Feature Document (FD)

Remote Start and Schedule Remote Start

(MyFeatureId)

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1 INTRODUCTION

1.1 Document Purpose

A Feature Document (FD) document specifies **what** the feature shall do and how it shall behave from customer perspective. It should also provide reasoning and background **why** we have the feature in the vehicle.

The FD also serves as an Item Definition as defined by ISO26262 for those features, which follow the Ford Functional Safety process.

To get more information about the concept of feature, function and component level abstraction refer to the Ford RE Wiki. For details on the Ford Functional Safety (ISO26262) process refer to the Ford Functional Safety Sharepoint.

1.2 Document Scope

This Feature Document (FD) specifies the following features:

Feature ID	Feature Name	Owner	Reference
<Add VSEM Global Feature Dictionary ID>			<Add VSEM Link>

Table 1: Features described in this FD

1.3 Document Audience

The FD is written by the feature owner of <Remote Start and Schedule Remote Start / Command and Control>. All Stakeholders, i.e., all people who have a valid interest in the feature should read and, if possible, review the FD. It needs to be guaranteed, that all stakeholders have access to the currently valid version of the FD.

1.3.1 Stakeholder List

For the latest list of stakeholder of the feature and their influence refer to <Put VSEM Link here>.

Name	CDSID	Role	Department
Harminder Sandhu	HSANDH20	Feature Owner Supervisor	CVVP
Lalitha Kovuru	LKOVURU	Program Manager	CVVP
Audriene Bell	abell101	Feature Owner Requirements	CVVP
Raad Alhussainy	ralhussa	Feature Owner Requirements	CVVP
Shaina Sethi	ssethi4	Software Engineer	CVVP
Samir Gandhi	SGANDH11	Validation Engineer	CVVP
Berney Samuels	hsamue14	Lead Product Engineer	CVVP
Zahra Badaoui	Badaoui	Systems Engineer	CVVP
Robert Paquette	rpaquet2	FISI Engineer	INFOTAIN&CONNECT ELECTR/A
Gail Cheng	gcheng	Infotain Sys Supervisor	INFOTAIN&CONNECT ELECTR/A
Nhi Torres	ntorres5	Network Communication (NetCom) Engineer	NetCom
Murali Chitturi	mchittur	FTCP Manager	FTCP
Magesh Mohan	mmohan17	FTCP Engineer	FTCP
Uday Kumar Valke	uvalke		VSDN / TMC
Eva Kala	ekala	VVSDN / TMC-VSDN / TMC Supervisor	VSDN / TMC

Dilip Paul	dpaul1	VVSDN / TMC-VSDN / TMC Delivery Mgr	VSDN / TMC
Sherman Howe	showe	Product Manager Spl. Sr.	VSDN / TMC
James Wasnick	jwasnic1	Product Group Manager, CVPP	VSDN / TMC
Michael Meador	mmeador	Project Manager Delivery, VSDN / TMC	VSDN / TMC
Sujay Bontadka	SBONTADK	Product Designer, VSDN / TMC	VSDN / TMC
Aruna Vaidyanathan	avaidyan	Lead Program Manager, CV&S	VSDN / TMC
Julian Onuoha	jonuoha	Performance Testing	VSDN / TMC
Ghida Choukair	gchoukai	CV Product Group Manager, VSDN / TMC	VSDN / TMC
Rebecca Brown	rbrow650	Project Manager, MPP-Central	VSDN / TMC
Senthilna Balasubramaniam			VSDN / TMC
Dave Gersabeck	dgersabe	CVPP Integration Manager, VSDN / TMC	VSDN / TMC
Robert Holman	rholman	PM Defects and Optimization all CV Features	FordPass
Chandra Gopalam	cgopalam	PM Defects and Optimization all CV Features	FordPass
Claudia Ross	CROSS78	Product Manager	FordPass
Star Hayden	shayden5	EEIT - Release Mgr	FordPass
Neela Venkataraman	nvenkat2	Supervisor	FordPass
Rachel Sherman	rsherm		FordPass
Kelly Zechel	kzechel	Product Owner for CV Features	FordPass/Lincoln Way
Joseph Tesorero	jtesorer	Product Owner for CV Features	FordPass/Lincoln Way
Christian Dodd	CDODD7	FordPass Chief	FordPass
Andre Rogerio	asouz135	WACM LVD Microphones Spv	UPPERBODY APPLICATIONS UN
Bianca Selinger	bselinge	Manager - Body & Security Elect	BCM
Peter Redlich	predlich	Manager Underbody EESE	BCM
Uwe Zank	uzank	Supervisor Security Electronics	BCM
Ahmet Cinar	acinar1	Locking Feature Owner Core BCM	BCM
Carlos Vega	cvega3	Feature Owner Core BCM EU	BCM
Sally Cherian	scheria2	Feature Owner Core BCM	BCM
Sebastian Koessler	koessle	System Engineer, Alarm	BCM
Tahrik Alcodray	talcodra	Supervisor, Telematics	ECG
Greg Maida	gmaida	Telematics Core / D&R Eng	ECG
Flavia Araujo	faraujo9	Manager - Connect Vehicle Electro	ECG
Santosh Kumar Ankam	sankam1	Performance Testing	
Felicia Jones	fjones41	EV/ Vehicle Controls Supv	EV Remote Start
Felipe Castrejon	FCASTREJ	Systems Engineer	EV Remote Start

Table 2: Stakeholder List

1.4 Document Organization

1.4.1 Document Context

Refer to the Specification Structure page in the Ford RE Wiki to understand how the FD relates to other Ford Requirements Documents and Specifications.

1.4.2 Document Structure

The structure of this document is explained below:

Section 1 – Introduction how to use this document including responsibilities and requisite documents. Explains the terminology. Gives a clarification of the definitions, concepts and abbreviations used in the document.

Section 2 – Feature Description. States briefly the background and the purpose of the feature, feature variants and corresponding regions and markets. Also includes input requirements, assumptions and constraints.

Section 3 – Feature Context describes all external entities, which have an influence on the feature.

Section 4 – Feature Modeling. Contains Use Case, Driving Scenarios, State Charts to describe the functional behavior of the feature.

Section 5 – Safety. Lists System Behaviors and Safety Goals of the feature.

Section 6 – Feature Requirements. Lists functional and non-functional requirements of the feature.

Section 7 – Architecture. Shows the coarse architecture, which the feature requirements are deployed to. Describes the elements and the boundary of the feature as well as the decomposition and distribution of associated functions.

Section 8 – List of Open Conerns

Section 9 – Document Change History including a list of new or modified requirements. The requirements in this document are tagged, and this section contains different types of tables listing all, new, or changed requirements by their title and page no.

Section 10 – Appendix

1.5 Document Conventions

1.5.1 Requirements Templates

Each requirement, use case or scenario in this specification shall follow the corresponding template given in the document template *Specification_Macros.dotm* at RE Wiki - Specification Templates.

1.5.1.1 Identification of requirements

The unique requirement ID given in the headline of any requirement follows the requirement throughout the development process. The requirement ID format follows a well-defined syntax.

All identifiers in a FD shall be composed of 4 parts:

- A leading prefix, which indicates the type of requirement (R=Requirement, UC=Use Case, SC=Scenario, …)
- A prefix, which indicates the abstraction level (F=Feature, FNC=Function, CMP = component).
- Followed by a name, indicating the scope, which the requirement belongs to (e.g. feature or function name)
- Ending with the actual requirement number

Example:

R_F_AutoLamps_00004 This is the fourth requirement on feature level for the feature Autolamps.

1.5.1.2 Requirements Attributes

The templates provided by *Specification_Macros.dotm* define a list of attributes for each requirement. This helps to classify the requirement. The attributes are explained at RE Wiki - Requirements Attributes.

2 FEATURE OVERVIEW

2.1 Purpose and Description of Feature

In order to deliver an enhanced customer experience and to evolve FORD's connectivity leadership, the FORD mobile application will include a series of command control features developed to provide an expanded suite of remote connectivity to customers.

The purpose of this PRD is to explain the functionality of the command and control features, specifically the Remote Start and Schedule Remote Start features, which will be delivered to the customer and provide a series of user requirements needed to achieve this functionality.

2.2 Feature Variants

Variant Name	Variant Description	Remarks
FNV2	8 Networks: MS CAN (BCM), HS CAN (PCM, Body), FD CAN (ADAS), ETHERNET – UNTRUSTED (SYNC, TCU), ETHERNET – TRUSTED (IPC), LIN, DIAG1 (OBDII), DIAG2 (OBDII)	FB5, 2021MY

Table 3: Feature Variants

2.2.1 Regions & Markets

Market / Region / Variant Name	North America	South America	Europe	Middle East / Africa	Asia / Pacific	China
FNV2	*Mandatory: US & Canada* *Mandatory: Not available on manual vehicles*	N/A	Optional: Europe Mandatory: Extend Remote Start Not Available	N/A	N/A	Optional: China

Table 4: Regions & Markets

2.3 Input Requirements

2.3.1 Legal Requirements

Federal Motor Vehicle Safety Standard – United States
Remote Start and Schedule Remote Start feature must be FMVSS-102 compliant.
FMVSS-102: Transmission Shift Lever Sequence, Starter Interlock, and Transmission Braking Effect

Canadian Motor Vehicle Safety Standard - Canada
CMVSS-102: Is consistent with FMVSS-102

2.3.2 Trustmark Requirements

2.3.3 Industry Standards

2.4 Lessons Learned

2.4.1 FMA Quality History

ECG causes of failure include:

a. No Function – Internal error
b. No Function – Software Update
c. No Function – Internal Error
d. No Function – Connection timeout with gateway
e. No Function – Connection to cloud lost via MQTT broker
f. No Function – Transition from low power mode takes longer than expected
g. No Function – User does not receive status message within 120 seconds, appearing as a failure to the user
h. No Function – Loss of CAN communication
i. No Function – ECG is not provisioned and/or authorized
j. No Function – ECG is in deep sleep power mode
k. Partial – Engine starts but user does not receive confirmation
l. Partial – Engine starts but ECG does not send confirmation

Cloud causes of failure include:

a. No Function – Cloud loses connection with the ECG via MQTT broker
b. No Function – User does not receive status message within 120 seconds, appearing as a failure to the user
c. No Function – Internal failure within the cloud
d. No Function – Number of concurrent users too high

BCM causes of failure include:

a. No Function – BCM internal failure

Mobile App causes of failure include:

a. No Function – Mobile app icon is not available for user to select
b. No Function – Mobile app icon does not respond to user selection
c. No Function – User does not receive status message within 120 seconds
d. No Function – Incorrect icons are displayed for transmission type
e. Unintended – Mobile app displays the wrong status message
f. Partial – Engine starts without confirmation

Environmental causes of failure include:

a. No Function – External EMC/RF prevents electrical components from transmitting signals
b. No Function – Electrical components inoperable due to environmental conditions such as extreme temperatures, humidity, dust or dirt contamination

Vehicle causes of failure include:

a. No Function – Insufficient battery power to ECG, BCM, etc. (fuse blown, wiring problem, wire type leading to open circuit, short to ground or power, etc.)

