Begin is Successful

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is on 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle configured for NA or EU region
Scenario Description	User Plugs into In Network ISO Station
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq = 0x1: AttemptDgtlComm 5. OBCC starts communication with EVSE 6. EVSE sends leaf certificate with public key to the OBCC Via PLC and Establish TLS communication 7. OBCC Authenticates the leaf certificate and Validity of the Public key 8. EVSE Informs OBCC that it supports PnC 9. OBCC reports to BCCM that EVSE supports PnC via DgtlCommGtwyMde_D_St

	10. Since PnC is Enabled, OBCC continues with PnC mode via DgtlCommGtwyMde_D_Rq 11. OBCC Sends “PaymentDetailsREQ message” to the EVSE, which includes the Vehicle Contract Certificate and eMAID 12. EVSE receives PaymentDetailsREQ message 13. EVSE Authenticates the contract certificate Credentials locally by use one of its Stored MO Root Certificates 14. EVSE sends eMAID of the request message to the Mobility Operator 15. Mobility operator authorizes eMAID and sends eMAID to the Ford monetization platform 16. Monetization platform verifies payment method 17. Monetization platform sends authorization response to MO 18. Mobility operator tells EVSE to start charging 19. EVSE starts charging the Vehicle 20. Cloud Receives Alert from the Vehicle Indicating Charging has begun along with EVSE ID 21. User is Notified that Charging has Begun in Vehicle (Out of Scope for PnC) 22. User receives Charge Begin Notification and Charge Status in FordPass
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.2 PNCv1-UC-REQ-324843/B-User Plugs into Network ISO station and EVSE Failure in Charging Authentication and Authorization Process (EU)

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle Configured for **EU** Region
Scenario Description	EVSE Failure in Charging Authentication and Authorization Process (EU)
Post-conditions	1. User Plugs into In Network ISO Station 2. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 3. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 4. BCCM detects Pilot indicative of digital communications 5. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq = AttemptDgtlComm 6. OBCC starts communication with EVSE 7. EVSE Informs OBCC that it supports PnC 8. OBCC reports to BCCM that EVSE supports PnC via DgtlCommGtwyMde_D_St 9. Since PnC is Enabled, OBCC continues with PnC mode via DgtlCommGtwyMde_D_Rq 10. EVSE sends leaf certificate with public key to the OBCC Via PLC Communication 11. OBCC fails to Authenticates the leaf certificate and validity of the Public key 12. OBCC Send failure Signal to ECG, ECG to APIM and backend

	13. Message on Centerstack (8 Sec Auto Dismiss Message) tells user “There was an error with the transaction. To charge at this station, please plug in again and use FordPass or RFID card.” 14. Vehicle Sends an Alert to the Cloud 15. User receives a Notification in FordPass that tells “There was an error with the transaction. To charge at this station, please plug in again and use FordPass or RFID card.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.3 PNCv1-UC-REQ-325360/B-User Plugs into Network ISO station and EVSE Failure in Charging Authentication and Authorization Process (NA)

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle Configured for **NA** Region
Scenario Description	EVSE Failure in Charging Authentication and Authorization Process (NA)
Post-conditions	1. User Plugs into In Network ISO Station 2. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 3. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 4. BCCM detects Pilot indicative of digital communications 5. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq = AttemptDgtlComm 6. OBCC starts communication with EVSE 7. EVSE Informs OBCC that it supports PnC 8. OBCC reports to BCCM that EVSE supports PnC via DgtlCommGtwyMde_D_St 9. Since PnC is Enabled, OBCC continues with PnC mode via DgtlCommGtwyMde_D_Rq 10. EVSE sends leaf certificate with public key to the OBCC Via PLC Communication 11. OBCC fails to Authenticates the leaf certificate and validity of the Public key 12. OBCC Send failure Signal to ECG, ECG to APIM and backend 13. Message on Centerstack (8 Sec Auto Dismiss Message) tells user “There was an error with the transaction. To charge at this station, please plug in again and use FordPass.” 14. Vehicle Sends an Alert to the Cloud 15. User receives a Notification in FordPass that tells “There was an error with the transaction. To charge at this station, please plug in again and use FordPass.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.4 PNCv1-UC-REQ-324847/B-User Plugs into ISO, Out of Network Station

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	User Plugs into ISO, out of network station (Do not display at known charging locations)
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq = AttemptDgtlComm 5. OBCC starts communication with EVSE 6. EVSE Informs OBCC that it supports PnC 7. OBCC reports to BCCM that EVSE supports PnC via DgtlCommGtwyMde_D_St 8. Since PnC is Enabled, OBCC continues with PnC mode via DgtlCommGtwyMde_D_Rq 9. EVSE sends leaf certificate with public key to the OBCC Via PLC 10. OBCC rejects the leaf certificate and Contract Certificates 11. Message on Centerstack (8 Sec Auto Dismiss Message) tells user “This charging station is not part of the Ford network. To charge at this station, please plug in again and follow instructions on the station.” 12. Vehicle Sends an Alert to the Cloud 13. User receives a Notification in FordPass that tells “This charging station is not part of the Ford network. To charge at this station, please plug in again and follow instructions on the station.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.5 PNCv1-UC-REQ-325364/C-User Plugs into Non ISO, Out-of-Network Station

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	User Plugs into Non ISO, out of network station
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq (AttemptDgtlComm) 5. OBCC starts communication with EVSE 6. EVSE informs OBCC that it supports only EIM 7. OBCC reports to BCCM that EVSE supports only EIM via DgtlCommGtwyMde_D_St. 8. OBCC continue with EIM mode via DgtlCommGtwyMde_D_Rq

	9. Vehicle Sends an Alert to the Cloud 10. User receives a Notification in FordPass that tells “This charging station is not part of the Ford network. To charge at this station, please follow instructions on the station.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.6 PNCv1-UC-REQ-324848/C-User Plugs into an In-Network, Non ISO Station (EU)

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle Configured for **EU** Region
Scenario Description	Non ISO station, in network station (EU)
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq (AttemptDgtlComm) 5. OBCC starts communication with EVSE 6. EVSE informs OBCC that it supports only EIM 7. OBCC reports to BCCM that EVSE supports only EIM via DgtlCommGtwyMde_D_St. 8. OBCC continues with EIM mode via DgtlCommGtwyMde_D_Rq 9. Vehicle Sends an Alert to the Cloud 10. User receives a Notification in FordPass that tells “To charge at this station, please use the FordPass or RFID card.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.7 PNCv1-UC-REQ-325363/C-User Plugs into an In-Network, Non ISO Station (NA)

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle Configured for **NA** Region
Scenario Description	Non ISO station, in network station (NA)
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp)

	3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq (AttemptDgtlComm) 5. OBCC starts communication with EVSE 6. EVSE informs OBCC that it supports only EIM 7. OBCC reports to BCCM that EVSE supports only EIM via DgtlCommGtwyMde_D_St. 8. OBCC continues with EIM mode via DgtlCommGtwyMde_D_Rq 9. Vehicle Sends an Alert to the Cloud 10. User receives a Notification in FordPass that tells “To charge at this station, please use the FordPass.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.8 PNCv1-UC-REQ-335765/B-User Plugs into an Out of Network, ISO Station when PnC is disabled

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available **3. PnC is Disabled** 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle configured for NA Region/EU Region
Scenario Description	User Plug In ISO, Out of network station
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq (AttemptDgtlComm) 5. OBCC starts communication with EVSE 6. EVSE sends leaf certificate with public key to the OBCC Via PLC and Establish TLS communication 7. OBCC Authenticates the leaf certificate and Validity of the Public key 8. OBCC reports to BCCM that EVSE supports PnC and EIM via DgtlCommGtwyMde_D_St 9. Since PnC is Disabled, OBCC continues with EIM mode via DgtlCommGtwyMde_D_Rq 10. Vehicle Sends an Alert to the Cloud 11. User receives a Notification in FordPass that tells “This charging station is out of the Ford network. To charge here, please plug in again and follow the instructions on the station.
List of Exception Use Cases	
Interfaces	Vehicle interface

2.3.2.9 PNCv1-UC-REQ-335766/B-User Plugs into an Non-ISO, Out of network when PnC is disabled

Actors	FordPass user

Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available **3. PnC is Disabled** 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle configured for NA Region/EU Region
Scenario Description	User Plug In Non-ISO, Out of network
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq (AttemptDgtlComm) 5. OBCC starts communication with EVSE 6. EVSE sends leaf certificate with public key to the OBCC Via PLC and Establish TLS communication 7. OBCC Authenticates the leaf certificate and Validity of the Public key 8. OBCC reports to BCCM that EVSE supports PnC and EIM via DgtlCommGtwyMde_D_St 9. Since PnC is Disabled, OBCC continues with EIM mode via DgtlCommGtwyMde_D_Rq 10. Vehicle Sends an Alert to the Cloud 11. User receives a Notification in FordPass that tells “This charging station is out of the Ford network. To charge here, please follow instructions on the station.”
List of Exception Use Cases	
Interfaces	Vehicle interface

2.3.2.10 PNCv1-UC-REQ-335767/B-User Plugs into an Non-ISO, In Network (NA) when PnC is disabled

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available **3. PnC is Disabled** 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle configured for **NA** region
Scenario Description	User Plug In Non-ISO, In network
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq (AttemptDgtlComm) 5. OBCC starts communication with EVSE 6. EVSE sends leaf certificate with public key to the OBCC Via PLC and Establish TLS communication 7. OBCC Authenticates the leaf certificate and Validity of the Public key 8. OBCC reports to BCCM that EVSE supports PnC and EIM via DgtlCommGtwyMde_D_St

	9. Since PnC is Disabled, OBCC continues with EIM mode via DgtlCommGtwyMde_D_Rq 10. Vehicle Sends an Alert to the Cloud 11. User receives a Notification in FordPass that tells “To charge here, please use the FordPass app”.
List of Exception Use Cases	
Interfaces	Vehicle interface

2.3.2.11 PNCv1-UC-REQ-335768/B-User Plugs into an Non-ISO, In Network (EU) when PnC is disabled

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available **3. PnC is Disabled** 4. Vehicle is Keyed on, and Center Stack is activated 5. Vehicle configured for **EU** region
Scenario Description	User Plug In Non-ISO, In network
Post-conditions	1. EVSE Wakeup the BCCM with Hardwire Pilot line. (Pilot is a line from connector to BCCM) 2. BCCM wakes up OBCC using Hardwire Signal (AuxChrgWakeUp) 3. BCCM detects Pilot indicative of digital communications 4. BCCM asks OBCC to attempt digital communications via DgtlCommMde_d_Rq (AttemptDgtlComm) 5. OBCC starts communication with EVSE 6. EVSE sends leaf certificate with public key to the OBCC Via PLC and Establish TLS communication 7. OBCC Authenticates the leaf certificate and Validity of the Public key 8. OBCC reports to BCCM that EVSE supports PnC and EIM via DgtlCommGtwyMde_D_St 9. Since PnC is Disabled, OBCC continues with EIM mode via DgtlCommGtwyMde_D_Rq 10. Vehicle Sends an Alert to the Cloud 11. User receives a Notification in FordPass that tells “To charge here, please use the FordPass app or your RFID card”.
List of Exception Use Cases	
Interfaces	Vehicle interface

2.3.2.12 PNCv1-UC-REQ-324841/A-User Plugs into Network ISO station and Payment Subscription Balance is Low (NA)

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available Vehicle is key on and Center Stack is Activated

Scenario Description	Payment Subscription Balance is Low (NA), When User Plugs into In Network ISO Station
Post-conditions	1. EVSE Authorized the Contract Certificates and Sends eMAID to Mobility Operator 2. Mobility operator authorizes eMAID and sends eMAID to the Monetization Platform 3. Monetization Platform verifies payment method 4. Monetization Platform Shall Sends Subscription balance is low to SDN 5. SDN Shall Sends a Payment Subscription Balance is low to Vehicle and notification to the FordPass 6. Message on Centerstack tells the user “Your charging subscription balance is low. When the balance is exhausted, additional usage will be billed to your FordPay wallet.” 7. User receives a Notification in FordPass that tells “Your charging subscription balance is low. When the balance is exhausted, additional usage will be billed to your FordPay wallet.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.13 PNCv1-UC-REQ-324851/A-User Plugs into Network ISO station and Payment Subscription Balance is Low (EU)

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available Vehicle is key on and Center Stack is Activated
Scenario Description	Payment Subscription Balance is Low (EU), When User Plugs into In Network ISO Station
Post-conditions	1. EVSE Authorized the Contract Certificates and Sends eMAID to Mobility Operator 2. Mobility operator authorizes eMAID and sends eMAID to the Monetization Platform 3. Monetization Platform verifies payment method 4. Monetization Platform Shall Sends Subscription balance is low to SDN 5. SDN Shall Sends a Payment Subscription Balance is low to Vehicle and notification to the FordPass 6. Message on Centerstack tells the user “Your charging account balance is low. When the balance is exhausted, you will not be able to start a charging session. Please use the FordPass app to add additional funds to your account.” 7. User receives a Notification in FordPass that tells “Your charging account balance is low. When the balance is exhausted, you will not be able to start a charging session. Please use the FordPass app to add additional funds to your account.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.14 PNCv1-UC-REQ-324849/A-User Plugs into Network ISO Station and Charging account is overdue and Charging is suspended (EU)

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available Vehicle is key on and Center Stack is Activated Configured for EU
Scenario Description	Charging account is overdue and Charging is suspended (EU), When the User Plugs into In Network ISO Station
Post-conditions	1. EVSE Authorized the Contract Certificates and Sends eMAID to Mobility Operator 2. Mobility operator authorizes eMAID and Sends eMAID to the Monetization Platform 3. Monetization Platform verifies payment method 4. Monetization Platform Shall Sends Charging account is overdue and Charging is suspended to SDN 5. SDN Shall Sends Charging account is overdue and Charging is suspended to Vehicle and notification to the FordPass 6. Message on Centerstack tells the user “Your charging account is overdue and your account has been suspended. Please pay the bill to reactivate your account.” 7. User receives a Notification in FordPass that tells “Your charging account is overdue and your account has been suspended. Please pay the bill to reactivate your account.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.15 PNCv1-UC-REQ-324845/A-User Plugs into Network ISO station and Charging account is overdue, but charging is still allowed (EU),

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available Vehicle is key on and Center Stack is Activated Configured for EU
Scenario Description	Charging account is overdue, but charging is still allowed (EU), When the User Plugs into In Network ISO Station
Post-conditions	1. EVSE Authorized the Contract Certificates and Sends eMAID to Mobility Operator 2. Mobility operator authorizes eMAID and Sends eMAID to the Monetization Platform 3. Monetization Platform verifies payment method 4. Monetization Platform Shall Sends Charging account is Overdue, but Charging is Still allowed to SDN 5. SDN Shall Sends Charging account is Overdue, but Charging is Still allowed to Vehicle and notification to the FordPass

	6. Message on Centerstack tells the user "Your charging account is overdue. Please pay the bill to ensure your account remains active." 7. User receives a Notification in FordPass that tells "Your charging account is Overdue. Please pay the bill to ensure your account remains active."
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.16 PNCv1-UC-REQ-324850/A-User Plugs into Network ISO Station and Payment Balance has run out (EU)

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available Vehicle is key on and Center Stack is Activated
Scenario Description	Payment Subscription balance has run out (EU), When the User Plugs into In Network ISO Station
Post-conditions	1. EVSE Authorized the Contract Certificates and Sends eMAID to Mobility Operator 2. Mobility operator authorizes eMAID and Sends eMAID to the Monetization Platform 3. Monetization Platform verifies payment method 4. Monetization Platform Shall Sends Subscription balance has run out to SDN 5. SDN Shall Sends to Subscription balance has run out to Vehicle and notification to the FordPass 6. Message on Centerstack tells the user "Your charging account balance is not sufficient to start a charging session. Please use the FordPass app to add additional funds to your account." 7. User receives a Notification in FordPass that tells "Your charging account balance is not sufficient to start a charging session. Please use the FordPass app to add additional funds to your account."
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.17 PNCv1-UC-REQ-324842/A-User Plugs into Network ISO station and Backend system failures (EU)

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available Vehicle is key on and Center Stack is Activated Configured for EU
Scenario Description	Backend system failures (EU), When the User Plugs into In Network ISO Station

Post-conditions	1. EVSE Authorized the Contract Certificates and Sends eMAID to Mobility Operator 2. Mobility operator authorizes eMAID and Sends eMAID to the Monetization Platform 3. Monetization Platform Fails to Authenticates eMAID and fails to Verifies Payment Method 4. Monetization Platform Shall Sends Failure Response to CPO and SDN 5. SDN Shall Sends Backend System Failure to Vehicle and notification to the FordPass 6. Message on Centerstack tells the user “There was an error with the transaction. To charge at this station, please plug in again and use FordPass or RFID card. If the error persists, follow the instructions on the charger to activate charging.” 7. User receives a Notification in FordPass that tells “There was an error with the transaction. To charge at this station, please plug in again and use FordPass or RFID card. If the error persists, follow the instructions on the charger to activate charging.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.18 PNCv1-UC-REQ-320377/A-User Plugs into Network ISO station and Backend system failures (NA)

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available Vehicle is key on and Center Stack is Activated
Scenario Description	Backend system failures (NA), When the User Plugs into In Network ISO Station
Post-conditions	1. EVSE Authorized the Contract Certificates and Sends eMAID to Mobility Operator 2. Mobility operator authorizes eMAID and Sends eMAID to the Monetization Platform 3. Monetization Platform Fails to Authenticates eMAID and fails to Verifies Payment Method 4. Monetization Platform Shall Sends Failure Response to CPO and SDN 5. SDN Shall Sends Backend System Failure to Vehicle and notification to the FordPass 6. Message on Centerstack tells the user “There was an error with the transaction. To charge at this station, please plug in again and use the FordPass app. If the error persists, follow the instructions on the charger to activate charging.” 7. User receives a Notification in FordPass that tells “There was an error with the transaction. To charge at this station, please plug in again and use the FordPass app. If the error persists, follow the instructions on the charger to activate charging.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.3.2.19 PNCv1-UC-REQ-320378/B-Failure Corrected, Then Charging Begins Successfully While Centerstack is off

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available User has Plugged In at Any EVSE Vehicle is Turn off and Center stack is deactivated Any Failure occurred after user Plugged In
Scenario Description	Failure Corrected, Then Charging Begins Successfully While Centerstack is off
Post-conditions	1. The Failure Message Shall Sends Both APIM and FordPass 2. When the Vehicle is turnoff, The User sees the Failure message in FordPass and Correct the issue and Vehicle Starts Charging Successfully 3. Once Charging begins Successfully and Sync will Clear failure message Notifications on Center stack in next ignition cycle
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

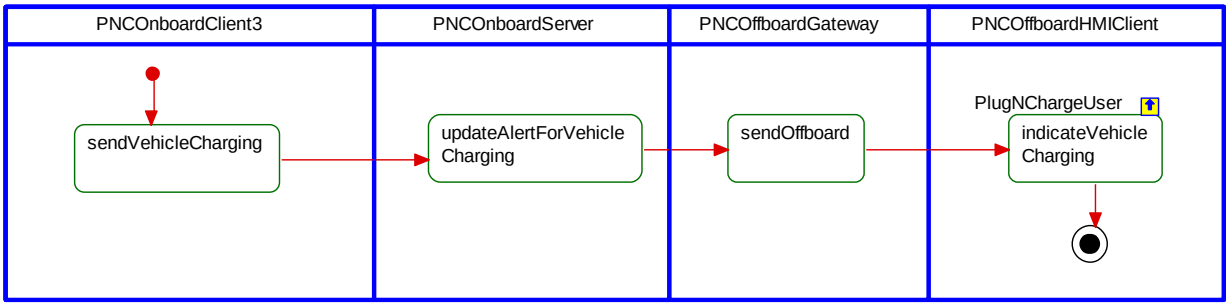
2.3.2.20 PNCv1-UC-REQ-324840/A-User Plugs into Network ISO station and Payment Balance has run out (NA)

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available Vehicle is key on and Center Stack is Activated
Scenario Description	Payment Subscription balance has run out (NA), When the User Plugs into In Network ISO Station
Post-conditions	1. EVSE Authorized the Contract Certificates and Sends eMAID to Mobility Operator 2. Mobility operator authorizes eMAID and Sends eMAID to the Monetization Platform 3. Monetization Platform verifies payment method 4. Monetization Platform Shall Sends Subscription balance has run out to SDN 5. SDN Shall Sends to Subscription balance has run out to Vehicle and notification to the FordPass 6. Message on Centerstack tells the user “You have exhausted your charging subscription balance. Transactions will be billed to your FordPay wallet until the next renewal period.” 7. User receives a Notification in FordPass that tells “You have exhausted your charging subscription balance. Transactions will be billed to your FordPay wallet until the next renewal period.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

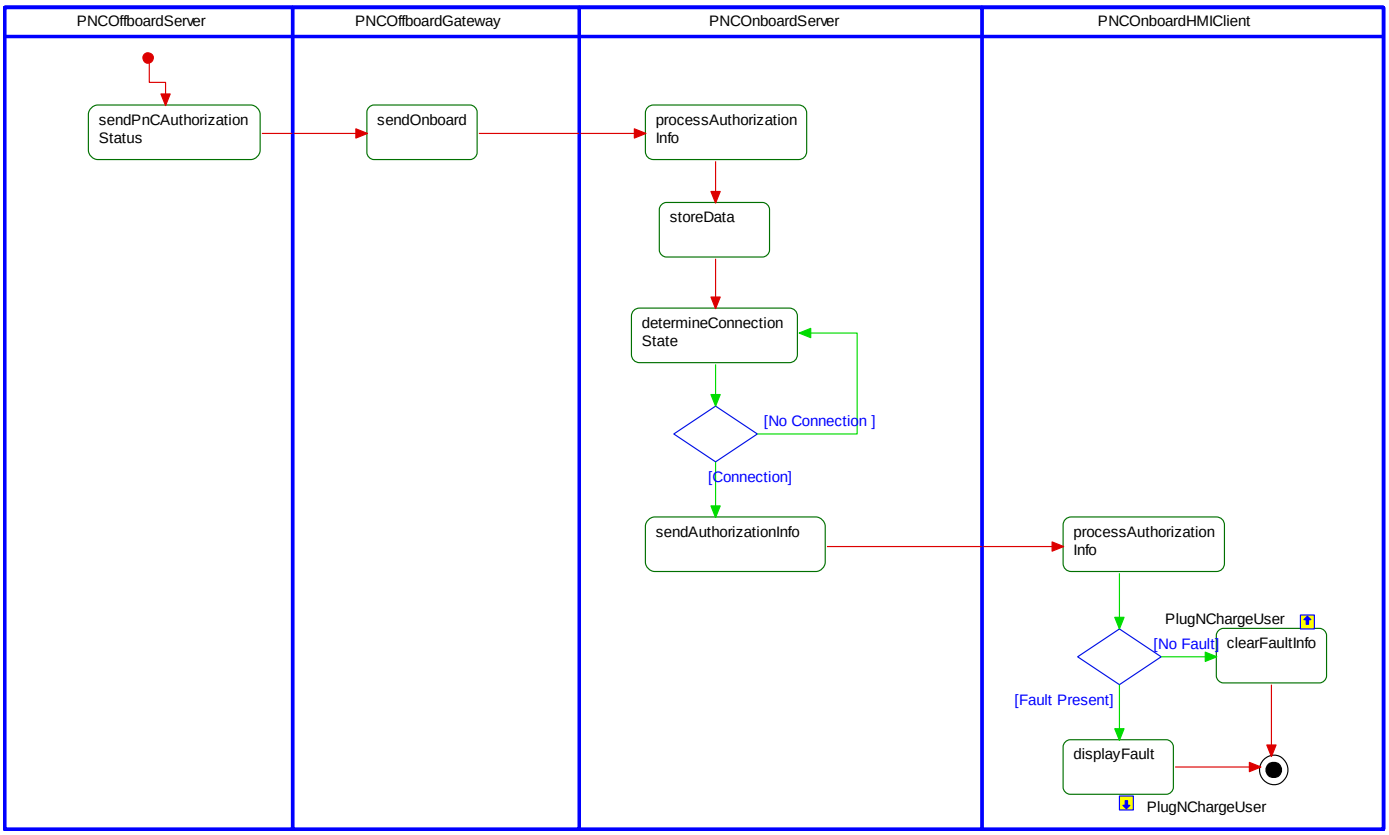
2.3.3 White Box Views

2.3.3.1 Activity Diagrams

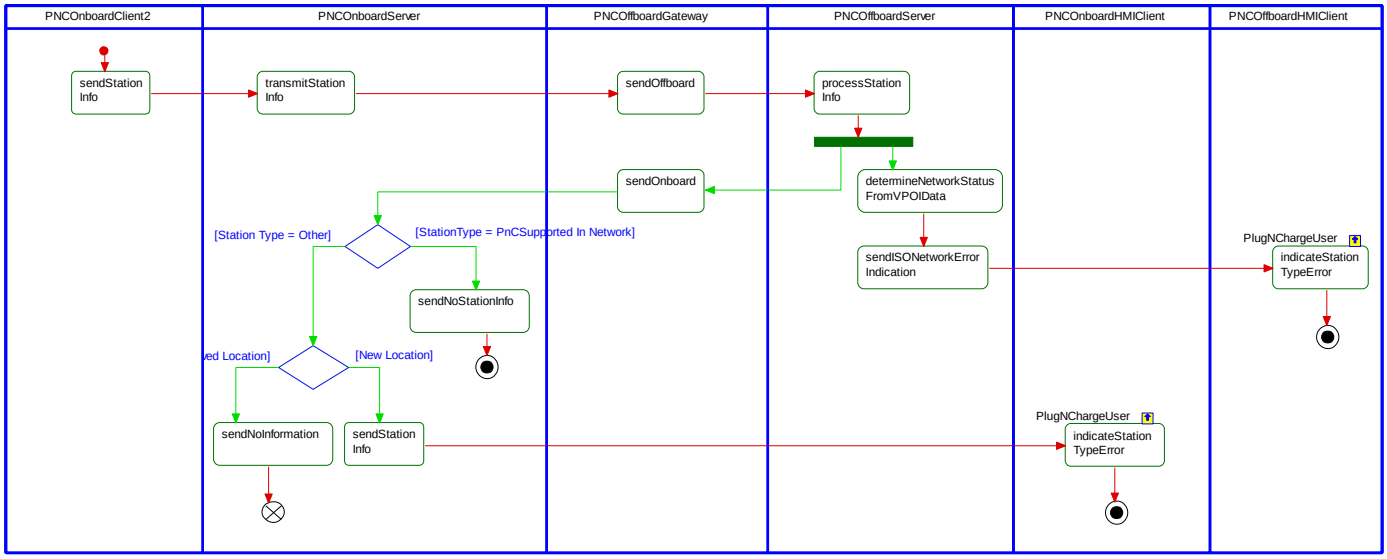
2.3.3.1.1 PNC-ACT-REQ-326581/A-Plug In and Charge Begin



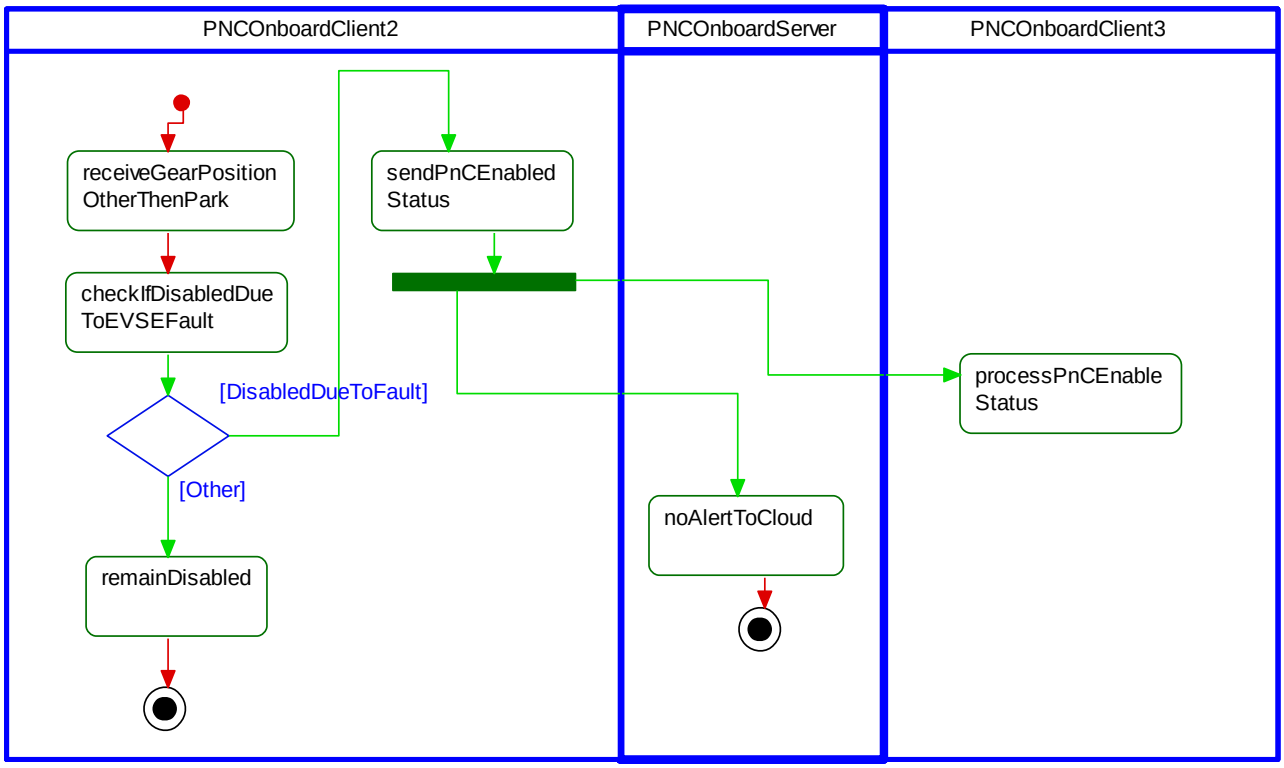
2.3.3.1.2 PNC-ACT-REQ-329240/A-Plug In And Charge Authorization Failures



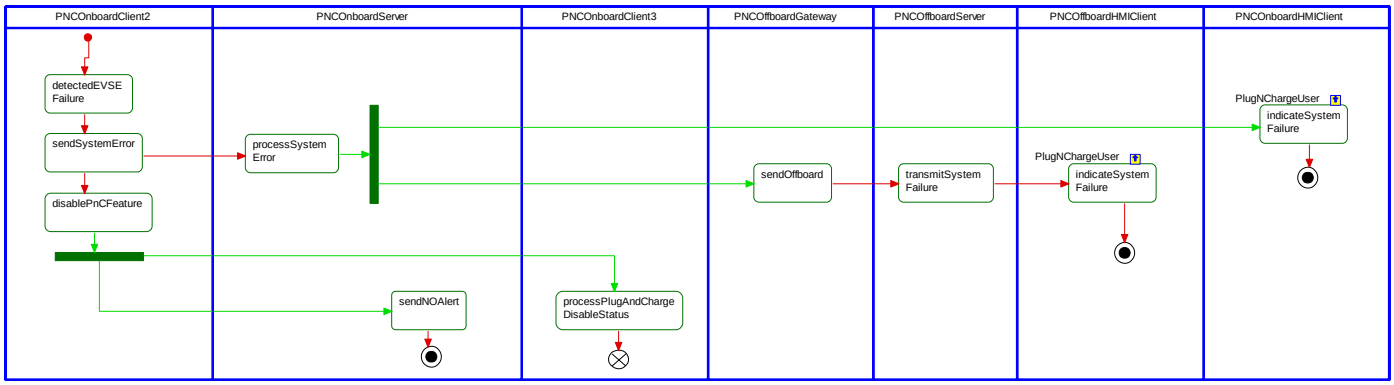
2.3.3.1.3 PNC-ACT-REQ-330591/B-Charge Station Network and ISO Errors



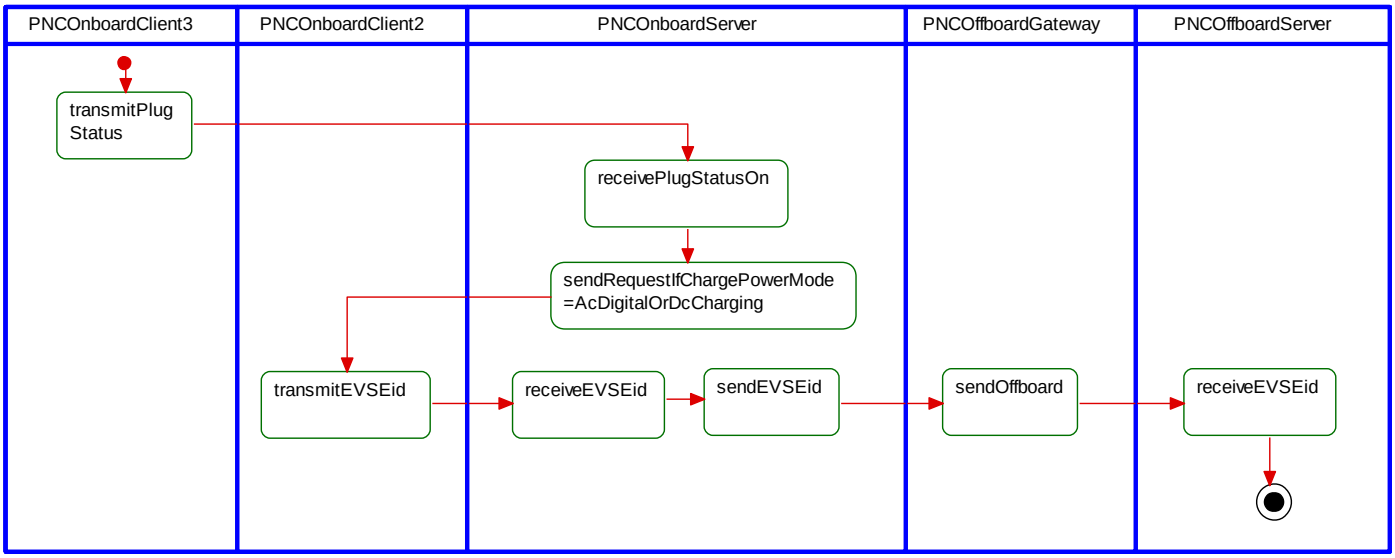
2.3.3.1.4 PNC-ACT-REQ-330592/B-Enable PnC Once Vehicle is Shifted Out of Park