BCM causes of failure include:

a. No Function – BCM inoperable due to water/fluid ingress
b. No Function – BCM inoperable due to:
    i. Internal electrical failure
    ii. Reliability degradation from electrical or mechanical cycling
    iii. Failure from vibration or other durability related controls
c. No Function – Loss of CAN communication
d. Partial Function – System integrity compromised due to signal tampering/hacking or other security issues

2.5 Assumptions, Constraints & Dependencies

Assumptions

- The user has installed and created a valid login account for the FORD/LINCOLN owner mobile app
- The user has registered an eligible vehicle VIN (defined as a VIN which is known to have a ECG installed and has sent a provisioning message to the VSDN / TMC)
- The user has completed the authorization process for the eligible vehicle VIN
- Shared access allows multiple users to create an account for a vehicle.
- Swapping the ECG shall not affect vehicle remote controls

Dependencies

- Vehicle must be equipped with an ECG supporting the CVPP platform.
- Mobile app components must be supported on FordPass and Lincoln Way Mobile app
- Mobile App availability (for download) will depend on mobile application stores (i.e. AppStore, Google Play, etc.)
- A mobile device with internet access will be needed

Constraints

- Feature availability is limited for access to registered owners and users
- CCS setting may disable or enable remote command functionality
- Vehicle Connectivity is required is to enable remote command functionality
- Stolen Vehicle Location Services may disable remote command functionality when SVLA services are invoked

2.6 References

2.6.1 Ford Documents

List here all Ford internal documents, which are directly related to the feature.

Reference	Title	Doc. ID	Document Location	Revision
1	Control My Car Client v3 ECG Infotainment Subsystem Part Specific Specification (SPSS) v1.2			
2	Control My Car v3 ECG Implementation Guide			
3	Embedded Modem Common Functions ECG SPSS			

Reference	Title	Doc. ID	Document Location	Revision
4	Product Requirements Document Electric Vehicle Connected Services (Feature Bundle 4)			
5	Connected Vehicle Feature Management Application(CVFMA)Project Number: 25657Application # 22514, Activate/Enable Vehicle for a Feature			
6	Customer Opt-In Product Requirement Document			
7	Telematics Control Unit (ECG) to NGVSDN / TMC Security Requirements			
8	Addendum to ECG Security Specification			
9	Product Requirements Document Master Reset			
10	Command and Control Requirements			
11	Customer Opt-In Product Requirement Document (PRD)			
12	Product Requirements Document Vehicle Authorization			
13	Product Specification Document (PSD) Vehicle Authorization			
14	Product Requirements Document FTCP			
15	FNV2 Concept of Operations			
16	Customer Connectivity Settings SPSS			
17	Stolen Vehicle Services SPSS			
18	Body Control Module Functional Specification FS-LU5T-14B476-AAC			

Table 5: Ford internal Documents

2.6.2 External Documents and Publications

The list of external documents could include books, reports and online sources.

Reference	Document / Publication	Document Location	Version
1	Control My Car Client v3 ECG Infotainment Subsystem Part Specific Specification (SPSS) v1.2		1.2
2	Control My Car v3 ECG Implementation Guide		1.0
3	Embedded Modem Common Functions ECG SPSS		1.3
4	Product Requirements Document Electric Vehicle Connected Services (Feature Bundle 4)		1.5
5	Connected Vehicle Feature Management Application(CVFMA)Project Number: 25657Application # 22514, Activate/Enable Vehicle for a Feature		2.0
6	Customer Opt-In Product Requirement Document		1.1
7	Telematics Control Unit (ECG) to NGVSDN / TMC Security Requirements		1.1.4
8	Addendum to ECG Security Specification		1.0.3
9	Product Requirements Document Master Reset		2.0
10	Command and Control Requirements		09-06-2016
11	Customer Opt-In Product Requirement Document (PRD)		1.3
12	Product Requirements Document Vehicle Authorization		1.7
13	Product Specification Document (PSD) Vehicle Authorization		1.3
14	Product Requirements Document FTCP		0.5
15	FNV2 Concept of Operations		1.0
16	Customer Connectivity Settings SPSS		1.0

Reference	Document / Publication	Document Location	Version
17	Stolen Vehicle Services SPSS		1.5
18	Body Control Module Functional Specification FS-LU5T-14B476-AAC		12.08

Table 6: External documents and publications

2.7 Glossary

2.7.1 Definitions

Definition	Description
FordPass App	Mobile app used to present information, configure and command Ford vehicles
System	System refers to the overall eco-system from the cloud to the vehicle
FordPass	Mobile app used to present information, configure and command Ford vehicles
Lincoln App	Mobile app used to present information, configure and command Lincoln vehicles
System	System refers to the overall eco-system from the cloud to the vehicle
Function	A connected vehicle function is an indivisible piece of functionality that performs a unit of work and can be bundled onto a feature package in order to be offered for subscription to the customers. Each connected vehicle function should have its own data definition i.e. Remote Start, Door Lock, etc.

Table 7: Definitions used in this document

2.7.2 Abbreviations

Abbr.	Stands for	Description
API	Application Programming Interface	Also called SYNC, It is the head unit of the vehicle
BCM	Body Control Module	
BEV	Battery Electric Vehicle	
API	Application Programming Interface	Also called SYNC, It is the head unit of the vehicle
BCM	Body Control Module	
BEV	Battery Electric Vehicle	
CAN	Controller Area Network	
CCS	Customer Connectivity Settings	
CP	CAN Processor	
CVBOP	Connected Vehicle Business & Operations Portal	
CVFMA	Connected Vehicle Feature Management Application	
CVFTA	Connected Vehicle Ford Telematics Application	
ECG	Enhanced Central Gateway	
ECG	Telematics Control Unit	
EOL	End of Line	A ECG is an Ethernet enabled component with excess computing capability to house and/or bridge next generation information technology.
EVCS	Electric Vehicle Connected Services	
FB	Feature Bundle	
FCI	Ford Cloud Interface	
FordPass	Mobile app used to present information, configure and command Ford vehicles	Release of Telematics features by Ford Motor Company

Abbr.	Stands for	Description
GVMS	Global In-Vehicle Information System	Ford's Fully Networked Vehicle Version 2 (FNV2) is an advanced in-vehicle networked architecture intended to succeed the current CGEA 1.3c architecture.
HARA	Hazard Analysis and Risk Assessment	
HS1	High Speed 1	High Speed CAN Network 1
HS2	High Speed 2	High Speed CAN Network 2
HS3	High Speed 3	High Speed CAN Network 3
IPC	Inter-Processor Communication	
IVSS	In-vehicle Security Services	
Lincoln App	Mobile app used to present information, configure and command Lincoln vehicles	
MS1	Medium Speed 1	Medium Speed CAN Network 1
PHEV	Plug-in Hybrid Electric Vehicle	
RVCM	Remote Vehicle Configuration Manager	
RVCM	Remote Vehicle Configuration Management	
SDLC	Smart Data Link Connector, i.e. Vehicle Gateway Module	
SOA	Service Oriented Architecture	
SuMo	Subscription Management	
System	System refers to the overall eco-system from the cloud to the vehicle	
T&C	Terms & Conditions	
TMC	Transportation Mobility Cloud	
UI / UX	User Interface / User Experience	
User	An individual or group that benefits from a system during its utilization.	
VCS	Vehicle Capability Services	
VIN	Vehicle Identification Number	

Table 8: Abbreviations

2.7.3 Parameters / Values

Name	Description	Range / Resolution

Table 9: Parameters / Values used in this document

3 FEATURE CONTEXT

3.1 Feature Context Diagram

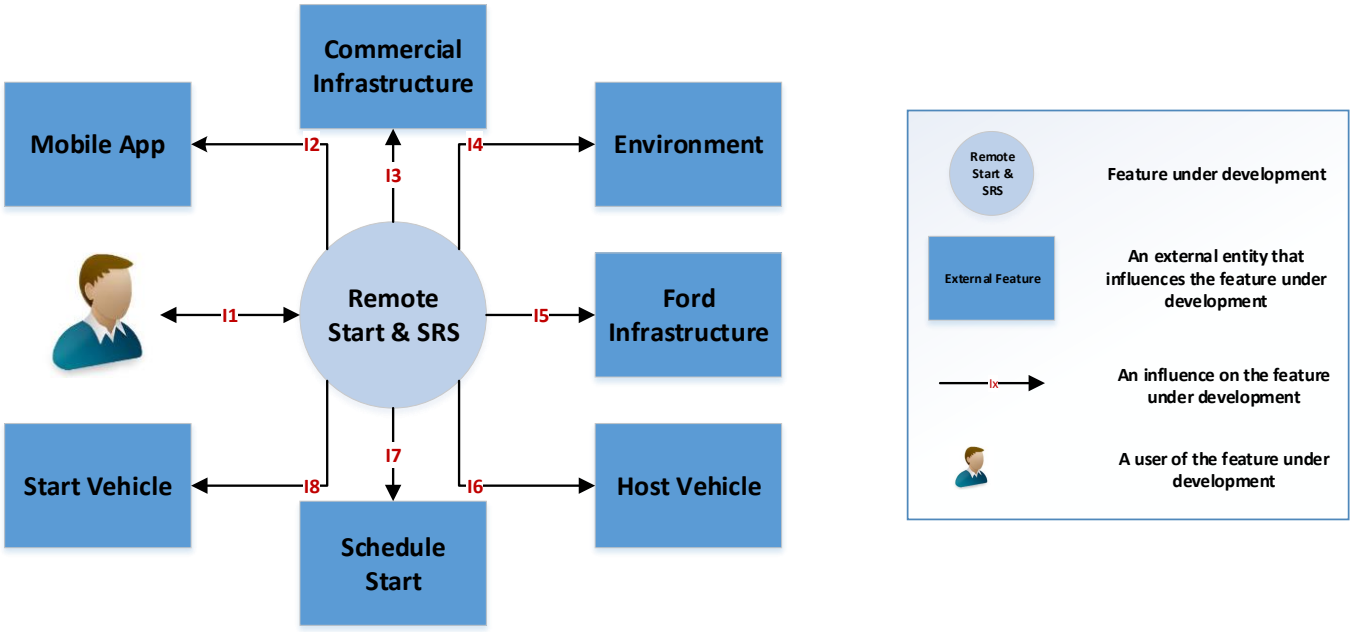

Figure 1: Context Diagram

3.2 List of Influences

ID	Interaction	Influence	Influence Description
I1	User with authorized vehicle subscribed to feature	Remotely start vehicle engine Remotely stop vehicle engine Remotely extend start Schedule remote start	• User request is an input to trigger the feature functions
I2	Mobile app, interface between user and vehicle	Send remote start command Send remote stop command Send extend remote start command Schedule remote start	• FordPass or Lincoln Way apps bridge connection between user and vehicle when distance is far apart between the two is the interface between the user and the vehicle • Display for user interface
I3	Commercial Infrastructure	IOT Gateway SMS Gateway	• ATT is the Mobile Network Operator for NA • China Unicom is the Network Operator for China • MNO is the interface between the FordPass/Lincoln Way apps and the VSDN / TMC Cloud
I4	Environment	External Environment	External environmental effects: • EMC/ESD effects (consumer devices with LF/UHF) • Radio towers • RF barriers (buildings, vehicles); • Fluid ingress (spill on antennas); ice/snow ingress; Dust/Mud
I5	Ford Infrastructure	Ford Assembly Plants / Service	• System effects due to manufacturing processes

I6	Host Vehicle	Provides input of the following states: Ignition State Vehicle Speed Lock State Engine State	• Ignition Status • Vehicle Speed • Vehicle Locks • Engine State
I7	Schedule Start	Schedule Remote Start Request	User Schedules Request to initiate vehicle Remote Start
I8	Start Vehicle	Remote Start Request	User Request to initiate vehicle Remote Start

Table 10: List of Influences

4 FEATURE MODELING

4.1 Operation Modes and States

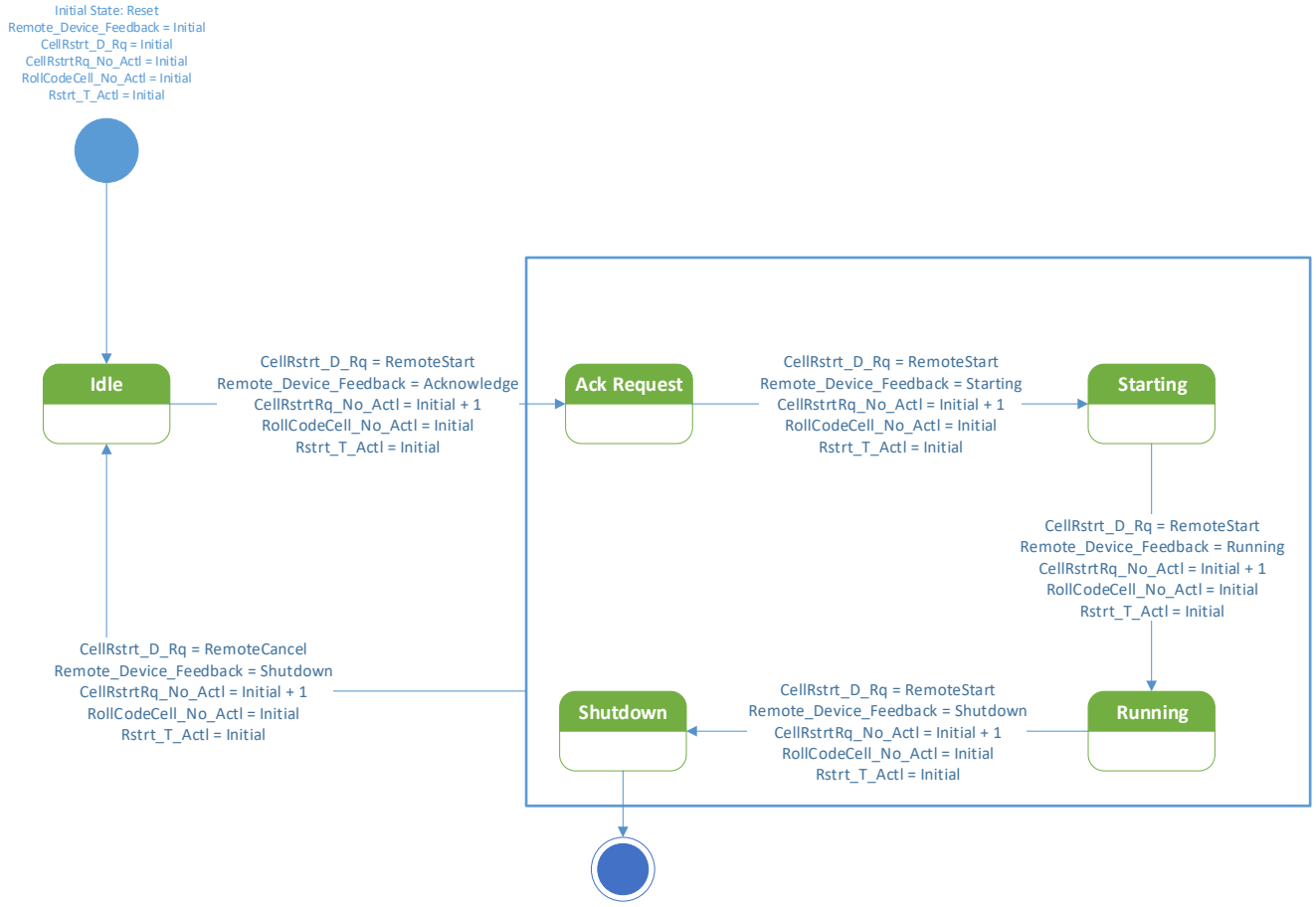

Figure 2: Feature Operation Modes and States

State	Description	Requirements Reference (optional)
S1	Initial	
S2	Acknowledge Request	
S3	Starting	
S4	Running	
S5	Shutdown	

Table 11: Operation Modes and States

Transition ID	Description	Requirements Reference (optional)
T0	Initial State: Reset Remote_Device_Feedback = Initial CellRstrt_D_Rq = Initial CellRstrtRq_No_Actl = Initial RollCodeCell_No_Actl = Initial Rstrt_T_Actl = Initial	
T1	CellRstrt_D_Rq = RemoteStart Remote_Device_Feedback = Acknowledge	

	CellRstrtRq_No_Actl = Initial + 1 RollCodeCell_No_Actl = Initial Rstrt_T_Actl = Initial	
T2	CellRstrt_D_Rq = RemoteStart Remote_Device_Feedback = Starting CellRstrtRq_No_Actl = Initial + 1 RollCodeCell_No_Actl = Initial Rstrt_T_Actl = Initial	
T3	CellRstrt_D_Rq = RemoteStart Remote_Device_Feedback = Running CellRstrtRq_No_Actl = Initial + 1 RollCodeCell_No_Actl = Initial Rstrt_T_Actl = Initial	
T4	CellRstrt_D_Rq = RemoteStart Remote_Device_Feedback = Shutdown CellRstrtRq_No_Actl = Initial + 1 RollCodeCell_No_Actl = Initial Rstrt_T_Actl = Initial	
T5	CellRstrt_D_Rq = RemoteCancel Remote_Device_Feedback = Shutdown CellRstrtRq_No_Actl = Initial + 1 RollCodeCell_No_Actl = Initial Rstrt_T_Actl = Initial	