2.3.3.1.5 PNC-ACT-REQ-330593/B-Plug In and EVSE Failure

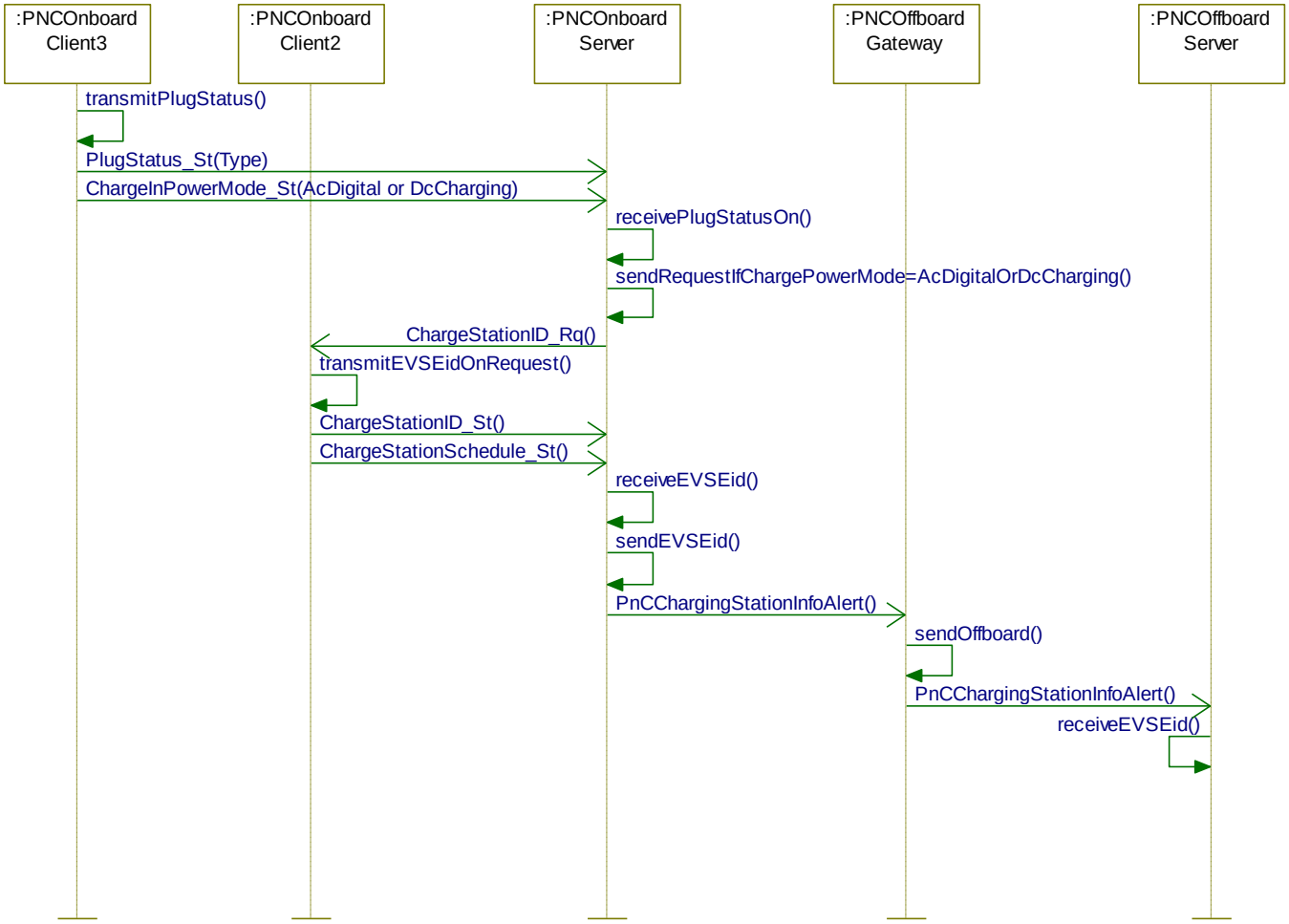


2.3.3.1.6 PNC-ACT-REQ-330594/B-Plugged In and Charging Has Not Begun Transmit EVSEid

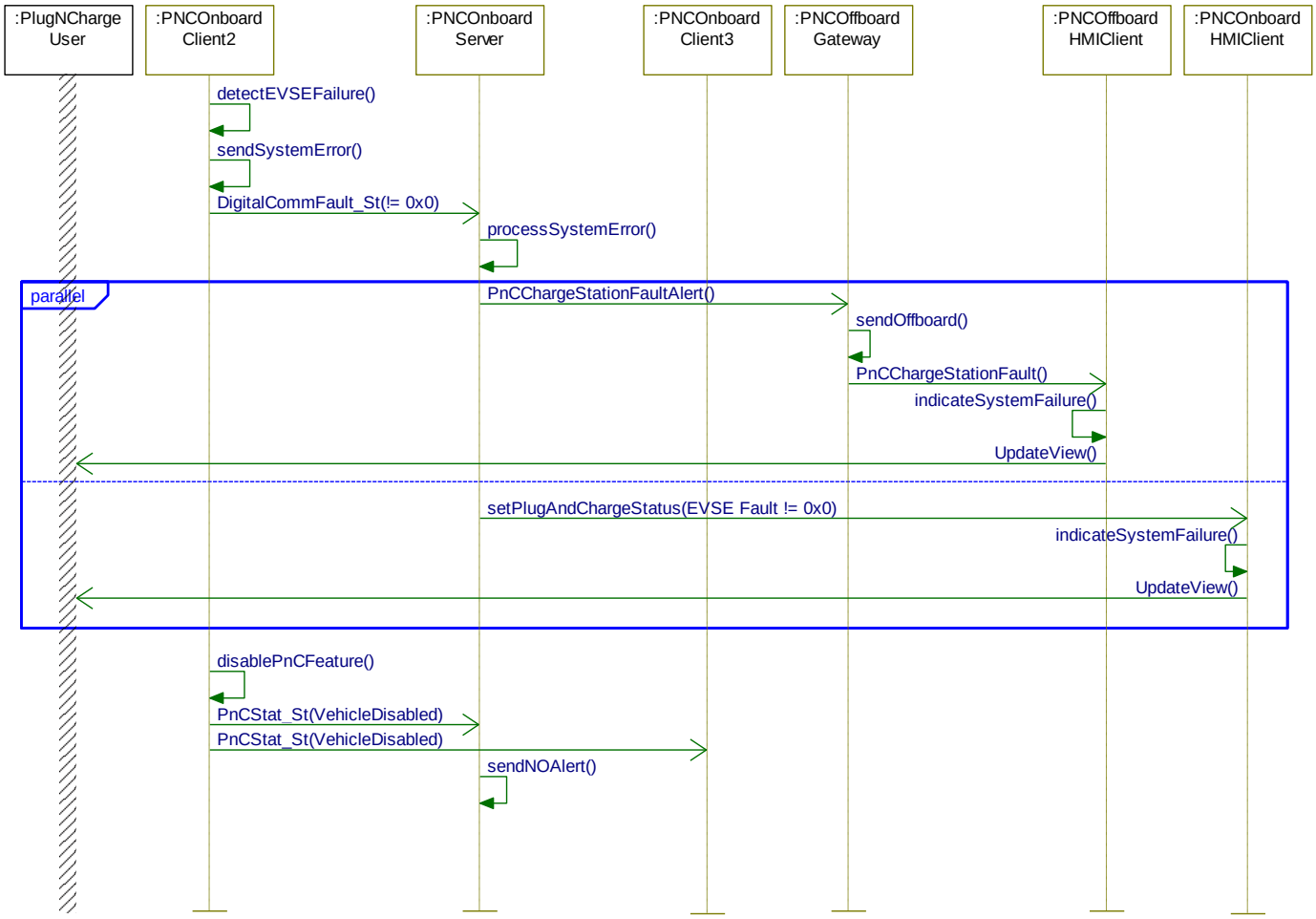


2.3.3.2 Sequence Diagrams

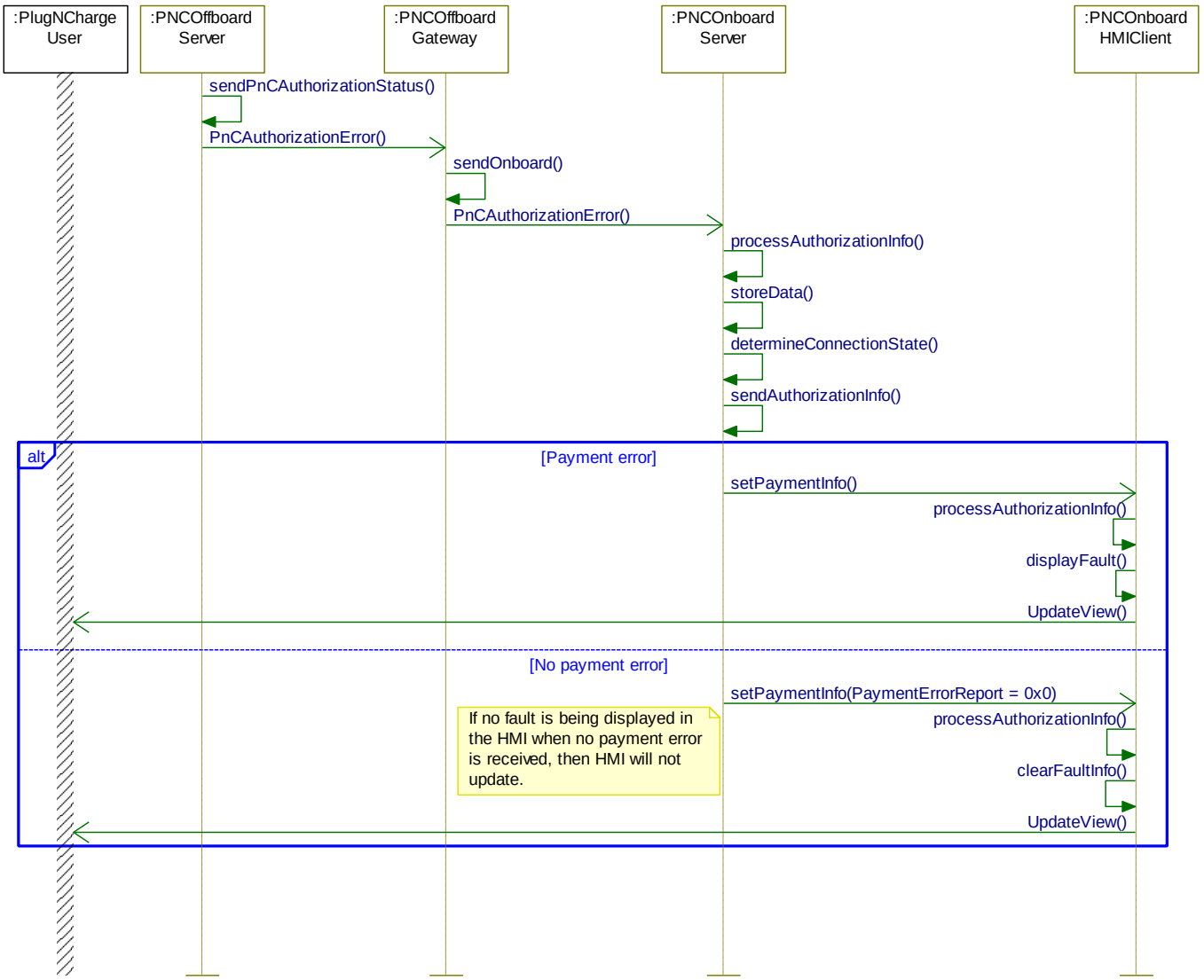
2.3.3.2.1 PNC-SD-REQ-330599/B-Plugged In and Charging Has Not Started Transmit EVSEid



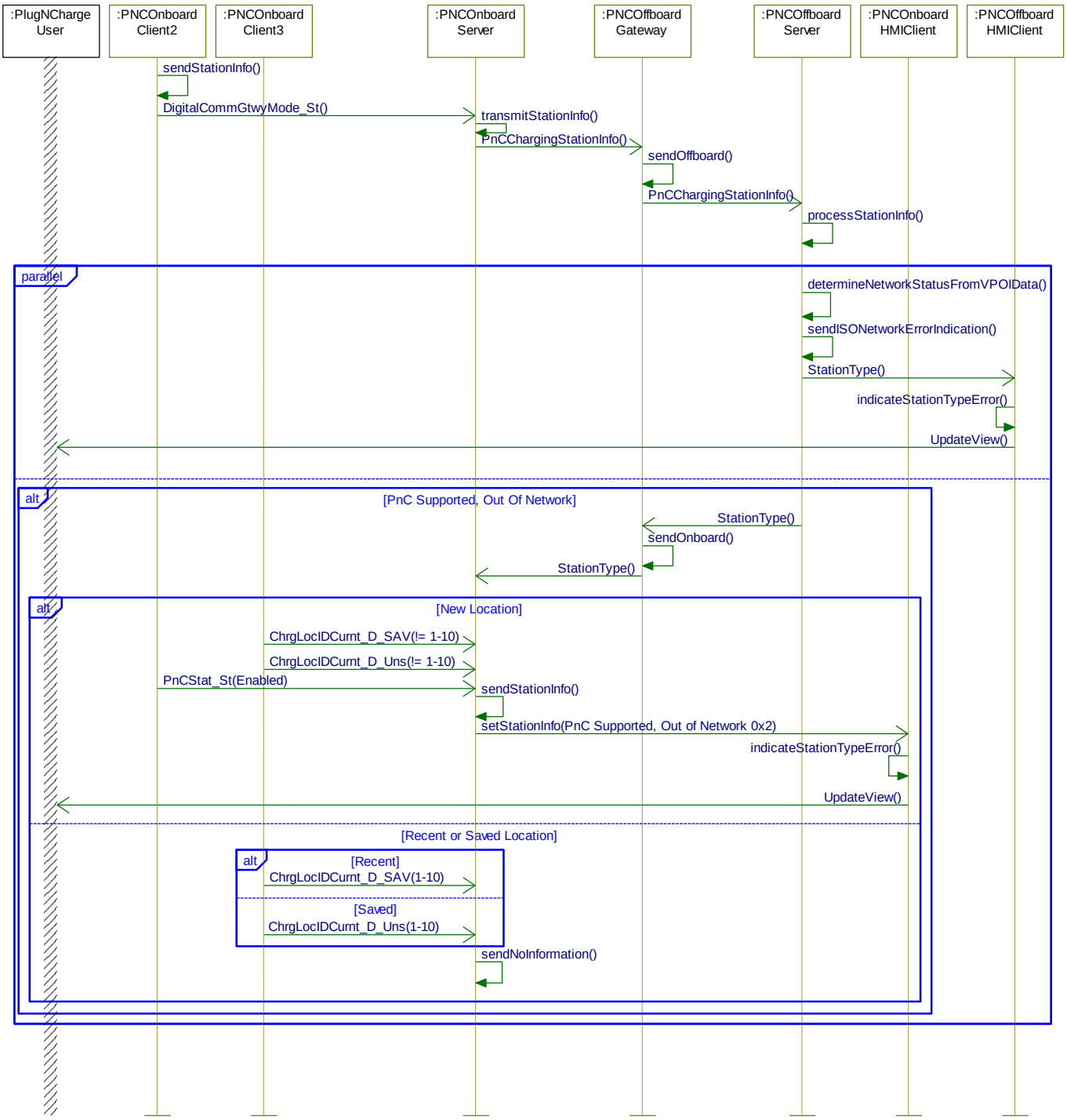
2.3.3.2.2 PNC-SD-REQ-326580/B-Plug in and Charge Failed to Begin



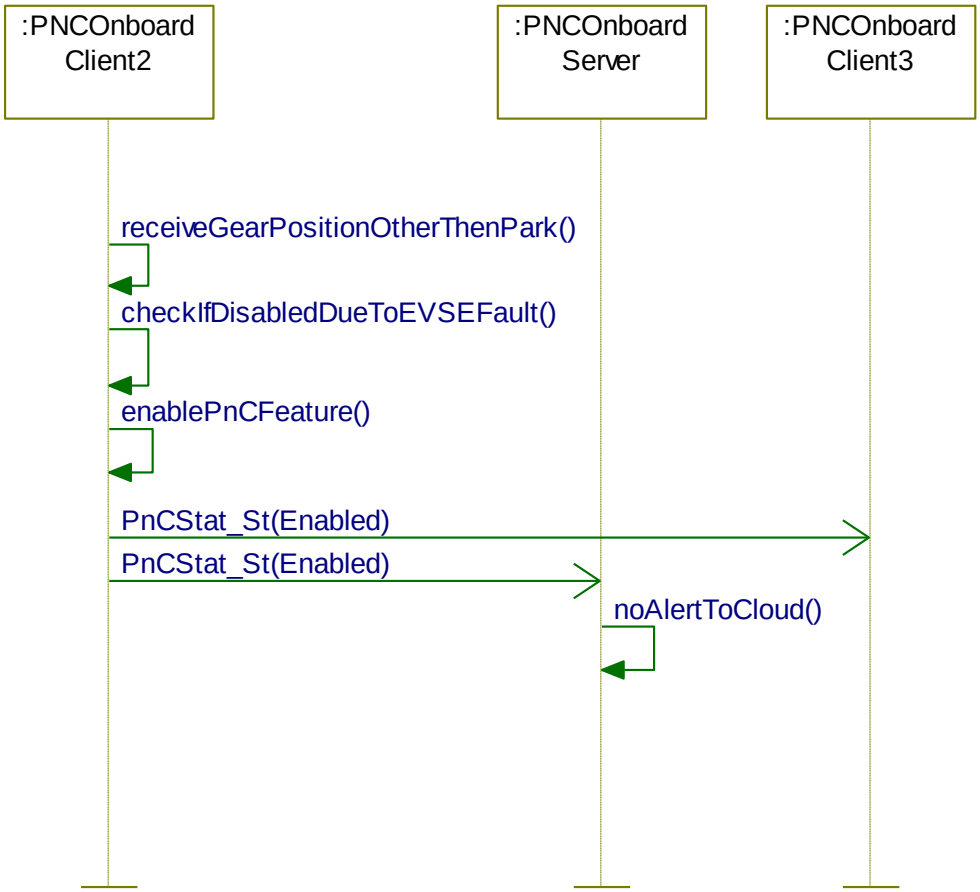
2.3.3.2.3 PNC-SD-REQ-329239/B-Plug In and Plug Authorization Failures



2.3.3.2.4 PNC-SD-REQ-330597/C-Charge Station ISO and Network Errors



2.3.3.2.5 PNC-SD-REQ-330598/B-Enable PnC Once Vehicle is Shifted Out of Park



2.4 PNC-FUN-REQ-324747/A-Charge Complete

2.4.1 Requirements

2.4.1.1 PNC-REQ-326849/A-Charge Complete

When the vehicle reaches target charge, as defined in the EV settings, or the user unplugs, the following will occur:

- User receives notification/status in vehicle
- User receives notification via FordPass
- Trip & Charge Log is updated

2.4.1.2 PNC-REQ-326850/E-Charge Complete - In Vehicle

The following information shall be displayed in vehicle HMI with units after the user unplugs:
8 second auto-dismiss messages (no sound alert)

- SOC (Percentage)
- Total time Plugged In (Seconds)
- Total distance added (Miles/Kilometers, based on the user setting in the Centerstack)
- Total cost for the charging session (USD,EUR…,KWh a string value from the cloud and no translation is required)
- Balance on subscription, if user has subscription (capped subscription balance remaining [kWh] or stored value monetary value)

Display receipt without cost and balance information if charging cost and balance are not received as of key-on. Display with cost and balance information if data received by CMS as of key-on.
If charging cost has not been received by the APIM at key-on, cost and balance will be displayed as “Not yet available” (even if the most recent balance value is available, balance will be displayed as “not yet available” because the balance does not yet reflect the recent charging session.)
A note will be included at the end of the receipt if the charging session cost information is not available: “Charging cost and updated balance information will generally be available in FordPass within 24 hours after the charging event.”