Table 12: Transitions between Operational Modes and States

4.2 Use Cases

4.2.1 Use Case Diagram

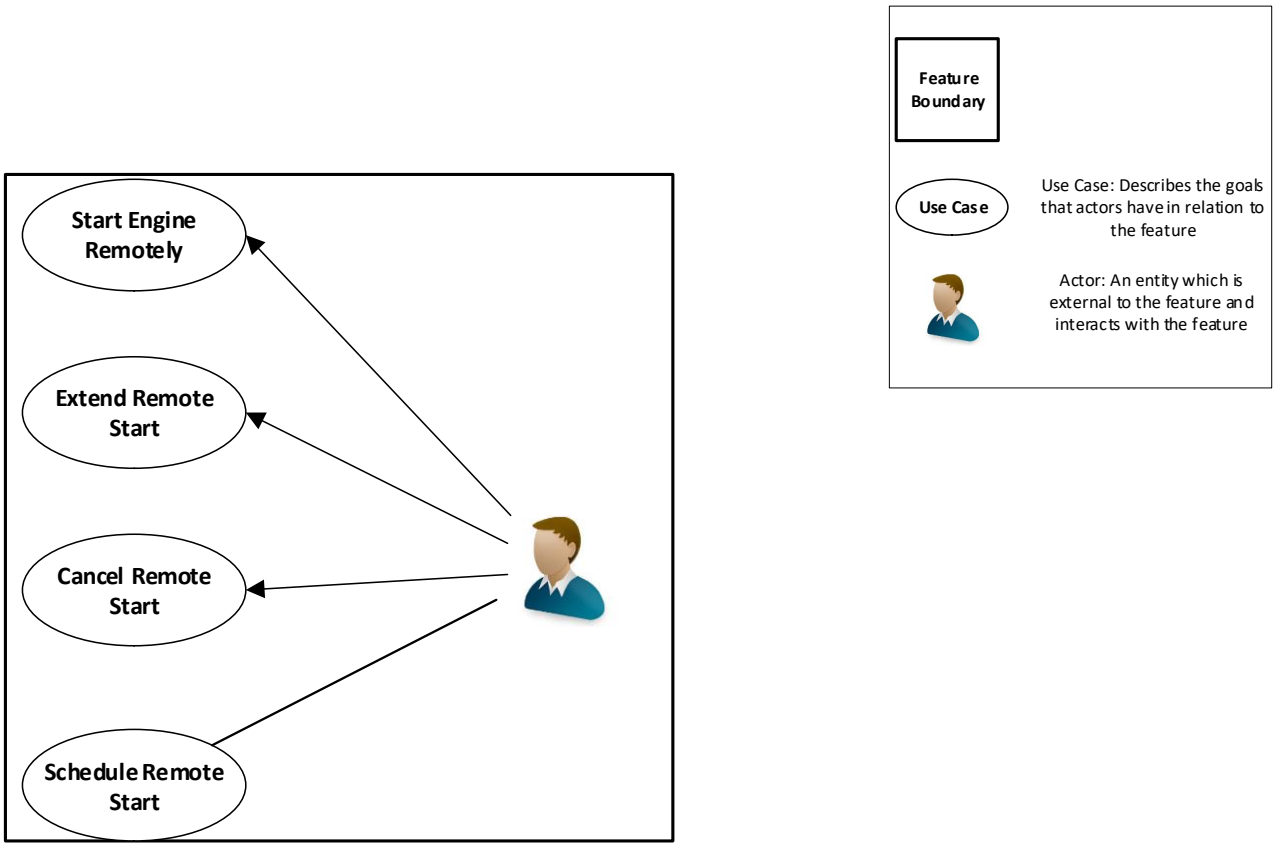

Figure 3: Use Case Diagram

4.2.2 Actors

Actor	Description
User	Customer or End-User

Table 13: List of Actors

4.2.3 Use Case Descriptions

###UC_F_Remote Start and Schedule Remote Start_00001### User wants to send a remote start request to turn on the vehicle's engine

Purpose		To remotely start the vehicle
Actors		• Mobile App • NGVSDN / TMC

		• ECG • Gateway Module • BCM
Precondition		• ECG installed successfully • ECG is provisioned • ECG is authorized • ECG has established connection with the cellular network • User registered and logged into the mobile app
Main Flow	M1	User selects the remote start button on the mobile app
	M2	User waits for the vehicle engine to start
	M3	User waits for visual confirmation on the mobile app
Alternative Flow 1		User has turned Off Connectivity to Ford Cloud (or Ford Cloud Control) through Sync • Cloud Command Processing Service determines vehicle Owner/Operator has turned Cloud connectivity, or Ford Cloud Control OFF through SYNC via CCS settings ○ Vehicle Connectivity Off (Remote Start and Schedule Remote Start feature disabled) • Remote Command & Control Disabled (Remote Start and Schedule Remote Start feature disabled)
Post-condition		1. The vehicle engine starts 2. The Mobile App displays the status of the request
Exception		1. The remote start request is not processed successfully 2. The vehicle engine does not start 3. The mobile does not display a visual confirmation

###UC_F_Remote Start and Schedule Remote Start_00002### User wants to extend the remote start time

Purpose		To extend the time the vehicle is remotely started
Actors		• Mobile App • NGVSDN / TMC • ECG • Gateway Module • BCM
Precondition		• ECG installed successfully • ECG is provisioned • ECG is authorized • ECG has established connection with the cellular network • User registered and logged into the mobile app • Vehicle is remotely started
Main Flow	M1	User selects the extend button on the mobile app
	M2	User waits for the duration timer to increase
	M3	User waits for visual confirmation on the mobile app
Exception		1. The additional remote start request does not have enough time to process before the vehicle turns off
Alternative Flow 1		User has turned Off Connectivity to Ford Cloud (or Ford Cloud Control) through Sync

		• Cloud Command Processing Service determines vehicle Owner/Operator has turned Cloud connectivity, or Ford Cloud Control OFF through SYNC via CCS settings ○ Vehicle Connectivity Off (Remote Start and Schedule Remote Start feature disabled) • Remote Command & Control Disabled (Remote Start and Schedule Remote Start feature disabled)
Post-condition		1. The vehicle engine stays remotely started for additional time
Exception		1. An additional remote start request is not processed (extension sends another remote start request) 2. The additional remote start request does not have enough time to process before the vehicle turns off 3. The initial remote start request has already completed 4. The mobile app does not display a change in the timer

###UC_F_Remote Start and Schedule Remote Start_00003### The user would like to cancel the remote start

Purpose		To turns off the vehicle's engine that was started remotely
Actors		• Mobile App • NGVSDN / TMC • ECG • Gateway Module • BCM
Precondition		• ECG installed successfully • ECG is provisioned • ECG is authorized • ECG has established connection with the cellular network • User registered and logged into the mobile app • Vehicle is remotely started
Main Flow	M1	The user selects the cancel remote start button on the mobile app
	M2	User waits for the vehicle's engine to turn off
	M3	User waits for visual confirmation on the mobile app
Alternative Flow 1		User has turned Off Connectivity to Ford Cloud (or Ford Cloud Control) through Sync • Cloud Command Processing Service determines vehicle Owner/Operator has turned Cloud connectivity, or Ford Cloud Control OFF through SYNC via CCS settings ○ Vehicle Connectivity Off (Remote Start feature disabled) • Remote Command & Control Disabled (Remote Start feature disabled)
Post-condition		1. The engine turns off 2. The Mobile App displays the status of the request
Exception		1. The remote start cancel command is not processed 2. The remote start has ended

###UC_F_Remote Start and Schedule Remote Start_00004### User wants to schedule a remote start

Purpose		User wants to pre-condition the vehicle for future use
Actors		• Mobile App • NGVSDN / TMC • ECG • Gateway Module • BCM
Precondition		• ECG installed successfully • ECG is provisioned • ECG is authorized • ECG has established connection with the cellular network • User registered and logged into the mobile app • Vehicle is remotely started
Main Flow	M1	User selects the option to schedule a remote start
	M2	Users selects the following: a. Days of the week b. Time c. Recurring or Non-Recurring
	M3	The user waits for the engine to start on the selected date and time
	M4	The user waits for visual confirmation on the mobile app
Alternative Flow 1		User has turned Off Connectivity to Ford Cloud (or Ford Cloud Control) through Sync • Cloud Command Processing Service determines vehicle Owner/Operator has turned Cloud connectivity, or Ford Cloud Control OFF through SYNC via CCS settings ○ Vehicle Connectivity Off (Remote Start feature disabled) • Remote Command & Control Disabled (Remote Start feature disabled)
Post-condition		1. The vehicles engine turns on at designated day and time 2. The Mobile app displays the status of the request
Exception		1. The vehicles engine turns on at designated day and time 2. The Mobile app displays the status of the request

###UC_F_Remote Start and Schedule Remote Start_00005### User wants to send a remote start request to turn on the vehicle's engine when vehicle is plugged in

Purpose		To remotely start the vehicle when vehicle is plugged in
Actors		• Mobile App • VSDN / TMC • TCU • ECG / Gateway Module • BCM • HPCM/PCM • BECM
Precondition		• Vehicle is plugged in • ECG installed successfully • TCU is provisioned • ECG is provisioned and Authorized • ECG has established connection with the cellular network • User registered and logged into the mobile app

Main Flow	M1	User selects the remote start button on the mobile app when the vehicle is plugged in
	M2	User waits for the vehicle engine to start
	M3	User waits for visual confirmation on the mobile app
Alternative Flow 1		User has turned Off Connectivity to Ford Cloud (or Ford Cloud Control) through Sync • Cloud Command Processing Service determines vehicle Owner/Operator has turned Cloud connectivity, or Ford Cloud Control OFF through SYNC via CCS settings ○ Vehicle Connectivity Off (Remote Start and Schedule Remote Start feature disabled) • Remote Command & Control Disabled (Remote Start and Schedule Remote Start feature disabled)
Post-condition		3. The vehicle engine starts when vehicle plugged in 4. The Mobile App displays the status of the request
Exception		4. The remote start request is not processed successfully 5. The vehicle engine does not start 6. The mobile does not display a visual confirmation

###UC_F_Remote Start and Schedule Remote Start_00006### User initiated remote start request to turn on the vehicle's engine and user triggered Scheduled departure time

Purpose		Active remote start shall not get affected with schedule Scheduled departure time.
Actors		• Mobile App • VSDN / TMC • TCU • ECG / Gateway Module • BCM • HPCM/PCM • BECM
Precondition		• User initiated remote start • User added scheduled departure time • ECG installed successfully • TCU is provisioned • ECG is provisioned • ECG is authorized • ECG has established connection with the cellular network • User registered and logged into the mobile app
Main Flow	M1	Scheduled schedule departure time shall not take precedence over active remote start
	M2	User will continue to see vehicle start status until timer expires
Alternative Flow 1		User has turned Off Connectivity to Ford Cloud (or Ford Cloud Control) through Sync • Cloud Command Processing Service determines vehicle Owner/Operator has turned Cloud connectivity, or Ford Cloud Control OFF through SYNC via CCS settings ○ Vehicle Connectivity Off (Remote Start and Schedule Remote Start feature disabled)

		• Remote Command & Control Disabled (Remote Start and Schedule Remote Start feature disabled)
Post-condition		1.Remote starts continuing to work when scheduled schedule departure time triggers. 2.The Mobile App displays the status of the request
Exception		1.The remote start request is not processed successfully 2.The vehicle engine does not start 3.The mobile does not display a visual confirmation

###UC_F_Remote Start and Schedule Remote Start_00007### Scheduled departure time is active and user initiated remote start request.

Purpose		To remotely start the vehicle when vehicle Scheduled departure time is triggered
Actors		• Mobile App • VSDN / TMC • TCU • ECG / Gateway Module • BCM • HPCM/PCM • BECM
Precondition		• ECG installed successfully • TCU is provisioned • ECG is provisioned and authorized • ECG has established connection with the cellular network • User registered, logged into the mobile app and added schedule departure time. • Schedule Scheduled departure time active –> Climate control turned ON
Main Flow	M1	User schedule departure time is active and same time user clicks on remote start button on the mobile app
	M2	User waits for the vehicle engine to start
	M3	User waits for visual confirmation on the mobile app
Alternative Flow 1		User has turned Off Connectivity to Ford Cloud (or Ford Cloud Control) through Sync • Cloud Command Processing Service determines vehicle Owner/Operator has turned Cloud connectivity, or Ford Cloud Control OFF through SYNC via CCS settings ○ Vehicle Connectivity Off (Remote Start and Schedule Remote Start feature disabled) • Remote Command & Control Disabled (Remote Start and Schedule Remote Start feature disabled)
Post-condition		5. Remote start will take over departure time 6. The Mobile App displays the status of the request
Exception		7. The remote start request is not processed successfully 8. The vehicle engine does not start 9. The mobile does not display a visual confirmation

4.3 Driving and Operation Scenarios

4.4 Decision Tables

Input Signal 1	Input Signal 2	Input Signal 3	Input Signal 4	Output Signal
Value I1	Value I2			Value O1

Table 14: Sample Decision Table

5 FEATURE REQUIREMENTS

5.1.1 Remote Start

###R_F_Remote Start and Schedule Remote Start_00001### Initiate Remote Start

The mobile app shall display a dedicated Remote Start button on the screen. The user shall press and hold the Remote Start button on the mobile app to initiate the remote start process.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Button HMI

The Remote Start button will be animated clockwise with a colored line around the perimeter while being held.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Gray Out Other Command Buttons

All other remote control buttons shall be grayed out and not selectable when remote start button pressed.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### Progress Visual Indicator

While the Remote Start request is in process, the mobile app shall display a visual indicator of the progress.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00005### Switching HMI Screens

The user shall be able to switch between screens on the mobile app or run in background mode at any time without affecting the lifecycle of the request.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00006### Mobile App API Request

The mobile app shall send an API request to Ford VSDN/TMC to initiate a Remote Start request

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00007### Command from Cloud to Vehicle

The mobile app shall send an API request to Ford VSDN/TMC to initiate a Remote Start request

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00008### Retrieval Time

The mobile app shall send an API request to Ford VSDN/TMC to initiate a Remote Start request

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00009### Polling Status

The mobile app shall send an API request to Ford VSDN/TMC to initiate a Remote Start request

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00010### Mobile app Timeout

The Command shall time out after 120 seconds from the moment the user clicked on the remote start button. This should be configurable

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00011### Backend Timeout

The Command shall time out after 90 seconds from the moment the backend sent the command to the vehicle. This should be configurable

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00012### Paging

The user shall be able to page through the mobile app without affecting the Remote Start request

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00013### Paging and Progress Loading

When a user navigates away from the page while remote start is in progress, coming back to the page it should show the progress loading on the remote start button

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00014### Paging and Progress Loading

When a user navigates away from the page while remote start is in progress, coming back to the page it should show the progress loading on the remote start button

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00015### Paging and Notifications

When a user navigates away from the page while remote start is in progress, coming back to the page it should show the progress loading on the remote start button

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00016### No Network Connectivity

If there is no network connectivity, the Remote Start request will not be processed and the user will be notified that there is a network connectivity issue

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00017### VSDN/TMC/Vehicle Error

If there is an error between the VSDN/TMC and vehicle, the Remote Start request will not be processed and a failure notification is sent to the user

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00018### Updating Mobile App Screen

The mobile shall update the Remote Start status on the screen.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00019### Success Message

The mobile app will display a success message when the Remote Start request is successful or When the vehicle engine successfully starts, a success message is displayed on the mobile app.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00020### Remote Start Alert

If the vehicle engine is started, the vehicle shall send an alert to the VSDN/TMC

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00021### Countdown Timer & Button Transformation

The mobile app shall display the duration timer indicating the duration of the engine on until shutoff. All other remote control feature buttons will reset and will be selectable again.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00022### Configurable Display Time

The mobile app shall display the success message when the vehicle engine starts for a configurable time in seconds before returning to the default state

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00023### Failure Message

The mobile app will display a failure message when the Remote Start request fails even if the app is closed

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00024### Vehicle Unable to Execute Command

If the vehicle is unable to execute the command, the Remote Start request will not be processed and a failure notification is sent to the user

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00025### Configurable Display Time

The mobile app will display the failure message for a configurable time in seconds before returning to the default state

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00026### Reset Buttons

All other remote buttons shall become available after the request is complete

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00027### EU Countries with RS

CR 312: Remote Start shall be made available in the following EU countries
a. Britain
b. Germany
c. France
d. Italy
e. Spain
f. Netherlands
g. Sweden
h. Portugal
i. Ireland
j. Denmark
k. Poland
l. Austria
m. Belgium
n. Finland

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00028### Remote Start Preconditions

- The hood must be securely lathed
- The engine should be off
- The battery power is not low
- The vehicle is not in DRx mode
- The vehicle is in an area with good cell reception
- The vehicle does not have any active engine light DTCs

End of Requirement

###R_F_Remote Start and Schedule Remote Start_PHEV/BEV 00029### Vehicle plugged in

The user shall have the ability to do remote start when vehicle is plugged in

End of Requirement

###R_F_Remote Start and Schedule Remote Start_PHEV/BEV 00030### Scheduled departure time

When there is an active remote start, triggered scheduled departure time shall not impact an active remote start.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_ PHEV/BEV 00031### Active Scheduled departure time and initiate remote start

When there is an active scheduled departure time, user shall have the ability to initiate remote start and it shall take precedence over scheduled departure time.

End of Requirement

5.1.2 Extend Remote Start

###R_F_Remote Start and Schedule Remote Start_00001### Extend Duration Timer

While the duration timer is still active, the user shall have the option to extend the engine on time before shutoff.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Extend Button Selectable

The user shall be able to select the extend button on the mobile app to increase the duration timer.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Duration Timer Settings

The duration timer shall be increased by a user-selected number of minutes. The user shall be able to set the value to 5, 10 or 15 minutes in the vehicle cluster.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### Maximum Duration Timer

The user will have the option to extend the remote start for no more than 30 minutes, for C1CMA only. After 30 minutes the extend button shall disappear.

End of Requirement

5.1.2 Extend Remote Start

###R_F_Remote Start and Schedule Remote Start_00005### SRS triggers and extends Duration Timer

If SRS triggers during an active remote start and the timer shall get extended. If the BCM has not reached the max duration timer (30 min)

End of Requirement

5.1.3 Cancel Remote Start

###R_F_Remote Start and Schedule Remote Start_00001### Countdown Timer Expiry

The Remote Start shall be canceled by starting the vehicle or allowing the duration timer to expire.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Cancel Remote Start Button

While the remote start is in progress, the mobile app shall display a cancel button. If the user selects the cancel button, the vehicle engine will shut off. In addition, the duration will not be displayed on the mobile app. All other remote service buttons will reset. Prior to the Cancel Remote Start being processed, the vehicle must have been remote started.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Cancel Remote Start

The Remote Start shall be cancelled after the Remote Start has been requested

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### Engine Shutdown

When the user selects the Cancel, Remote Start Button the vehicle engine shall shutdown

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00005### Countdown Timer Display

When the Remote Start Cancel has been confirmed, the countdown timer shall not be displayed

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00006### Reset Buttons

When the user selects the Cancel Remote Start Button the vehicle engine will shutdown

End of Requirement

5.1.4 Schedule Remote Start

###R_F_Remote Start and Schedule Remote Start_00001### Schedule Remote Start Options

The user shall have the ability to create, repeat, delete and edit Scheduled Remote Starts in the mobile application. In addition, the user shall be able to create two kinds of Remote Start Schedules, recurring and non-recurring.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Recurring Schedule

The user shall be able to create a recurring Scheduled Remote Start.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Switch On

A recurring remote start is considered active when user switches it to ON.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### Switch Off

A recurring remote start is considered inactive when user switches it to Off.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00005### Disabling All Scheduled Remote Starts

When all Scheduled Remote Starts are disabled due to schedule remote start auto shutdown, all authorized users shall receive a notification.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00006### Subsequent Starts

When the schedule is de-activated, subsequent remote starts will not occur for that schedule.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00007### Switch On: Recurring Remote Start

A non-recurring remote start is considered active when user switches it to ON.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00008### Switch Off: Recurring Remote Start