ECG Rule:

If ECG receives PnCStationType command from the cloud with any of this 0x1: PnC capable, in network 0x2: PnC capable, out of network, 0x3: non PnC capable, in network, 0x4: non PnC capable, out of network we can assume charging station is Public charging station.
ECG shall aggregate Charging complete data and Payment receipt in the ChargeSummary Command and send to APIM via SOA API.

PnC App shall Send DISPLAY_PAYMENT_INFO (SOA API) to APIM only when PlgActvArb_B_Actl = 0x0: Off Plug, Ignition_Status != OFF and TrnRng_D_Rq != Park signals conditions are satisfied.

ECG shall store PnCStationType command for one ignition cycle.

Edge case:
- If ECG don't receives PnCStationType command from the cloud at ignition-on we can assume it is private charging station ECG don't send charging receipt message to vehicle HMI.
- If ECG receives ChargeSummaryCommand from the cloud at private charging station don't show payment info in Vehicle HMI.

- When PlgActvArb_B_Actl changes from on-Plug to off-Plug AND a charge event has occurred, the ECG will aggregate the payment receipt and charge complete data:
    - BattTracSoc_Pc_Dsply to capture SOC
    - Total distance added will be calculated in the ECG by VehElRnge_L_Dsply (after charge) - VehElRnge_L_Dsply (before charge) at vehicle unplugs from the charger.
    - Total time Plugged In will be captured by calculating time from PlgActvArb_B_Actl = 0x1: On Plug (Connected) to PlgActvArb_B_Actl = 0x0: Off Plug (Disconnected)
    - ECG shall send a PnCChargeComplete alert which includes Total distance added, Total time Plugged In and SOC shall be calculated by ECG PnC app for every charging event When the Vehicle Unplugged.
    - The following information shall be captured by ChargeSummary command from the cloud
        - 0x1 = Total Cost of Charge
        - 0x2 = Balance on Subscription
        - 0x3 = Charging Session cost info not available (Charging cost and updated balance information will generally be available in FordPass within 24 hours after the charging event)
        - 0x4: CurrencyType (string)

2.4.1.3 PNC-REQ-425922/A-Charge Complete Alert Monitor

ECG PnC app shall implement the following to trigger the PnCChargeComplete alert:

- Before triggering the PnCChargeComplete alert upon plug status signal change from 0x0: OFF Plug to 0x1: ON Plug, ECG shall monitor the PlgActvArb_B_Actl signal for 10 secs for signal stability then trigger the PnCChargeComplete alert.
- If the Plug status signal change to a new enumeration but doesn't remain stable for the full 10 secs duration, the PnCChargeComplete alert shouldn't trigger.

- If Plug status signal doesn't stay stable for the full 10 secs duration, ECG app shall throw SOC, total time plugged in and total distance added data out.

2.4.2 Use Cases

2.4.2.1 PNCv1-UC-REQ-324852/B-Charging Completed Successfully

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. User Plugs into public charging station that is contained in VPOI data 4. Vehicle is Unplugged 5. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	PnC Charge Complete Successful
Post-conditions	Vehicle Sends Alert to the SDN with SOC, Total time Plugged In and total distance added Charge Point Operator Sends Charge Event Data to Mobility Operator Mobility Operator Sends Charge Event Data to Monetization Platform Monetization Platform Calculates Cost of Charge/Update Subscription Balance Monetization Platform Sends Payment Info to SDN SDN Shall Sends Payment Summary to Vehicle The Centerstack HMI Displays the following information: - Charge is Complete/SOC - Total Cost - Total time Plugged In - Total Distance added - Balance on Subscription, if user has subscription SDN Shall Sends a Notification to FordPass In FordPass, Following will be added to existing Trip and Charge logs - Total Cost of Charging - Total Distance added - Total time Plugged In - Balance on Subscription (If user has Subscription)
List of Exception Use Cases	
Interfaces	Vehicle System interface HMI

2.4.2.2 PNCv1-UC-REQ-330860/C-PnC Charge Summary Delay/Failed

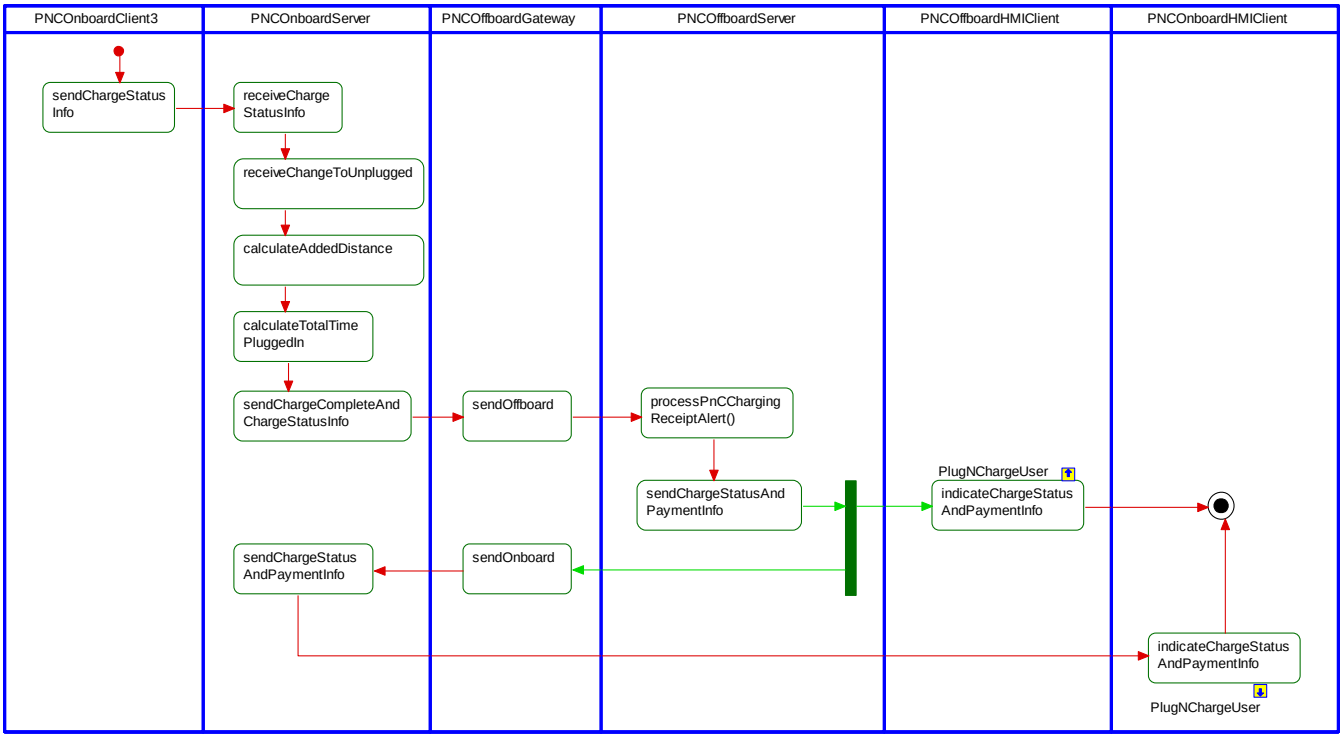
Actors	Vehicle Occupant
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. User Plugs into public charging station that is contained in VPOI data 4. Vehicle is Unplugged 5. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	PnC Charge Complete Successful, Charging Session Cost information is not Available at Key-on.
Post-conditions	1. Vehicle Sends Alert to the SDN with SOC, Total time Plugged In and total distance added 2. Charge Point Operator Sends Charge Event Data to Mobility Operator

	3. Mobility Operator Delay to Sends Charge Data Record to Ford Monetization Platform 4. Monetization Platform fails to Calculates Cost of Charge/Update Subscription Balance before vehicle key on. 5. The Centerstack HMI Displays the following information: - Charge is Complete/SOC - Total Cost - Total time Plugged In - Total Distance added - "Charging cost and updated balance information will generally be available in FordPass within 24 hours after the charging event." 6. SDN Shall Sends a Notification to FordPass 7. In FordPass, Following will be added to existing Trip and Charge logs - Total Cost of Charging - Total Distance added - Total Time Plugged In - "Charging cost and updated balance information will generally be available in FordPass within 24 hours after the charging event."
List of Exception Use Cases	
Interfaces	Vehicle interface, Offboard interface, Centerstack HMI

2.4.3 White Box Views

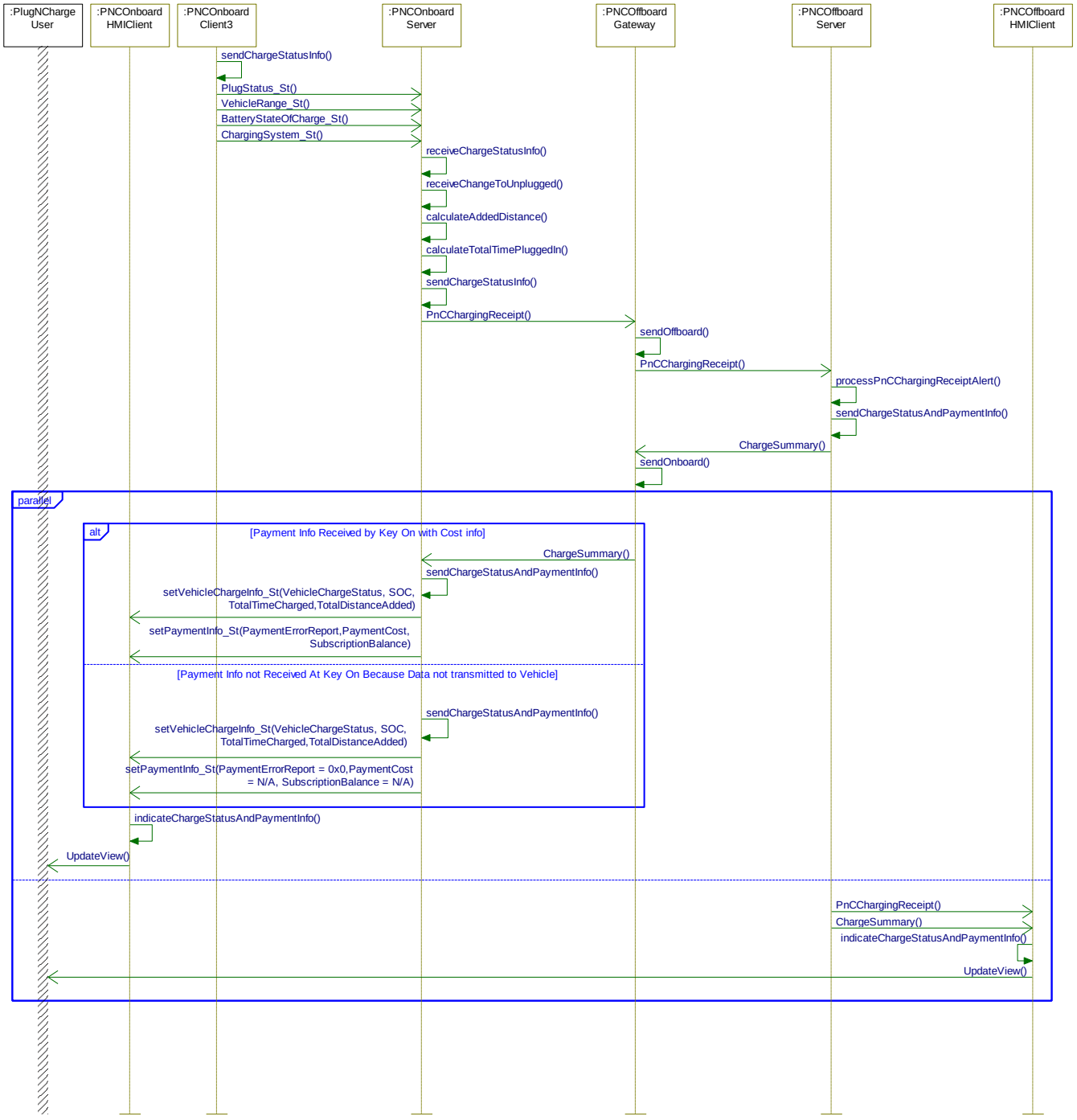
2.4.3.1 Activity Diagrams

2.4.3.1.1 PNC-ACT-REQ-326582/B-Charging Complete



2.4.3.2 Sequence Diagrams

2.4.3.2.1 PNC-SD-REQ-326575/B-Charge Complete



2.5 PNC-FUN-REQ-324755/A-Disabling and Re-Enabling Plug and Charge

2.5.1 Requirements

2.5.1.1 PNC-REQ-330759/B-Notifications for Plug and Charge Status Change

HMI Rule:
8 second auto-dismiss messages (no sound alert)

Reason for Notification	Region (NA/EU/Both)	In Vehicle status/notification	FordPass Notification	Sample message	
Plug & Charge setup or re-enable successful	Both	Success message displayed	Notification sent to FP	"Plug & Charge is now active on this vehicle. When you plug in to a Plug & Charge-enabled station in the Ford network, charging will start automatically and your charging account will be billed."	Plug & Charge is now active on this vehicle. Charging will now start automatically when you plug in to a Plug & Charge-enabled station in the Ford network, and your account will be billed.
Plug & Charge setup or re-enable failed	Both	Not displayed	Notification sent to FP	[Notification to be written by FordPass designers]	
Plug & Charge disable was successful	EU	Success message displayed	Notification sent to FP	"Plug & Charge is no longer active on this vehicle. Please use FordPass or RFID card to charge at stations in the Ford network."	Plug & Charge is no longer active on this vehicle. Please use the FordPass app or your RFID card to charge at stations in the Ford network.
Plug & Charge disable was successful	NA	Success message displayed	Notification sent to FP	"Plug & Charge is no longer active on this vehicle. Please use the FordPass app to charge at stations in the Ford network."	Plug & Charge is no longer active on this vehicle. Please use the FordPass app to charge at stations in the Ford network.
Plug & Charge disable failed	Both	Not displayed	Notification sent to FP	[Notification to be written by FordPass designers]	

2.5.1.2 PNC-REQ-330377/C-Disabling PnC

The Cloud will send a SyncP Disable Payload Command to turn off PnC in the Vehicle when the user disables via FordPass.

ECG:
OptOutPnC Command with SyncP Payload is received by the ECG, ECG sends to OBCC via SyncP Diagnostic Routine

OBCC:
After Completing the PnC Disable Service Request by SyncP Request, OBCC Shall Disable the PnC Feature and Sends a Positive SyncP Diagnostic Response with a Payload of a SyncP Packet and DgtlCommPnc_D_Stat with Disable State to ECG

ECG:
SUCCESS:
ECG Receives SyncP response from OBCC module and Sends Encrypted SyncP Response as an "OptOutPnC Alert" to the Cloud AND

IF DgtlCommPnc_D_Stat changes from enabled to disabled
THEN send PnCFeatureStatus alert to the Cloud with DgtlCommPnc_D_Stat state
(FordPass Notification: "Plug & Charge disable was successful")

Retry Strategy:
ECG shall do Retry 3 times if SyncP Request Diagnostic Routine timeout or fail to Receive Command Response after 10 sec and 10s will be calibrated value.

In-Vehicle HMI notification:
The user will receive a notification in the Vehicle HMI if the disabling PnC was successful.
Shown in vehicle ONLY if successful; no message for failure

APIM:
- IF DgtlCommPnc_D_Stat changes from enable to Disable, indicating PnC been disabled in the vehicle
SYNC shall detect Signal Change and display "Plug & Charge disable" notification to the user in the Vehicle HMI by subscribing to the ECG's VIM CAN signals directly.
- SYNC shall Persist last received CAN Signal value and compare with new incoming CAN Signal value upon every vehicle Key-on events.

2.5.1.3 PNC-REQ-330378/D-Re-Enabling PnC

The Cloud will send a SyncP Enable Payload Command to turn off PnC in the Vehicle when the user enables via FordPass. When contract certificates are already installed in the vehicle (as determined by the Cloud):

ECG:
OptInPnC Command with SyncP Payload is received by the ECG, ECG sends to OBCC via SyncP Diagnostic Routine.

OBCC:
After Completing the PnC Enable Service Request by SyncP Request, OBCC Shall Enable the PnC Feature and Sends a Positive SyncP Diagnostic Response with a Payload of a SyncP Packet and DgtlCommPnc_D_Stat with Enable State to ECG

ECG:
SUCCESS:
ECG Receives SyncP response from OBCC module and sends Encrypted SyncP Response as an "OptInPnC Alert" to the Cloud AND
IF DgtlCommPnc_D_Stat changes from Disabled to Enabled
THEN send PnCFeatureStatus alert to the Cloud with DgtlCommPnc_D_Stat state
(FordPass Notification: "Plug & Charge Enable was successful")

Retry Strategy:
ECG shall do Retry 3 times if SyncP Request Diagnostic Routine timeout or fail to Receive Command Response after 10 sec and 10s will be calibrated value.

APIM:
- IF state of signal changes from any other values to DgtlCommPnc_D_Stat = Enable, indicating PnC is now enabled in-vehicle
SYNC shall detect Signal Change and display "Plug & Charge Enable" notification to the user in the Vehicle HMI by subscribing to the ECG's VIM CAN signals directly.
- SYNC shall Persist last received CAN Signal value and compare with new incoming CAN Signal value upon every vehicle Key-on events.

2.5.2 Use Cases

2.5.2.1 PNCv1-UC-REQ-324854/C-Plug and Charge Re-Enabling

Actors	FordPass user

Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Disabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	Plug and Charge Re-enabling
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Cloud will Check Whether Contract Certs are installed in vehicle 3. If yes, Cloud Sends PnC Enable Command with SyncP Payload to the vehicle's ECG 4. ECG Sends PnC Enable SyncP Payload to OBCC via SyncP Request Diagnostic Routine 5. OBCC enable PnC and Send PnC Feature status signal to BCCM and ECG 6. ECG Sends PnC Enable response to APIM and backend 7. If DgtlCommPnc_D_Stat signal changes from Any state to Enable – SYNC shall show the Pop-up on the Centerstack "Plug & Charge is now active on this vehicle. When you plug in to a Plug & Charge-enabled station in the Ford network, charging will start automatically, and your charging account will be billed." 8. Vehicle Sends an Alert to the Cloud 9. User receives a Notification in FordPass that tells "Plug & Charge is now active on this vehicle. When you plug in to a Plug & Charge-enabled station in the Ford network, charging will start automatically, and your charging account will be billed."
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.5.2.2 PNCv1-UC-REQ-324855/A-Plug and Charge Re-Enabled - No Ford Pass To Cloud Connectivity

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Disabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	Plug and Charge Re-enabling, No FordPass to Cloud Connectivity
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Command in Progress for 120 sec in FordPass 3. FordPass receives PnC enable failure Notification
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.5.2.3 PNCv1-UC-REQ-324856/A-Plug and Charge Re-Enabled - No Cloud to Vehicle Connectivity

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Disabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	Plug and Charge Re-enabling, No Cloud to Vehicle Connectivity
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Cloud receives the Command and failed to connect Vehicle, Command times out after 90 sec 3. FordPass receives PnC enable failure Notification
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.5.2.4 PNCv1-UC-REQ-324857/B-Plug and Charge Re-Enabled - Downstream Module Error

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Disabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	Plug and Charge Re-enabling, Downstream module error
Post-conditions	1. FordPass Sends a PnC Enable Command to the Cloud 2. Cloud will Check Whether Contract Certs are installed in vehicle 3. If yes, Cloud Sends PnC Enable Command to vehicle's ECG 4. Vehicle ECG/OBCC fails to process PnC Enable Command 5. Vehicle Sends failure alert to Cloud 6. FordPass receives PnC enable failure notification
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.5.2.5 PNCv1-UC-REQ-325313/B-Plug and Charge is Disable (EU)

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	Plug and Charge Disable (EU)
Post-conditions	1. FordPass Sends a PnC Disable Command to the Cloud 2. Cloud Sends PnC Disable Command with SyncP Payload to the vehicle's ECG 3. ECG Sends PnC Disable SyncP Payload to OBCC via SyncP Request Diagnostic Routine

	4. OBCC Disables PnC and Send PnC Feature status signal to BCCM and ECG 5. ECG Sends PnC Disable response to APIM and backend 6. Message on Centerstack tells user “Plug & Charge is no longer active on this vehicle. Please use FordPass or RFID card to charge at stations in the Ford network.” 7. Vehicle Sends an Alert to the Cloud 8. User receives a Notification in FordPass that tells “Plug & Charge is no longer active on this vehicle. Please use FordPass or RFID card to charge at stations in the Ford network.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.5.2.6 PNCv1-UC-REQ-325314/B-Plug and Charge is Disable (NA)

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	Plug and Charge Disable (NA)
Post-conditions	1. FordPass Sends a PnC Disable Command to the Cloud 2. Cloud Sends PnC Disable Command with SyncP Payload to the vehicle’s ECG 3. ECG Sends PnC Disable SyncP Payload to OBCC via SyncP Request Diagnostic Routine 4. OBCC Disables PnC and Send PnC Feature status signal to BCCM and ECG 5. ECG Sends PnC Disable response to APIM and backend 6. Message on Centerstack tells user “Plug & Charge is no longer active on this vehicle. Please use the FordPass app to charge at stations in the Ford network.” 7. Vehicle Sends an Alert to the Cloud 8. User receives a Notification in FordPass that tells “Plug & Charge is no longer active on this vehicle. Please use the FordPass app to charge at stations in the Ford network.”
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.5.2.7 PNCv1-UC-REQ-325316/A-Plug and Charge is Disable - No Ford Pass to Cloud Connectivity

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Disabled 4. Vehicle is Keyed on, and Center Stack is activated

Scenario Description	Plug and Charge Disabling, No FordPass to Cloud Connectivity
Post-conditions	1. FordPass Sends a PnC Disable Command to the Cloud 2. Command in Progress for 120 sec in FordPass 3. FordPass receives PnC Disable failure Notification
List of Exception Use Cases	
Interfaces	Vehicle HMI, Vehicle interface

2.5.2.8 PNCv1-UC-REQ-325317/A-Plug and Charge is Disable - No Cloud to Vehicle Connectivity

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Disabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	Plug and Charge Disable, No Cloud to Vehicle Connectivity
Post-conditions	1. FordPass Sends a PnC Disable Command to the Cloud 2. Cloud receives the Command and failed to connect Vehicle, Command times out after 90 sec 3. FordPass receives PnC Disable failure Notification
List of Exception Use Cases	
Interfaces	Vehicle interface

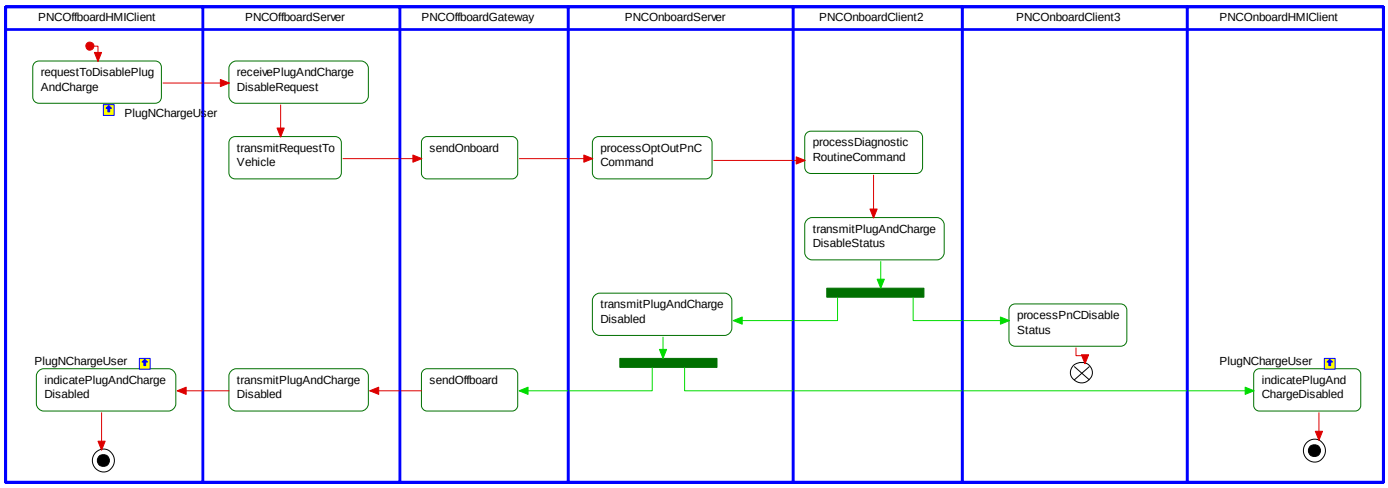
2.5.2.9 PNCv1-UC-REQ-325318/B-Plug and Charge is Disable - Downstream Module Error

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Disabled 4. Vehicle is Keyed on, and Center Stack is activated
Scenario Description	Plug and Charge Disable, Downstream module error
Post-conditions	1. FordPass Sends a PnC Disable Command to the Cloud 2. Cloud Sends PnC Disable Command to vehicle's ECG 3. Vehicle ECG/OBCC fails to process PnC Disable Command 4. Vehicle Sends failure alert to Cloud 5. FordPass receives PnC Disable failure notification
List of Exception Use Cases	
Interfaces	Vehicle interface