A non-recurring remote start is considered inactive when user switches it to Off.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00009### Time Increments

Schedule Remote Start can only be scheduled in five whole minute increments.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00010### Selecting Days of the Week

The mobile app shall display a weekday's legend for remote starts scheduled Monday through Friday, a weekend legend for Saturday and Sunday and an everyday legend for Monday through Sunday.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00011### Maximum Number of Schedules

The maximum number of Remote Start Schedules are ten, it is configurable

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00012### Maximum Number of Schedule Message

The mobile app will display a message that the limit of schedules has been reached when attempting to add more than ten.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00013### Failure to Create Schedule

Mobile app should inform the user when the Remote Start Schedule failed even if the App is not open.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00014### Mobile App Notification – Non-recurring

The mobile app shall display a success or failure notification when the scheduled non-recurring remote start completes.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00015### Mobile App Notification-Recurring

The mobile app shall display a success or failure notification when the scheduled recurring remote start completes.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00016### EU Availability

CR 230: Schedule Remote Start shall not be available for EU countries.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00017### Store

VSDN/TMC shall store the Schedule Remote Start settings. This feature being a cloud feature only.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00018### Trigger

Schedule Remote Start will trigger a remote start command to the vehicle. There is no different command for Schedule Remote Start.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00019### Scheduled Remote Start Success

When the vehicle has been successfully, remote started due to a Scheduled Remote Start then all authorized user shall be notified.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00020### Scheduled Remote Start Failure

When the vehicle has been successfully, remote started due to a Scheduled Remote Start then all authorized user shall be notified.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00021### Weekday/weekend Schedule

The mobile app will distinguish between weekday / weekend schedules.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00022### Time Zone and Daylight Savings

VSDN/TMC will automatically adjust the Remote Start Schedule based on time zone changes and daylight savings time (CR421).

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00023### Time Zone and Daylight Savings

The user shall be allowed to configure any time zone and daylight savings time from the mobile app.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00024### Automatic Shutdown

When the vehicle has been successfully remote started due to a Scheduled Remote Start all authorized users will receive notification. Once automatic shutdown has occurred, the system will send a notification to inform all authorized users when automatic shutdown has occurred.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00025### Shared Schedules

Scheduled remote starts shall be tied to the vehicle, so if more than one user are authorized they all share the same schedule.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00026### Creating Multiple Schedules

VSDN / TMC does not contain the logic to prevent a user from creating multiple schedules. However, since the vehicle must be in motive mode between each remote start, the vehicle will only process the first instance.

End of Requirement

5.1.5 Motive Mode

###R_F_Remote Start and Schedule Remote Start_00001### Motive Mode

When the vehicle is in motive mode, the ignition is turned on a periodic alert is sent to VSDN / TMC from the vehicle. If a subsequent Scheduled Remote Start is requested without motive mode previously enabled, the request will not be serviced.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Manual Requests

Manual Remote Starts do not require motive mode be activated in between each request.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Motive Mode Active

When motive mode is active, the vehicle cannot be remotely started.

End of Requirement

5.1.6 Subscription Management

###R_F_Remote Start and Schedule Remote Start_00001### Register Account

When the user registers an account, the Remote Start and Schedule Remote Start feature will be available as part of the FordPass and Lincoln Way features.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Subscription Costs

The feature will be free for the first year. Afterwards, the customer will pay for modem access for remote features.

End of Requirement

5.1.7 Feature Enrollment

###R_F_Remote Start and Schedule Remote Start_00001### Feature Enablement

The Remote Start and Schedule Remote Start feature shall be enabled once the vehicle is authorized.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### CVFMA Feature Capabilities

CVFMA will be responsible for determining if the vehicle is authorized prior to the Remote Start and Schedule Remote Start feature. Remote Start and Schedule Remote Start feature capabilities shall be determined by CVFMA.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Feature Package Definition

The feature package is defined prior to enrollment.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### Auto Enrollment

Remote Command & Control is an auto enrollment feature upon user authorization. Authorization information will serve as a confirmation for the feature enrollment.

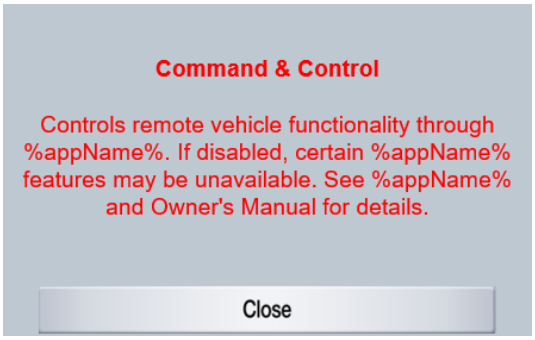

Figure 4: Command and Control Info Popup

End of Requirement

5.1.8 De-Authorization

###R_F_Remote Start and Schedule Remote Start_00001### De-Authorization

De-Authorization removes the link between user and vehicle. Upon De-authorization of the vehicle, remote vehicle controls are disabled for that user.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Master Reset

The vehicle must be authorized before the feature is enabled and available to use.

End of Requirement

5.1.9 Brand Connect Master Reset

###R_F_Remote Start and Schedule Remote Start_00001### Initiate Master Reset

An authorized user shall complete a Brand Connect Master Reset through the vehicle HMI to reset the embedded modem.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Clear User Settings

The user shall have the option to clear user settings. When the Brand Connect Master Reset is complete, all user settings are removed and remote vehicle controls will be disabled.

End of Requirement

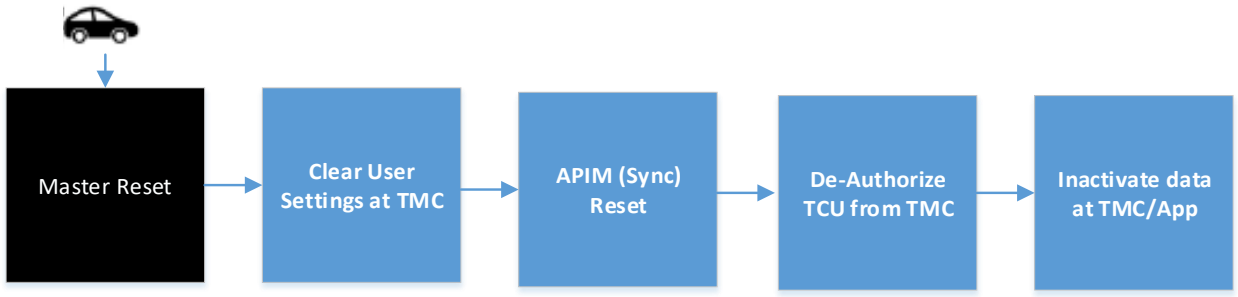

Figure 5: Master Reset Flow

5.1.10 Consumer Connectivity Settings (CCS)

###R_F_Remote Start and Schedule Remote Start_00001### Privacy Settings

The CCS feature provides the ability to a user to opt-in / opt-out from connectivity settings within the vehicle preventing data from being shared with the cloud. This will allow the user to have greater control of their vehicle settings.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Meta Entities – Disabled

CCS Meta Entities shall be enabled or disabled by individual switches. Remote Start and Schedule Remote Start are affected by only Vehicle Connectivity, Vehicle Data and Authorization,

Remote Start and Schedule Remote Start					
	Vehicle Connectivity Disabled	**Location Services Disabled**	**Vehicle Data Disabled**	**Driving Characteristics Disabled**	**Authorization Disabled/Not Authorized**
Remote Door Lock	Disable Remote Functions	N/A	Disable Remote Functions	N/A	Disable Remote Functions
Remote Door Unlock	Disable Remote Functions	N/A	Disable Remote Functions	N/A	Disable Remote Functions

Table 15: Remote Start and Schedule Remote Start Disabled Meta Entities

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00074_00003### Meta Entities – Enabled

If the Meta Entities are enabled, then the feature functions shall be enabled. If any of the Meta Entities are disabled, then the feature function shall be disabled.

Remote Start and Schedule Remote Start					
	Vehicle Connectivity	**Location Services**	**Vehicle Data**	**Driving Characteristics**	**Authorization**

Remote Door Lock	Enable Remote Functions	N/A	Enable Remote Functions	N/A	Enable Remote Functions
Remote Door Unlock	Enable Remote Functions	N/A	Enable Remote Functions	N/A	Enable Remote Functions

Table 16: Remote Start and Schedule Remote Start Enabled Entities

###R_F_Remote Start and Schedule Remote Start00004### Menu Switch

There shall be a separate feature switch for Command and Control in the CCS menu – when the feature switch is enabled the meta entities are needed for the feature to function properly.

5.1.11 Vehicle Configurations and Regional Requirements

###R_F_Remote Start and Schedule Remote Start_00001### Manual Transmissions

Remote Start and Schedule Remote Start is not currently available on vehicles with manual transmissions. UI implementation of the CR will remove the Remote Start button from the vehicle control page of the mobile app when the vehicle has a manual transmission (CR194).

End of Requirement

5.1.12 Stolen Vehicle Services (SVLA)

###R_F_Remote Start and Schedule Remote Start_00001### SVLA and Remote Functions

When Stolen Vehicle Services are in progress, the SVS system will send a start inhibit to the VSDN / TMC. Subsequent Remote Start requests will not be processed. When the start inhibit is deactivated, Remote Start and Schedule Remote Start will function as normal.

End of Requirement

5.1.13 Alternate Methods of Sending Commands

###R_F_Remote Start and Schedule Remote Start_00001### iOS and Android Devices

Android and iOS wearables shall be supported. The user shall have the following options when using a wearable:

- Initiate Remote Start command
- Initiate Remote Start command
- View Status of Remote Start
- View Status of Remote Start
- Receive notifications upon success or failure of Remote Start commands

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Sending Requests

The user shall be able send a Remote Start request using the wearable.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Request In Progress

The user shall be notified that the request is in progress by a “waiting” button on the wearable.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### Gray Out Other Buttons

While the wearable remote command request is in progress, the remaining remote vehicle commands shall be grayed out and unavailable.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00005### Notifications

Once the wearable remote command request is complete, a notification shall be displayed on the wearable indicating whether the request was successful or failed.

End of Requirement

5.1.14 Amazon Alexa

###R_F_Remote Start and Schedule Remote Start_00082_00001### Amazon Alexa

The user shall have the option to use Amazon Alexa to initiate Remote Start commands. Amazon Alexa integration is currently implemented on FordPass only.

- The user shall have the option to use Amazon Alexa to initiate a Remote Start command
- Account linking between FordPass/Lincoln Way and Amazon accounts is required
- The VSDN / TMC shall be able to track/monitor web services sent from an external service

Refer to Amazon PRDs and Functional specifications

End of Requirement

5.1.15 Change Requests

CR 421: Time Zone and Daylight Savings Synchronization in SDN

###R_F_Remote Start and Schedule Remote Start_00001### Cloud Synchronization of Timezones

The cloud shall synchronize the user’s timezone with the mobile app for Daylight Savings Time (DST).

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Remote Start and Schedule Remote Start Push Notification Timestamps

When a Remote Start is requested during DST the correct time shall be reflected in the notification; when a Schedule Remote Start is requested during DST, the correct timezone shall be reflected in the push notification.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Schedule Remote Start Timezone Synchronization

During Daylight Savings Time, the Scheduled Remote Start time shall be synchronized to the user's timezone to start the vehicle at the user requested time.

End of Requirement

CR422: Better Error Messaging for Customer Command Failures

###R_F_Remote Start and Schedule Remote Start_00004### Appropriate Error Messages Displayed to User

In cases where the remote command has failed, an appropriate error message shall be displayed to the user that is specific to the command requested.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00005### Defined Error Messages

The content of each error message displayed on the mobile app shall be defined by VML.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00006### FTCP Defined Errors

The FTCP protofile defines possible errors related to the cloud, TCU and ECG.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00007### Error Conditions

A Remote Start request shall fail under the below conditions for which better error messaging shall be defined:

- Vehicle in accessory mode
- Vehicle is already running
- Hood is ajar
- Alarm triggered
- No cellular network / airplane mode

End of Requirement

Better Messaging for Extended Remote Start

###R_F_Remote Start and Schedule Remote Start_00008### Maximum Duration Timer

CR is approved: Upon reaching the maximum Remote Start 30 minute time limit imposed by BCM limitations, the mobile app shall display an error message, "*.Remote Start cannot be extended, the maximum time limit has been reached*."

End of Requirement

Extend C&C Process to Send Notifications

###R_F_Remote Start and Schedule Remote Start_00009### Command Complete

When the remote command is complete, a notification shall be displayed informing the user of the result; if the request was a Scheduled Remote Start a notification shall be displayed.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00010### Status Information

The vehicle shall pass status information to the cloud and the cloud shall send a notification to all authorized users with a customized status information message.

End of Requirement

5.2 Functional Requirements

5.2.1 Error Handling

###R_F_Remote Start and Schedule Remote Start_00001### Error Handling

Command and Control shall define error states between system interfaces to ensure issues can be detected and remediated properly for the end user.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Mobile App Error Notifications

Error messaging displayed to the end user in the event that a Remote Start, Cancel Remote Start, Extend Remote Start or Schedule Remote Start. The FordPass or Lincoln Way app will display pop-up messages and/or push notifications to clearly alert the user that the feature did not act as expected. In addition, steps may be given to guide the user in how to remedy the error.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Vehicle Pre-Condition Errors

The vehicle must be in a certain state to imitate a remote start or scheduled remote start. These pre-conditions include, but are not limited to the following:

- The hood must be securely latched
- The engine should be off
- The battery power is not below a certain threshold

- The vehicle is not in DRx mode
- The vehicle is not connected to a charger
- The vehicle is in an area with good cell reception
- The vehicle does not have an active engine light DTC

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### Mobile App

The users' cellular device must have a connection to the internet to send remote commands. If the cellular device does not have a Wi-Fi nor cellular connection, an error message is displayed on the mobile device.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00005### VSDN / TMC

The VSDN / TMC must have an active connection to the vehicle through the ECG and ECG. If the connection between the VSDN / TMC and vehicle is lost, a connection retry strategy will be implemented.

If the VSDN / TMC does not receive a command response from the vehicle, the process will time out and a notification is sent to the mobile app. The failure message can include one of the following:

- No connectivity to network
- Vehicle to VSDN / TMC connection error
- Vehicle in unable to execute the command
- Other failure
- VSDN / TMC is not available
- ECG data invalid
- ECG is not authorized

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00006### ECG

ECG specific errors defined in the protofile will be expanded by the Command and Control team in order to make error processing simpler for the user to understand. Refer to CR 422 for additional details.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00007### BCM

The ECG will wait for a configurable time to receive a response from the BCM. If the response from the BCM is not received within that configurable time, a retry strategy will be implemented. If all retries fail, the ECG will send the status back to the VSDN / TMC to display an error on the mobile app. The configurable time is defined by DIDCode = 0xFD10 and DIDName = Command Response Timeout.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00008### Battery Voltage

If the battery fails below the operating threshold, the vehicle will go into DRx mode, in which case the user will not be able to send remote commands.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00009### Accessory Mode

If user initiates remote start while vehicle in accessory mode, the app shall display an appropriate failure message that vehicle failed to start because vehicle is in accessory mode.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00010### Engine Running

If user initiates remote start while vehicle engine in run, the app shall display an appropriate failure message that vehicle failed to start because vehicle engine is running.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00011### Engine Started

If user initiates remote start while vehicle engine is n start, the app shall display an appropriate failure message that vehicle failed to start because vehicle has started.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00012### Hood Ajar

If user initiates remote start while hood is ajar, the app shall display an appropriate failure message that vehicle failed to start because hood is ajar.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00013### Alarm Triggered

If user initiates remote start while alarm triggered, the app shall display an appropriate failure message that vehicle failed to start because alarm was triggered.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00014### Default Error Code

If none of the following conditions are met while initiating remote start
- Vehicle in Accessory
- Vehicle is Running
- Hood Ajar
- Alarm Triggered

Then the app shall use the default error code 411 (Generic failure command response)

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00015### MMOTA Update

MMOTA shall not inhibit vehicle function when remotely started.

When an MMOTA is needed that shall inhibit vehicle function, the vehicle shall send a notification VSDN.
VSDN will send notification to FordPass that the vehicle is inhibited; FordPass shall not allow the user to request any Command & Control functionality.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00016### Remote Start Alert Sent with Failure

If the remote start alert status indicates that the vehicle did not start, the mobile app shall display as error message.

End of Requirement

5.3 Non-Functional Requirements

5.3.1 Safety

5.3.2 Security

###R_F_Remote Start and Schedule Remote Start_00001## Rolling Code

At every Remote Start, the vehicle doors lock. Since the lock signal is sent over the air, there needs to be an added layer of security. Rolling codes is a security strategy implemented for keyless vehicle that prevents replay attacks when the lock signal is transmitted to the vehicle.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00002### Event Counter

An event counter counts the number of times a digital signal changes. When the ECG receives a request, it shall increment the event counter. When the remote request is sent, the ECG shall transmit the signal to the BCM and the event counter is incremented by one.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00003### Rolling Code

The CAN signal for the rolling code is transmitted to the BCM at a Remote Start request. The CAN signal for rolling code values transmitted by the BCM every one second in ignition on is RollCodeUnlock. The ECG monitors and stores the rolling code in non-volatile memory when the ignition is turned off. When a request to lock the doors is received, the ECG will transmit the rolling code stored in memory to the BCM only if it has been requested from VSDN / TMC. The BCM will then determine if the rolling code matches one of the last four codes that it published.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### ECG and BCM

The CAN signal for the rolling code, RollCodeUnlock, is transmitted to the BCM at a Remote Start request. The ECG shall store the rolling code in volatile memory while the ignition is not off. Once the ignition is turned off, the ECG stores the rolling code in non-volatile memory. When the Remote Start is requested, the ECG shall send the

stored rolling code to the BCM. If the rolling code is one of the last four published by the BCM, the request is serviced.

Remote Request	Door Status	Ignition Status	Rolling Code	Event Counter
(Remote Start) Lock	Unlock	Off	Yes	Yes
	Unlock	On	No	Yes
	Unlock	Off	Yes	Yes

Event counter will increment even if Remote Start request fails

Table 17: Rolling Code Security

End of Requirement

5.3.3 Reliability

5.3.4 Analytics

5.4 HMI Requirements

###R_F_Remote Start and Schedule Remote Start_00001### Remote Start HMI

Request	Result	Response	Vehicle Start Status
Remote Start	Success	• The app will change the text underneath the Start button to "Engine Start" • User will be notified of remote start success from a message on the status bar, which will be displayed for 10 seconds before returning to default state • A notification of success is displayed when the app is in background mode	Engine Start
	Fail	• The app will display a warning if the Remote Start operation fails. The warning message will contain red colored text and will display a red circle around the perimeter of the start button • User will be notified of remote start failure from a message on the status bar, which will be displayed for 10 seconds before returning to default state • A notification of the failure is displayed when the app is in background mode	Initial State