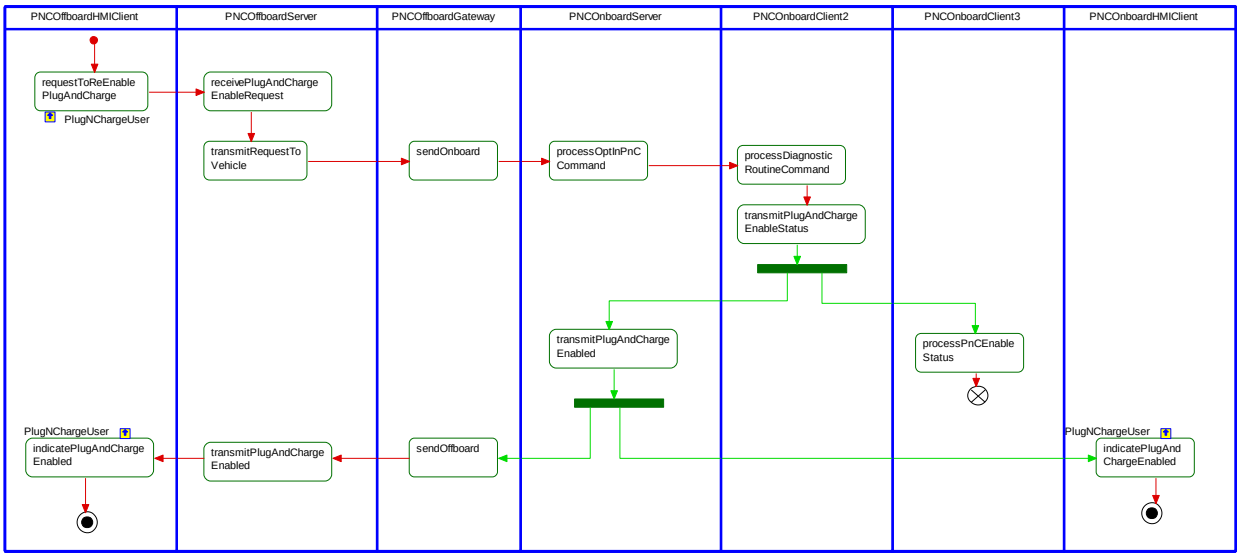
2.5.3 White Box Views

2.5.3.1 Activity Diagrams

2.5.3.1.1 PNC-ACT-REQ-326554/B-Disabling Plug and Charge

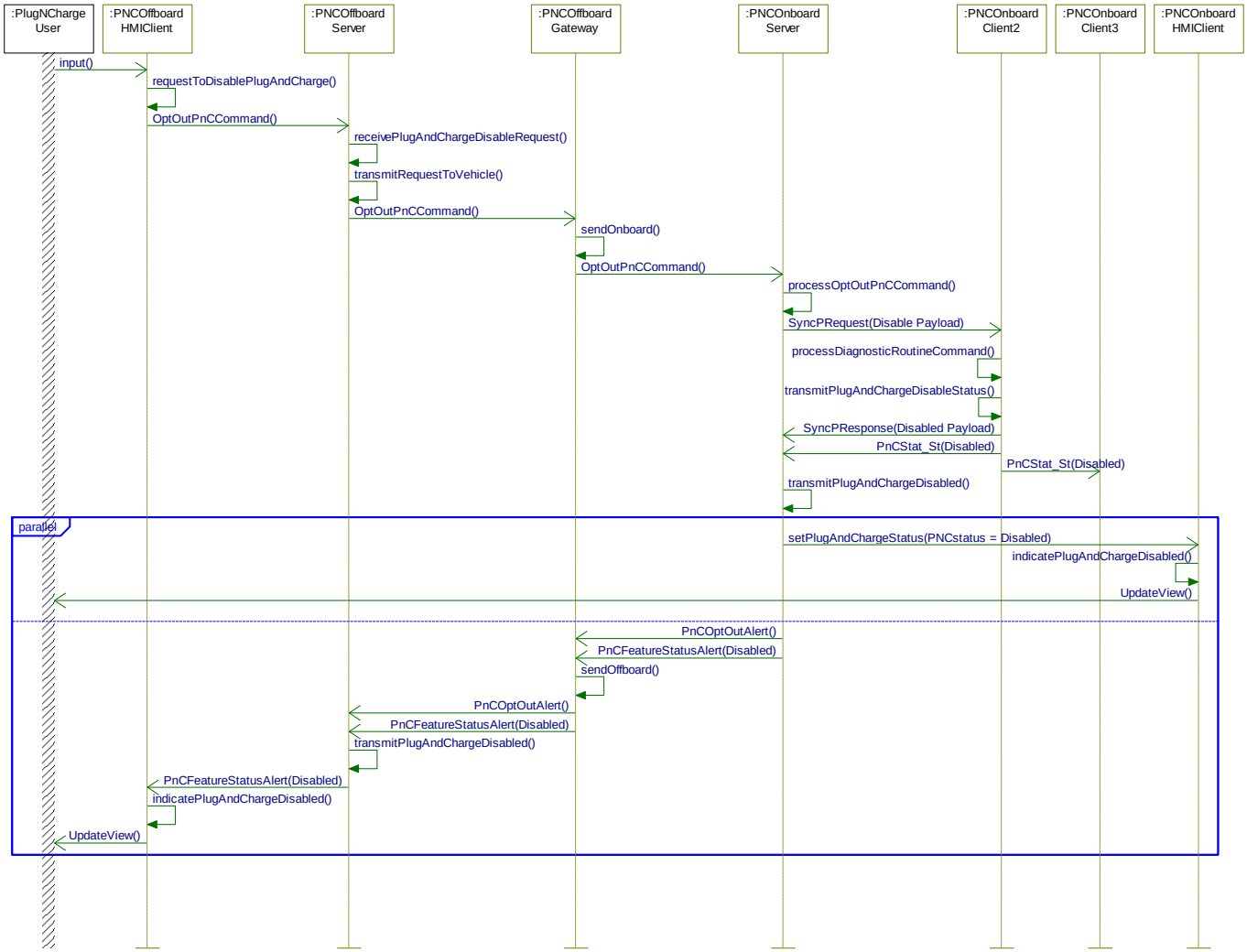


2.5.3.1.2 PNC-ACT-REQ-326555/B-Re-Enabling Plug and Charge

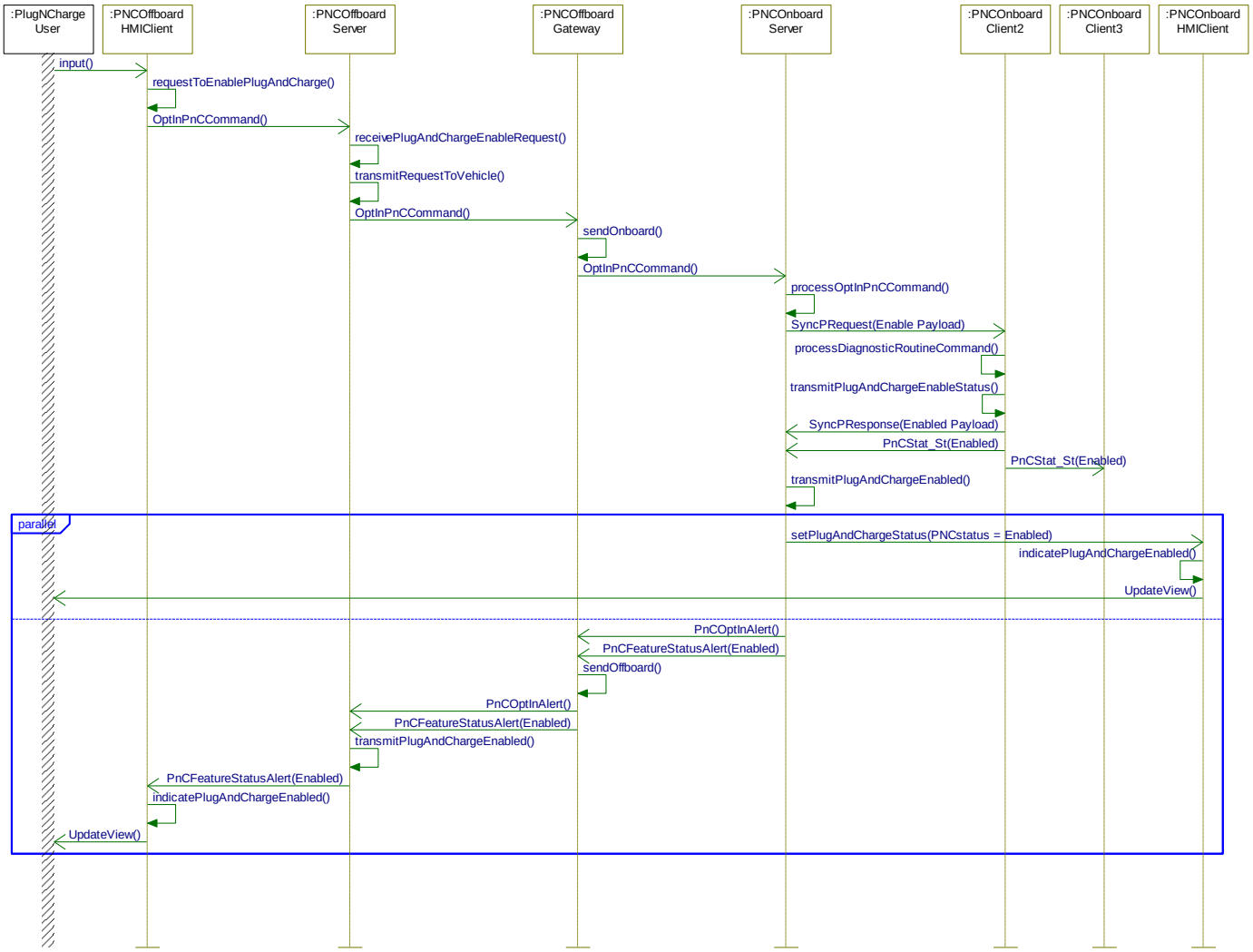


2.5.3.2 Sequence Diagrams

2.5.3.2.1 PNC-SD-REQ-326553/B-Disabling Plug and Charge



2.5.3.2.2 PNC-SD-REQ-326556/B-Re-Enabling Plug and Charge



2.6 PNC-FUN-REQ-326626/A-Managing Expired Contract Certificates

2.6.1 Requirements

2.6.1.1 PNC-REQ-326853/B-Managing Expired Contract Certifications - Success

Once installed in the vehicle, the maximum length of time contract certificates can be valid for is 2 years, according to the ISO standard. The cloud will store and track the expiration date of the contract certificate. One month before the contract certificate expires, the cloud will initiate a command to install new certificates and delete the expired ones.

If successful, the user is not notified, as this is a background process.

Installing New Contract Certificates:
One month Before Certificate Expiration data, Cloud will initiate Install new certificate Payload. If user using PnC feature actively.

Rule:
Cloud will initiate PnCManageCertificate Command with Install New Cert/Replace Certificate with SyncP Payload to ECG, ECG Sends SyncP Payload to OBCC Module by using SyncPRequest Diagnostic Routine
Response:

After completing the certificate Service request by SyncP Request, OBCC shall send a Positive Diagnostic Routine to the control Routine with a Payload of a SyncP packet.

ECG:
ECG receives SyncP response from OBCC module and sends Encrypted SyncP response as an "PnCManageCertificatestatus alert" to the Cloud

Delete cert Request:
Cloud will initiate PnCManageCertificate Command with Delete Cert SyncP Payload to ECG, ECG Sends SyncP Payload to OBCC Module by using SyncPRequest Diagnostic Routine.

Delete cert Response:
If successful:
ECG receives SyncP response from OBCC module and sends Encrypted SyncP response as an "PnCManageCertificatestatus alert" to the Cloud

If failed:
New Certificate Installation and delete of Expired certs are failed due to any Reason. Vehicle OBCC disables PnC Feature and notify the user to take vehicle to dealership

Failure:
If contract certificate deletion/Installation of New Certificate was not successful and cloud connectivity exists, the user will notify Via FordPass.

2.6.1.2 PNC-REQ-326854/A-Managing Expired Contract Certifications - Failure

If the contract certificate deletion and installation is not successful, given that the vehicle still has connectivity, the following will occur:

- If unable to update contract certs before the expiration date, Cloud will retry until successful
- If unable to update contract certs after expiration date, assuming cloud connectivity:
  - Notify customer to go to the shop,
  - Disable PnC

2.6.2 Use Cases

2.6.2.1 PNCv1-UC-REQ-320374/B-Deletion of Expired Contract Cert's and Install New Contract Cert's

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Contract Cert's are Installed in the Vehicle
Scenario Description	Deletion of Expired Contract Cert's and Install New Contract Cert's
Post-conditions	1. Contract Cert's will Expires Every two years 2. The Cloud will track the Expiration date of the Contract Certificates 3. One month Before Expiration data, Cloud will send Delete Expired Certificate payload to ECG 4. ECG will Send Payload to OBCC via Diagnostic Routine 5. OBCC Process the Diagnostic Routine and Send Success Response to ECG 6. ECG Tigger's an Alert to off board

	7. Cloud Shall sends New Certificate Payload to ECG, ECG sends Payload to OBCC via Diagnostic Routine 8. OBCC Shall Sends Success Response to ECG 9. ECG Tigger's an Alert to off board 10. If the Entire Process is Successfully Complete, the user is not notified and this is a background process
List of Exception Use Cases	
Interfaces	Vehicle interface, Offboard interface, Centerstack HMI

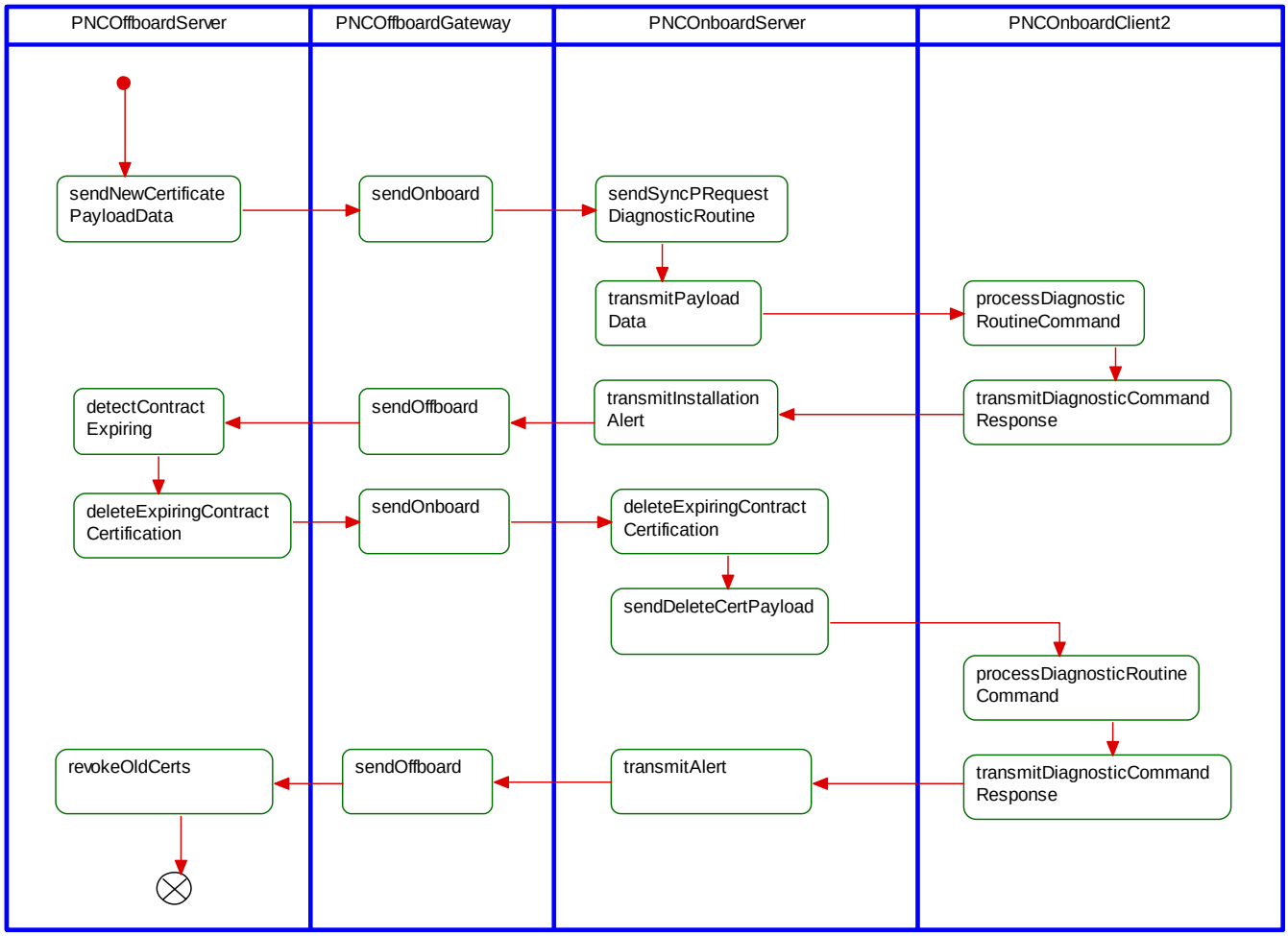
2.6.2.2 PNCv1-UC-REQ-320376/B-Failed to Delete Expired Contract Cert's and Install New Contract Cert's

Actors	FordPass user
Pre-conditions	1. Onboarding has been successfully completed 2. Cloud connectivity is available 3. PnC is Enabled 4. Contract Cert's are Installed in the Vehicle
Scenario Description	Failed to Delete Expired Contract Cert's and Install New Contract Cert's
Post-conditions	1. If Deletion of Expired Contract Cert's or installation of New Contract Cert's is Unsuccessful before the Expiration Data, Cloud will retry until Successful 2. If failed to Update delete Expired Contract Cert's and New contract Cert's 3. User get notify in FordPass and Disable PnC in Both Vehicle and FordPass
List of Exception Use Cases	
Interfaces	Vehicle interface, Vehicle HMI, Offboard HMI

2.6.3 White Box Views

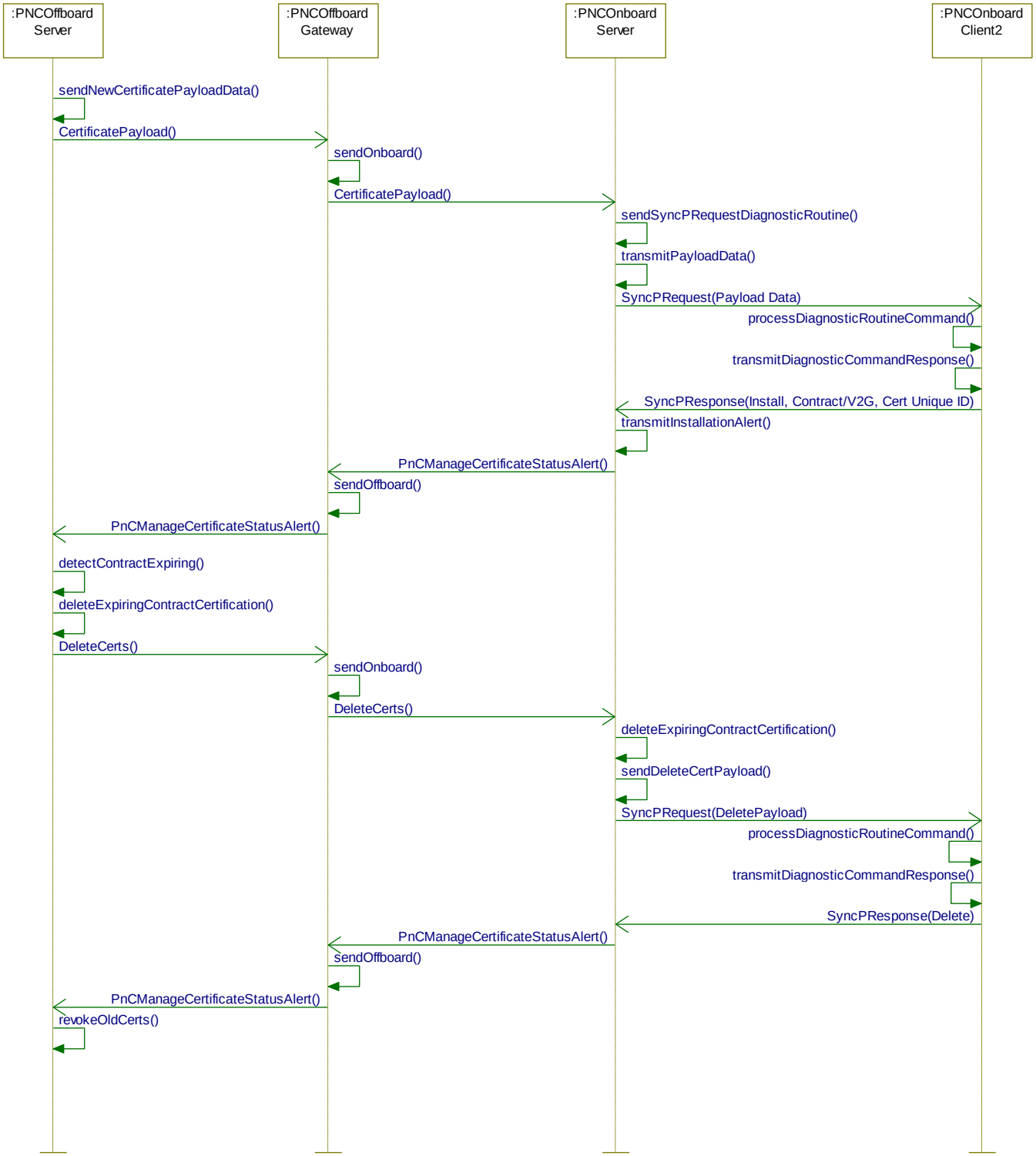
2.6.3.1 Activity Diagrams

2.6.3.1.1 PNC-ACT-REQ-326781/B-Delete Expiring Contract Certifications And Reinstall



2.6.3.2 Sequence Diagrams

2.6.3.2.1 PNC-SD-REQ-326782/B-Delete Expiring Certs and Installing New Cert



2.7 PNC-FUN-REQ-326625/A-Master Reset

2.7.1 Requirements

2.7.1.1 PNC-REQ-330380/D-Master Reset

If ECG receives any Reset Signals from SYNC and Cloud, ECG Sends PnC Reset CAN Signal to OBCC, OBCC shall delete all certificates and the respective Private Keys and Disables PnC Feature and send Feature status to ECG and BCCM

ECG PnC App will do the following upon master when ECG stores alerts while network is down and stored SOA message while SYNC is off:
1. Clear pending SOA messages from cache and storage during master reset
2. Clear pending queued alerts from cache and storage during master reset
3. Will not need to remove the persistent storage files as it is already empty anyway.

Delete All certificates and Disable PnC Feature in OBCC:
Requests will be sent to the OBCC to turn off PnC and delete all certificates when there is a Master Reset/Brand Connect Reset in the vehicle

ECG will do the following logic:
Upon ECG Receiving the FactoryReset_Rq=0x1 or ModemReset_D_Rq = 0x5 or ModemReset_D_Rq = 0x6, send DgtlCommPnc_D_Rq = Reset to OBCC module.

OBCC:
OBCC shall Resets memory by deleting all certificate, disable the PnC feature and increments server message ID counter to +1000.

SUCCESS
ECG and OBCC:
After Deleting all Contract Certificates and Disable PnC Feature, OBCC shall sends DgtlCommPnc_D_Stat = NoContractsInstalled to ECG, the ECG Sends a PnCManageCertificatestatus alert with PnCCertRevokeReason and PnCFeatureStatus alert with NoContractsInstalled state to the Cloud

ECG shall wait for 10s for a response from OBCC and 10s will be a calibrated value.

Last user removes VIN from FordPass app:
The last user remove VIN from FordPass account shall remove all EV Plug and Charge Functionally in the Vehicle.

a. A VIN removal command will be triggered by the user and the backend will transmit clearUserSettings Command to the ECG. The ECG shall transmit DgtlCommPnc_D_Rq = DeleteAll to OBCC module.
b. The OBCC shall delete all Contract certificates and the respective Private Keys, Disable the PnC Feature and doesn't increment their sever message ID Counter to +1000.
c. OBCC Sends DgtlCommPnc_D_Stat = NoContractsInstalled to ECG, the ECG Sends a PnCManageCertificatestatus alert with PnCCertRevokeReason and PnCFeatureStatus alert with NoContractsInstalled state to the Cloud.

ECG shall wait for 10s for a response from OBCC and 10s will be a calibrated value.

2.7.2 Use Cases

2.7.2.1 PNCv1-UC-REQ-325271/C-Master Reset Initiated from APIM

Actors	Vehicle Occupant
Pre-conditions	The Infotainment System is Power on
Scenario Description	Mater Reset/Brand Connect Reset Initiated from APIM

Post-conditions	1. The customer Initiates Master Reset via SYNC HMI. 2. A first popup will be displayed for Master Reset warning the customer 3. ECG send PnC master reset signal to OBCC 4. OBCC delete all contract certificates and Disable PnC Feature and Sends PnC Disable Command response to ECG 5. ECG Shall sends an alert to Cloud 6. CVFMA de-enrolls VIN in PaaK FI and subscription cancellation status is updated in the Subscription Management. 7. IVSS Core sends a revoke request to the Mobile App via the cloud 8. Authorized users are notified about a Master Reset event in FordPass app
List of Exception Use Cases	
Interfaces	HMI

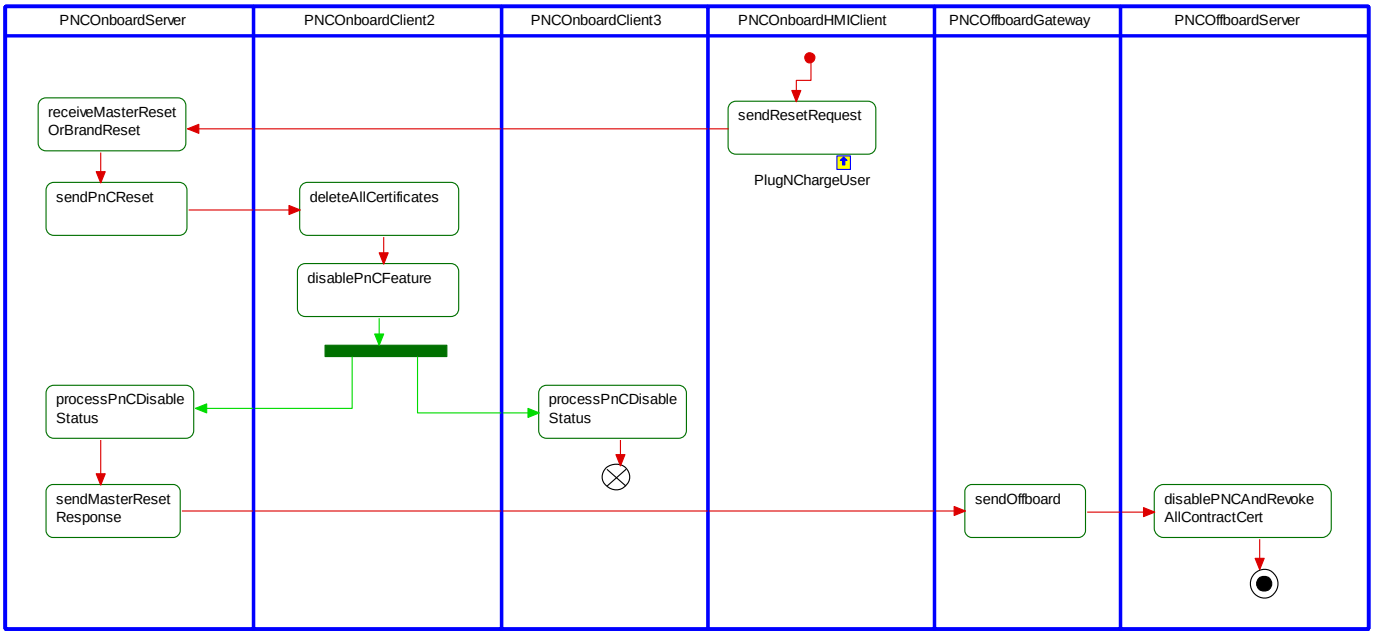
2.7.2.2 PNCv1-UC-REQ-325272/C-Last User Removes Vehicle from Mobile App

Actors	Mobile App User
Pre-conditions	The Vehicle is Authorized and Account is Activated
Scenario Description	Last User Removes Vehicle From Mobile App
Post-conditions	1. Clear User Setting Command is Initiated from the SDN to TCU/ECG 2. ECG send PnC master reset signal to OBCC 3. OBCC delete all contract certificates and Disable PnC Feature and Sends PnC Disable Command response to ECG 4. ECG Shall send an alert to Cloud
List of Exception Use Cases	
Interfaces	Mobile App, OBCC, BCCM

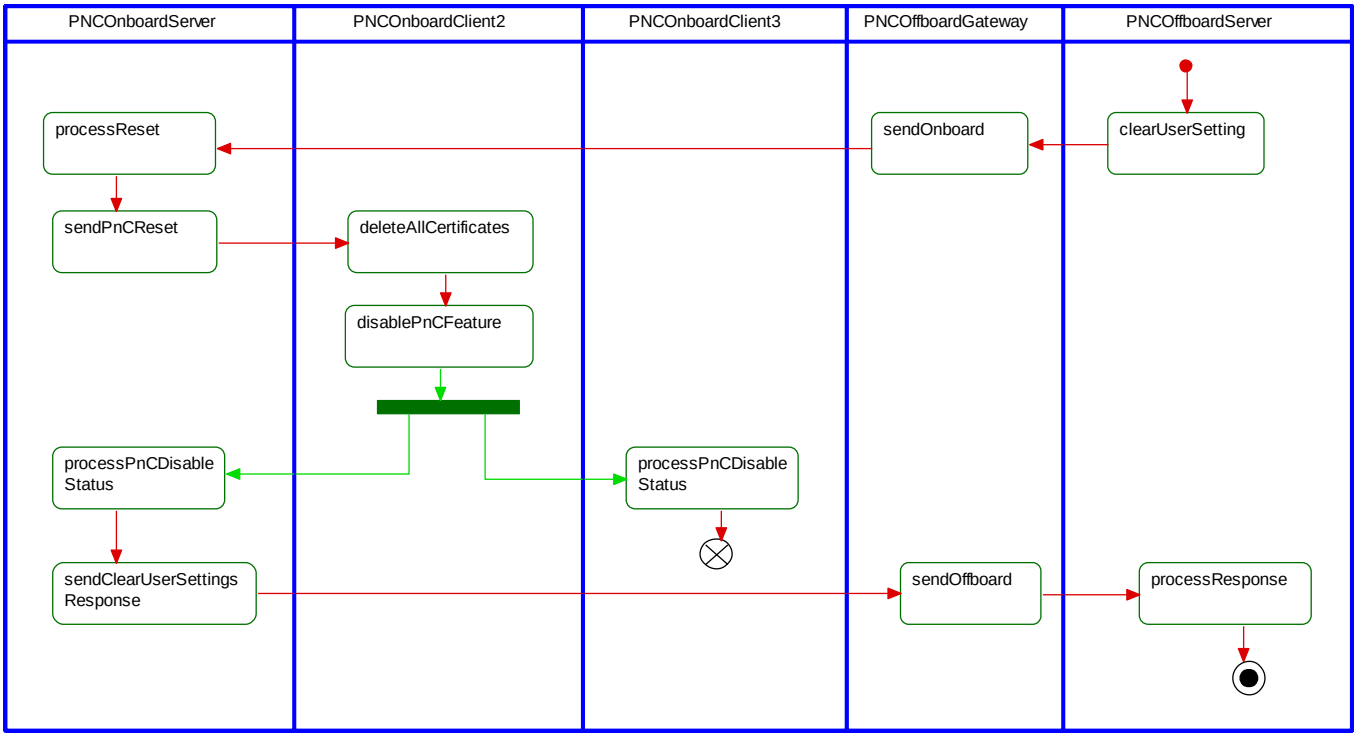
2.7.3 White Box Views

2.7.3.1 Activity Diagrams

2.7.3.1.1 PNC-ACT-REQ-326783/B-Master Reset from PnC Onboard HMI Client

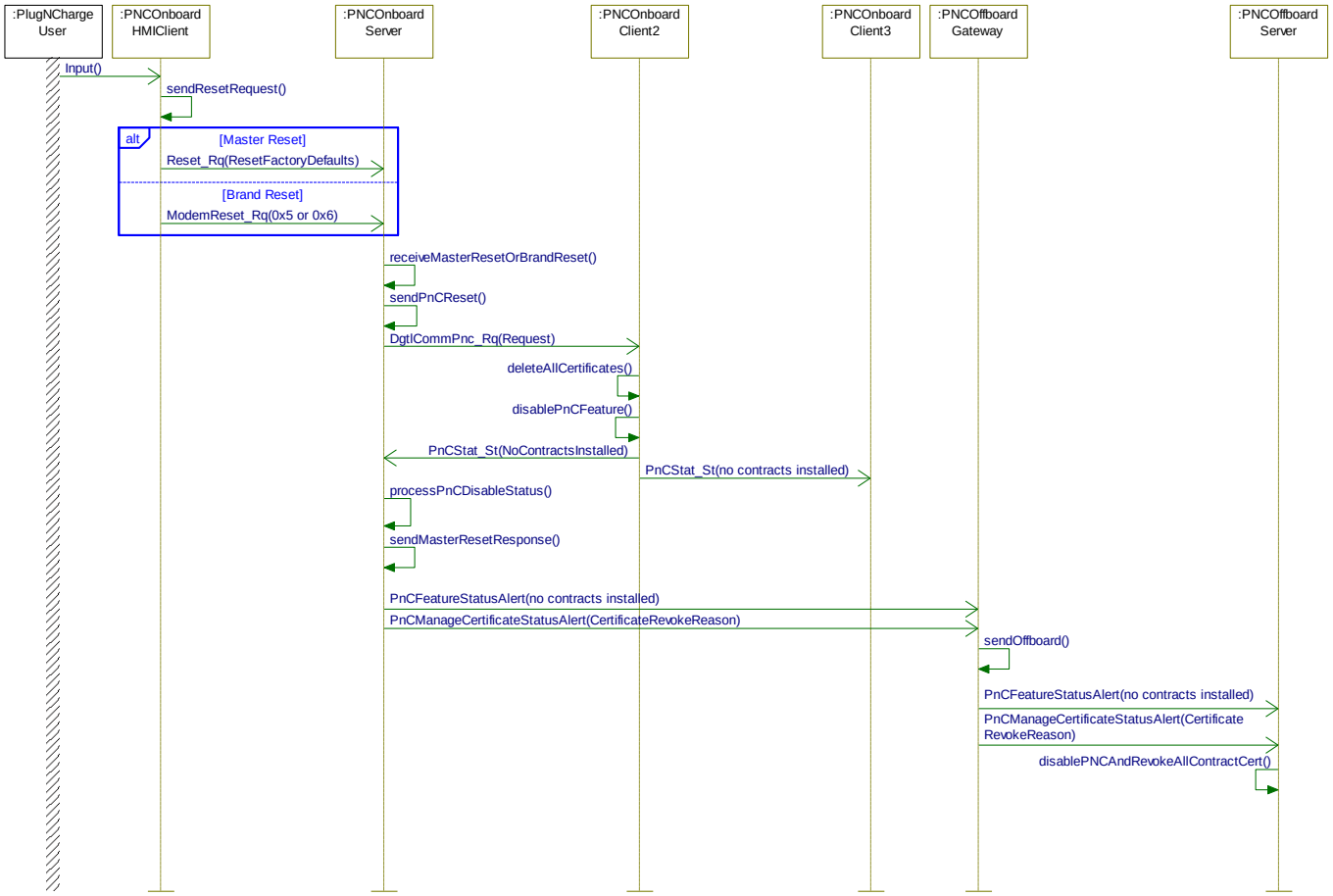


2.7.3.1.2 PNC-ACT-REQ-330600/B-Last User has Removed Vehicle from App

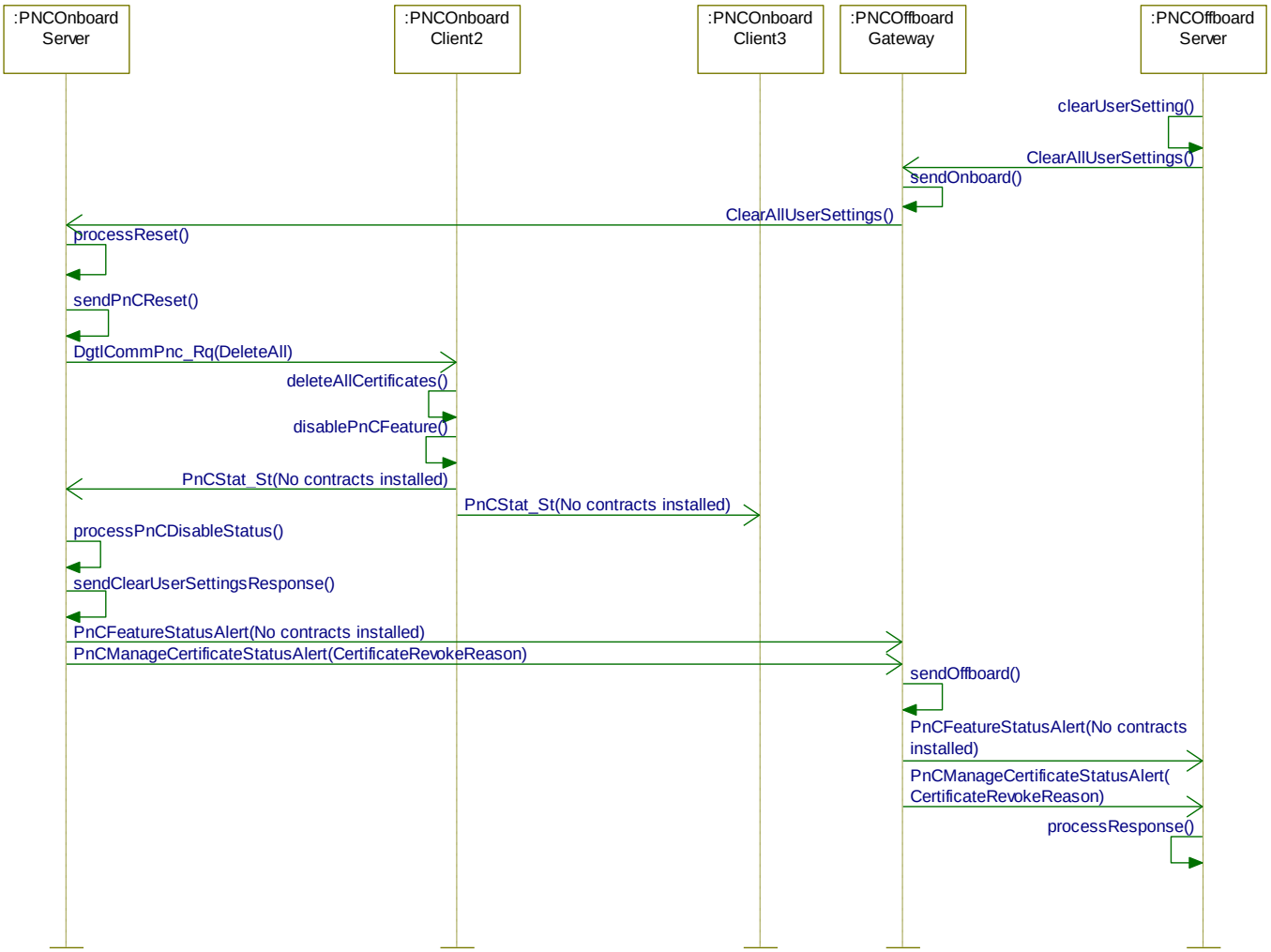


2.7.3.2 Sequence Diagrams

2.7.3.2.1 PNC-SD-REQ-326837/C-Master Reset



2.7.3.2.2 PNC-SD-REQ-330601/D-Last User has Removed Vehicle from App



2.8 PNC-FUN-REQ-326780/A-PnC Onboard Client2 Module Swap

2.8.1 Requirements

2.8.1.1 PNC-REQ-335761/B-OBCC Swap Detection

1. As defined in Provisioning Spec, If Module A is replaced with Module B then Module B has to go through self-test and start transmitting OBCC_ECG_Word_Tx TP Signal to ECG at a 1000msec event periodic rate and this condition will Checked by ProvServer in ECG and send Provisioning alert to the cloud.
2. Cloud (GVMS) shall detect change in FESN and send swap event to downstream cloud applications

OBCC Provisioning:
- If ObccProvStat changes from 0x3B provisioned to any other state, OBCC shall delete all the contract and V2G root certificates
- If ObccProvStat is not 0x3B Provisioned, and PnCStatus = “Enable” or “Faulty”, OBCC shall set PnCStatus = “Disabled”

For OBCC provisioning signals please refer to Peripheral Provisioning SPSS.

2.8.1.2 PNC-REQ-335762/B-Deleting Certificates in New OBCC Module

When OBCC module is at not provisioned state delete all certificates in OBCC Module and Disable Plug and Charge Feature. Send an alert to cloud

ECG and OBCC:
After Deleting all Certificates and Disable PnC Feature, OBCC shall sends DgtlCommPnc_D_Stat = NoContractsInstalled to ECG, the ECG Sends a PnCManageCertificatestatus alert with PnCCertRevokeReason and PnCFeatureStatus alert with NoContractsInstalled state to the Cloud

2.8.1.3 PNC-REQ-335763/A-Installing New Certificates in New OBCC Module

Cloud will revoke old Contract Certificates and Create new Certificates, send it to the vehicle and Enable PnC in the Vehicle.

Cloud:
Cloud will Create Secure Payload deliver to the Vehicle
ECG:
Follow On-boarding Process to install Certificates and Enabling PnC Feature in OBCC Module.

2.8.2 Use Cases

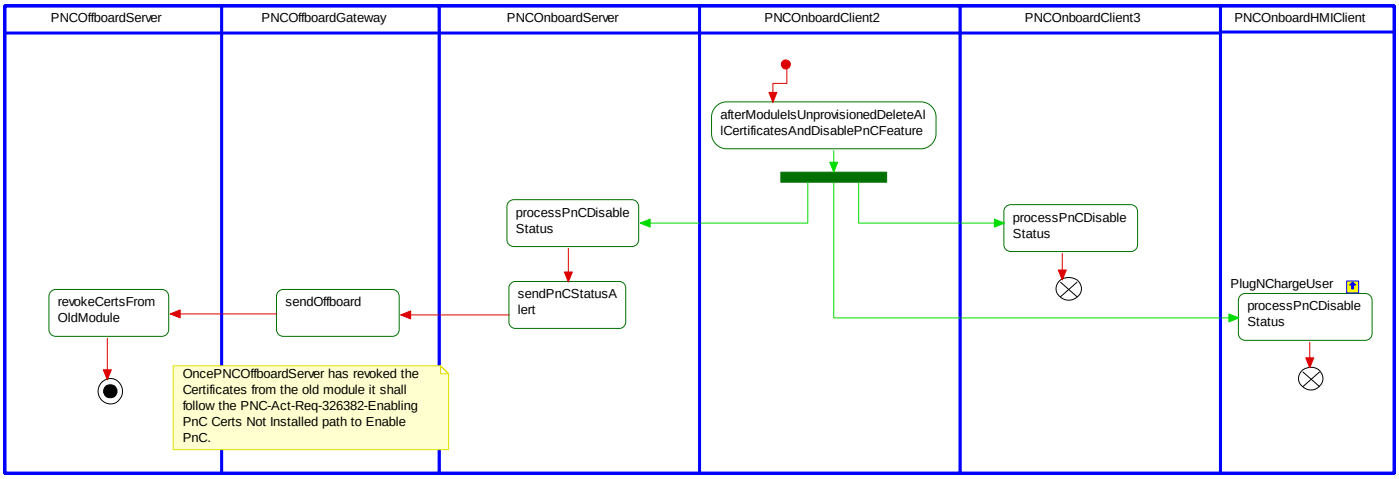
2.8.2.1 PNCv1-UC-REQ-326621/C-Installing New Certification after OBCC Swap

Actors	Vehicle Occupant
Pre-conditions	Onboarding has Successfully Completed PnC Enabled User has Subscription Cloud Connectivity is Available OBCC Module is Provisioned
Scenario Description	Installing New Cert's when OBCC Swap
Post-conditions	1. When the OBCC module Swap, ECG detect change in OBCC FESN 2. OBCC delete all certificates and Disables the PnC Feature, if the module is not provisioned. 3. After Deleting all Certificates and Disable PnC Feature, OBCC shall sends DgtlCommPnc_D_Stat = NoContractsInstalled to ECG 4. ECG Sends an alert to off board 5. Cloud shall void old Certificates in the Old OBCC Module 6. Cloud will send Payload to Vehicle and install new Certificates in new OBCC module and Enable PnC feature
List of Exception Use Cases	
Interfaces	Vehicle interface

2.8.3 White Box Views

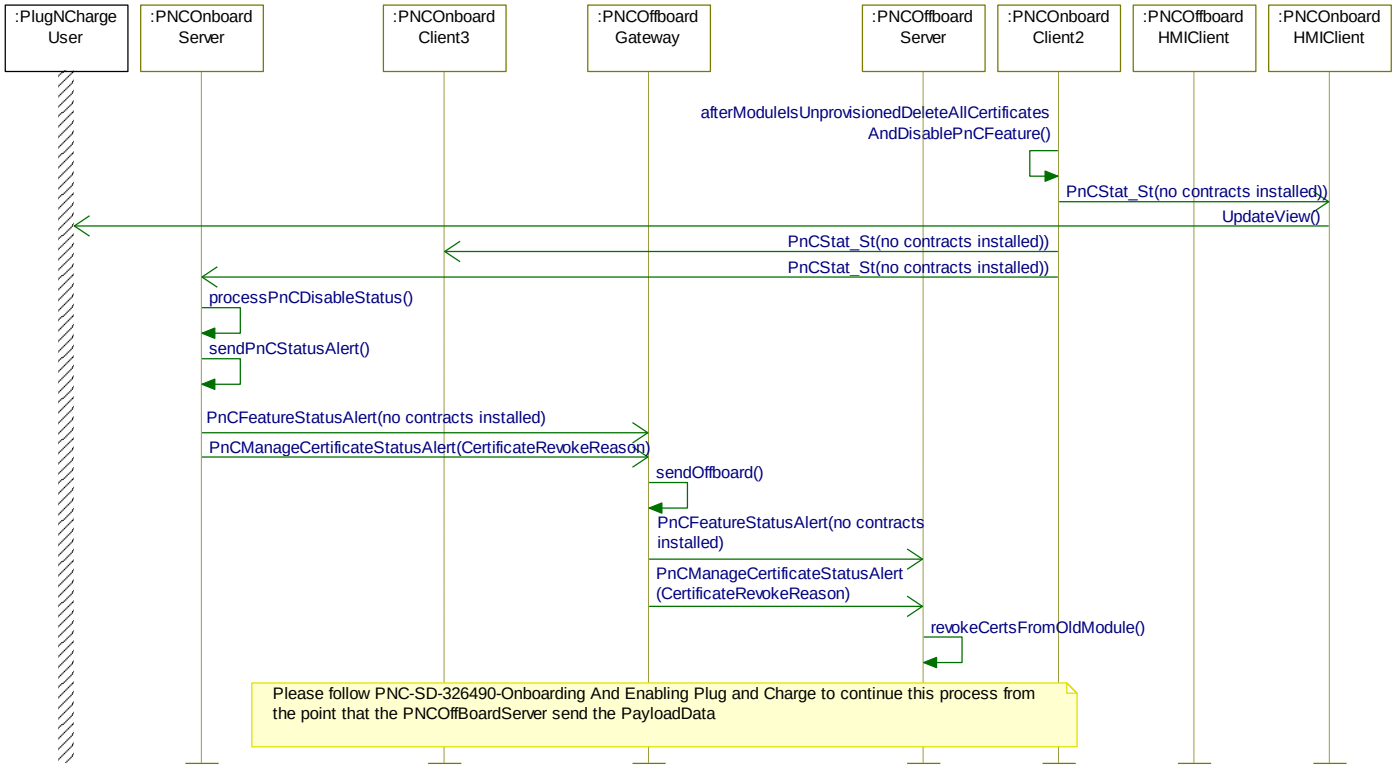
2.8.3.1 Activity Diagrams

2.8.3.1.1 PNC-ACT-REQ-326765/B-Install New Certification After Module Swap



2.8.3.2 Sequence Diagrams

2.8.3.2.1 PNC-SD-REQ-326779/C-Installing New Cert After Module Swap



2.9 PNC-FUN-REQ-334896/A-Wake Up Strategy

2.9.1 Requirements

2.9.1.1 PNC-REQ-334897/B-OBCC-BCCM Wakeup Strategy

Wake Up OBCC for PnC Certificate Installation (Install/Delete/Assign Priority) and PnC Re-Enabling and Disabling:

When Cloud sending Certificate Payload and Enable/Disable Command via FTCP when the vehicle ignition off. FTCP SMS will wakeup ECG, then ECG need to wake up BCM and BCM will Wakeup BCCM and BCCM wakeup OBCC

1. ECG send a PtWakeupActv1_B_Rq, 0x1: On Request to BCM for 5 seconds, and then resulting in a wake up to the BCCM for 5 Sec and the BCCM will be able to wake the OBCC.
2. ECG Sends Sustain “ChrgrPncSustn_B_Rq” CAN Signal to BCCM with 0x1: Active, BCCM wakeup OBCC

2.9.1.2 PNC-REQ-334898/B-Time Limit for Wakeup Strategy

- ECG need to wakeup OBCC/BCCM for Maximum 90 sec for Certificate installation Process and PnC Enable/Disable
- Rule: After 90 Sec, ECG send ChrgrPncSustn_B_Rq with Inactive state to BCCM to keep BCCM/OBCC in sleep mode

2.9.2 Use Cases

2.9.2.1 PNCv1-UC-REQ-334895/B-Wake Up for PnC Enable-Disable and Cert installs

Actors	Vehicle Occupant
Pre-conditions	1. User registers for FordPass app 2. User has Authorized Vehicle 3. User sets up wallet 4. User selects subscription in FordPass 5. CCS are Enabled 6. Cloud Connectivity is Available 7. Vehicle is key off
Scenario Description	Wakeup OBCC/BCCM for PnC Enable/Disable and Install Certificates. When Vehicle Ignition off
Post-conditions	1. For PnC requirement we want to Enable/Disable and Install Certificates even though vehicle Ignition off. 2. When Cloud sending Certificate Payload/Enable/Disable Payload via FTCP Command when the vehicle ignition off. FTCP SMS will wakeup ECG, then ECG need to wake up BCM and then resulting in a wake up to the BCCM for 5 Sec and the BCCM will be able to wake the OBCC 3. ECG Sends Sustain “ChrgrPncSustn_B_Rq” CAN Signal to BCCM with 0x1: Active, BCCM wakeup OBCC 4. Once ECG Receives Success Response from OBCC for PnC Enable/Disable and Certificates SyncPResponse from OBCC. ECG send CAN Signal to keep OBCC/BCCM in sleep mode.
List of Exception Use Cases	ECG, OBCC, BCCM
Interfaces	ECG, OBCC, BCCM

2.10 PNC-FUN-REQ-369804/A-V2G Certificate Delivery upon OBCC Being Provisioned

2.10.1 Requirements

2.10.1.1 PNC-REQ-369816/B-V2G Certificate Process

- Once the OBCC module gets provisioned at the End of the line, a cloud shall orchestrate V2G certificate payload to OBCC via ECG even before the customer authorized to the vehicle and customer never complete the subscription process in Fordpass App.
- Remove Authorization Pre-check for “PnCManageCertificate command, PnCManageCertificate Command Response and PnCManageCertificatestatus co-related alert” in the PnC ECG application whenever ECG receives this command from the cloud and send the Payload to OBCC module via “SyncPRequest” Diagnostic Routine.
- Once ECG receives SyncP response with status payload from OBCC then the ECG app shall trigger PnCManageCertificatestatus alert.
- ECG PnC application shall fully initialize and run in the Factory and Transport mode

EOL Configuration for Each Vehicle Life Cycle Modes:

The following are the EOL DID configurations for NA and EU region on each vehicle life cycle modes:

1. Factory and Transport
    a. CCS Vehicle connectivity, Vehicle data, Vehicle location, and Driving characteristics will always be enabled
    b. DE17 bSAllow_FEATURE27_PlugandChargeEV = ON
    c. DE1A bPAllow_FEATURE27_PlugandChargeEV = ON
    d. CCS Policy file UAllow = ON
2. Normal mode without Authorization – Location sharing is disabled by default
    a. CCS Vehicle connectivity, Vehicle data will always be enabled, and Vehicle Location is disabled by default
    b. DE17 bSAllow_FEATURE27_PlugandChargeEV = ON
    c. DE1A bPAllow_FEATURE27_PlugandChargeEV = ON
    d. CCS Policy file UAllow = OFF
3. Normal mode with Authorization
    a. All CCS settings are enabled by default
    b. DE17 bSAllow_FEATURE27_PlugandChargeEV = ON
    c. DE1A bPAllow_FEATURE27_PlugandChargeEV = ON
    d. CCS Policy file UAllow = ON

2.10.2 Use Cases

2.10.2.1 PNCv1-UC-REQ-369805/A-Install V2G Certificates

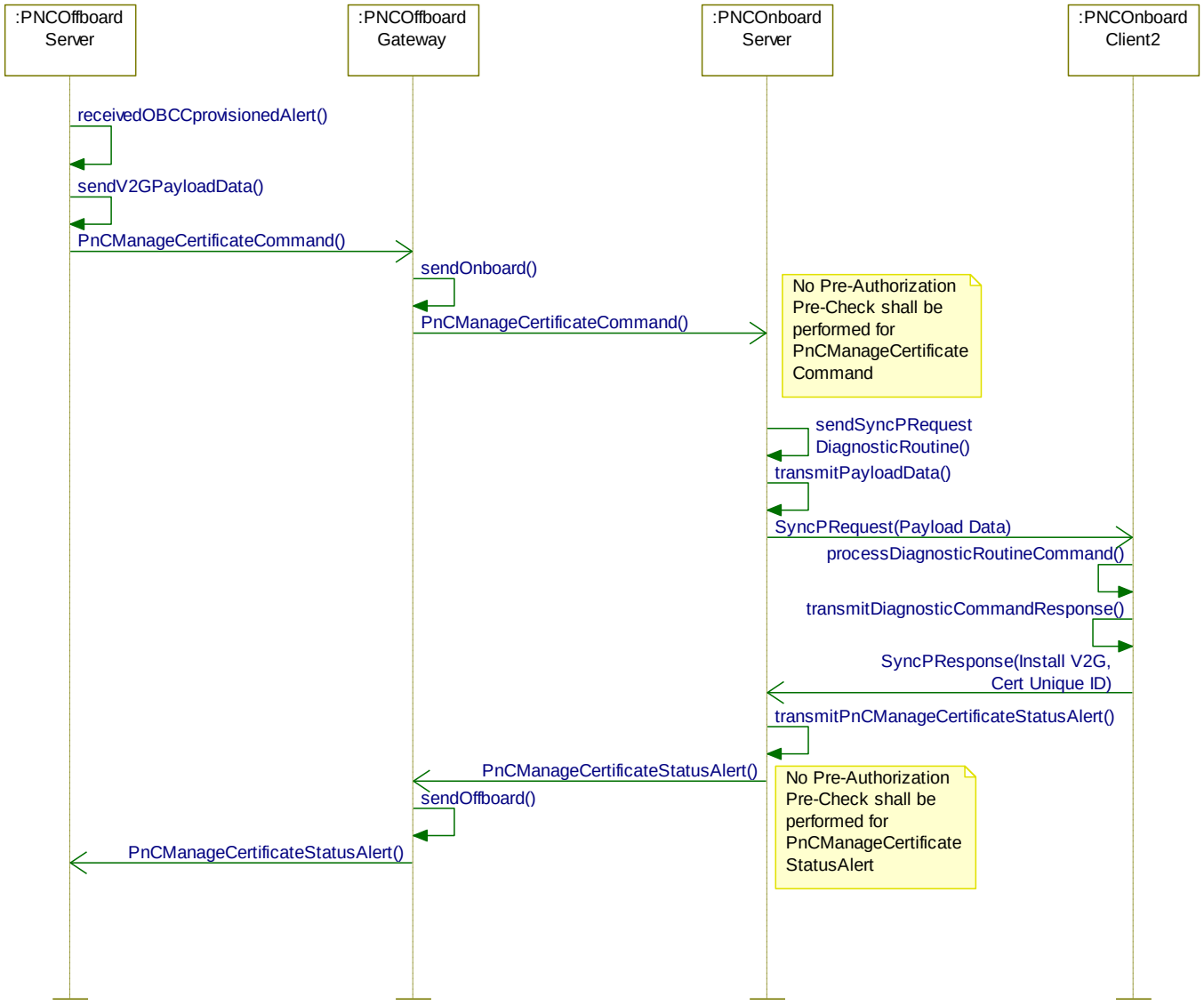
Actors	Cx727 Vehicle
Pre-conditions	1. User not registered to FordPass app 2. User not Authorized to the Vehicle 3. CCS settings are Enabled 4. Cloud Connectivity is Available 5. ECG Removes Authorization Pre-check for PnCManageCertificate command 6. ECG Removes Authorization Pre-check for PnCManageCertificatestatus alert 7. The Vehicle is key off
Scenario Description	Install V2G certificates upon OBCC Provisioned

Post-conditions	1. OBCC Module gets Provisioned at End of the line 2. Upon OBCC Provisioning alert Cloud shall create V2G certificate Payload and send it to ECG via PnCManageCertificate command 3. ECG shall send the Payload to the OBCC module via “SyncPRequest” Diagnostic Routine. 4. OBCC shall Send the Diagnostic Routine Command Response to ECG 5. ECG shall trigger PnCManageCertificatestatus alert with SyncP response Payload to the Cloud.
List of Exception Use Cases	
Interfaces	Cloud, ECG, OBCC

2.10.3 White Box Views

2.10.3.1 Sequence Diagrams

2.10.3.1.1 PNC-SD-REQ-369778/B-V2G Certificate Delivery once OBCC Provisioned



2.11 PNC-FUN-REQ-395797/A-China GBT Charger Data to the Cloud

2.11.1 Requirements

2.11.1.1 PNC-REQ-395798/B-China Specific Charge Station Info and Shifted Data

- ECG shall monitor ChrgrInPwMde_D_Actl CAN Signal with 0x3= AcBasic, 0x4= AcDigital, 0x5= DcCharging and send Request ChargeStationID_Rq TP signal to OBCC Module
- OBCC shall send ChargeStationID_St TP Signal with EVSE ID, TLS charging info, Station Schedule information to ECG.
- ECG shall send PnCChargingStationInfo alert with OBCC response Payload, Shifted GPS signals and DgtlCommGtwyMde_D_Stat signal to the cloud.

2.11.1.2 PNC-REQ-395799/B-Alerts Needed for China

- PnCChargingStationInfo
- PnCChargeComplete
- PnCManageCertificate alert

2.11.1.3 PNC-REQ-395801/A-Commands Needed for China

- PnCManageCertificate

3 Appendix A: Definitions / Acronyms

Abbr.	Stands for	Description

4 Appendix B: Reference Documents

Reference	Title	Doc. ID	Revision
1	Peripheral Module Provisioning SPSS		Latest

The requirements of the documents listed in the reference table above, of the latest revision level, form a part of this Engineering Specification