Table 18: Remote Start HMI

End of Requirement

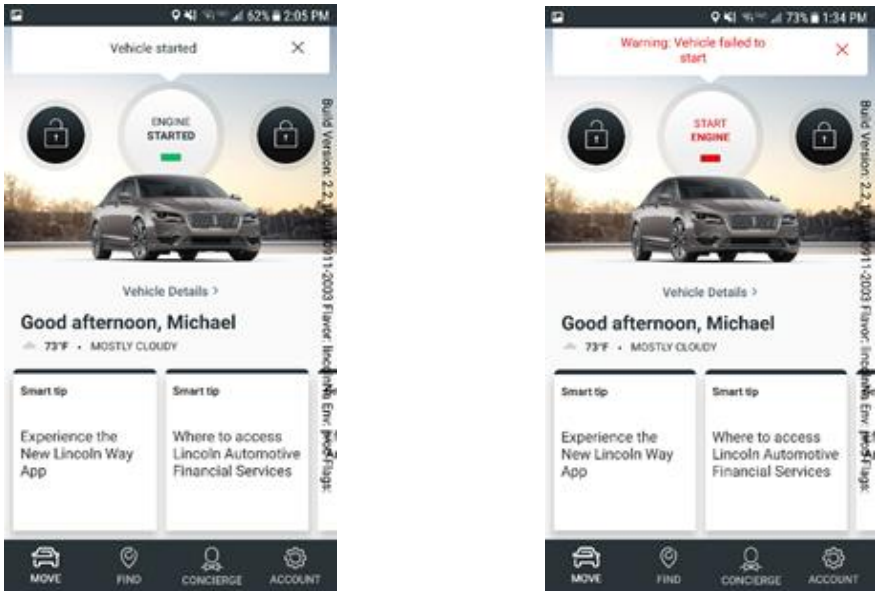

Figure 6: Remote Start Success and Failure on Mobile App

###R_F_Remote Start and Schedule Remote Start_00002### Duration Timer

When a Remote Start request is successful, the duration timer is displayed on the mobile app. The option to increase the engine on time is also displayed on the mobile app. When the time is increased, the timer value should also increase to reflect the change

End of Requirement

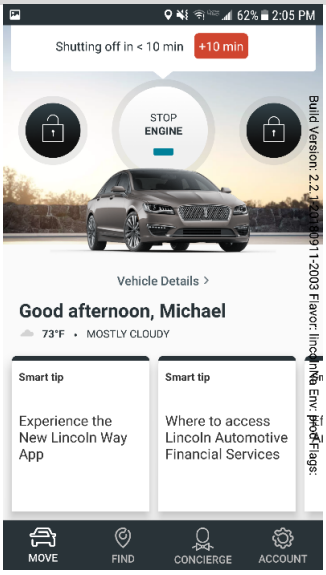

Figure 7: Remote Start Duration Timer

###R_F_Remote Start and Schedule Remote Start_00003### Cancel Remote Start HMI

Request	Result	Response	Vehicle Cancel Start Status
Cancel Remote Start	Success	• The app will change the text underneath the Start button to "Engine Stop" • User will be notified of remote start success from a message on the status bar, which will be displayed for 10 seconds before returning to default state • A notification of success is displayed when the app is in background mode	Engine Stop
	Fail	• The app will display a warning if the Cancel Remote Start operation fails. The warning message will contain red colored text and will display a red circle around the perimeter of the start button • User will be notified of Cancel Remote Start failure from a message on the status bar, which will be displayed for 10 seconds before returning to default state • A notification of failure is displayed when the app is in background mode	Initial State

Table 19: Cancel Remote Start HMI

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00004### Messaging When Mobile App is Offline

When the mobile app goes into offline mode, a snack bar shall be displayed at the bottom, “We’ve lost your connection. Please check your device settings and try again.”

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00005### Messaging When Scheduled Command Times Out

When a scheduled remote start fails because the command timed-out the mobile app shall display the message:

Message Center Notification
Headline: Scheduled Start Failed
Body: Sorry, we are unable to connect to your vehicle. Please try again later.

Push Notification
Headline: Your Scheduled Start failed
Body: Sorry, we are unable to connect to your vehicle. Please try again later.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00006### Ignition On Failure Message

When a scheduled remote start fails because the vehicle sent a command response of failure and the ignition status is accessary, run or start the mobile app shall display the message:

Message Center Notification
Headline: Your Scheduled Start Failed
Body: Sorry, we were unable to connect to your vehicle and your scheduled start failed. Please make sure [V.nickname] is connected to FordPass and try again later. If you need help, contact a Guide.

Push Notification
Headline: Your Scheduled Start Failed
Body: Sorry, we are unable to connect to your vehicle. Please try again later.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00007### Scheduled Remote Start Success Message

When a scheduled remote start initiated successfully, the mobile app shall display:

Message Center Notification
[V. nickname] Started as Scheduled
Body: Your vehicle was successfully started as planned. Enjoy your next journey!

Push Notification
Headline: [V. nickname] Started
Body: Your vehicle has started as scheduled!

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00008### Vehicle Not Driven Between Scheduled Remote Starts

When A scheduled remote start is triggered, but the vehicle has not been driven since the previous scheduled remote start.

Message Center Notification
Headline: [V.Nickname]'s scheduled starts have been deactivated. This is a precaution that occurs when you haven't driven your vehicle since your last scheduled start.
Body: Still want your starts scheduled? No problem. Just go to Vehicle Controls to manually turn them back on. If you need help, don't hesitate to reach out to one of our Ford Guides!

Push Notification
Headline: Scheduled Starts Deactivated
Body: Due to inactivity, your scheduled starts have been deactivated.

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00009### Scheduled Remote Start Success Message

When a scheduled remote start initiated successfully, the mobile app shall display:

Message Center Notification
Headline: [V. nickname] Started as Scheduled
Body: Your vehicle was successfully started as planned. Enjoy your next journey!

Push Notification
Headline: [V. nickname] Started
Body: Your vehicle has started as scheduled!

###R_F_Remote Start and Schedule Remote Start_00010### Scheduled Start Fails Due to Sleep Mode

When a scheduled remote start failed because the vehicle was in deep sleep mode, the mobile app shall display:

Message Center Notification
Headline: Your Scheduled Start Failed
Body: [V.Nickname]'s scheduled start failed because your vehicle's inactivity has put it in Deep Sleep mode in order to conserve battery power. To deactivate Deep Sleep mode, manually start your vehicle.

Push Notification
Headline: Scheduled Starts Deactivated
Body: Due to inactivity, your scheduled starts have been deactivated

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00011### Scheduled Start Fails Due to Engine Not Running

When a scheduled remote start failed because the VSDN could not create the command or put the command on the vehicles topic.:

Message Center Notification
Headline: Your Scheduled Start Failed
Body: Sorry, we were unable to connect to your vehicle and your scheduled start failed. Please make sure [V.nickname] is connected to FordPass and try again later. If you need help, contact a Guide.

Push Notification
Headline: Scheduled Starts Deactivated
Body: Due to inactivity, your scheduled starts have been deactivated

End of Requirement

###R_F_Remote Start and Schedule Remote Start_00012### Scheduled Start Fails Due to Generic Failure Reason

When a scheduled remote start failed because the vehicle sent a Command Response of failure AND the Ignition Status is on:

Message Center Notification
Headline: Your Scheduled Start Was Not Initiated
Body: Your scheduled start for [V.nickname] was not initiated — but nothing's wrong! Your vehicle was already running at the time, so there was no need to start it again..

Push Notification
HeadliIne: Scheduled Start Failed
Body: Due to a vehicle operating system update, Vehicle Controls were temporarily unavailable.

End of Requirement

5.5 Other Requirements

5.5.1 Design Requirements

5.5.2 Manufacturing Requirements

###R_F_Remote Start and Schedule Remote Start_00001### Software Update

When a software update is in progress, remote controls will not function.

End of Requirement

5.5.3 Service Requirements

5.5.4 After Sales Requirements

###R_F_Remote Start and Schedule Remote Start_00001### Transfer Ownership of Vehicle

If the Vehicle is to be sold or transferred to another Owner, the current Owner of the Vehicle should perform the following:

- Initiate Brand Connect Master Reset to remove remote control functionality for the current users

End of Requirement

5.5.5 Process requirements

6 FUNCTIONAL SAFETY

This feature has been analyzed in Remote start HARA.

6.1 System Behaviors for HARA

ID	Name
F_ATC_U0001	Prevent Accumulation of tailpipe emissions caused by Remote start

Table 20: System Behaviors for HARA

6.2 Safety Assumptions

ID	Assumption	
1	**Name**	
	Description	
	Purpose	
	Category	
	Related Requirements IDs	
2	**Name**	
	Description	
	Purpose	
	Category	
	Related Requirements IDs	

Table 21: Functional Safety Assumptions

6.3 Safety Goals

ID	Goal			
1	**Goal Name**	Prevent Accumulation of tailpipe emissions caused by Remote start- ASIL B		
	Description	The ASIL rated functionality have been handled by Remote Start function in the BCM. Scheduled Remote start from a mobile app has been decomposed to QM (B) rating.		
	Safety Goal Concept			
	ASIL	B	**FTTI**	
	Related FSR IDs			
2	**Goal Name**			
	Description			
	Safety Goal Concept	<fill in Safety Goal Concept incl. the Warning & Recovery Concept and also the Safe State>		
	ASIL		**FTTI**	
	Related FSR IDs			

Table 22: Functional Safety Goals

6.4 Functional Safety Requirements

6.4.1 Prevent Accumulation of tailpipe emissions caused by Remote start- ASIL B

6.4.2 <Goal 2 Name>

6.4.3 Derivation of Requirements on Assumptions

6.5 (Decomposed) Functional Safety Requirements

Initial Safety Requirement	Functional Safety Requirement X	
Decomposition Rationale		
Method for Decomposition	Choose a Method	
Functional Safety Requirement 1 after Decomposition	**F-S-Req-ID**	
	F-S-Req. Title	
	ASIL	
	Rationale	
	Allocated to	
Functional Safety Requirement 2 after Decomposition	**F-S-Req-ID**	
	F-S-Req. Title	
	ASIL	
	Rationale	
	Allocated to	
Functional Safety Requirement for Independence *Note: should consider commonly used input, output and processing* *Note: additional row should be added if additional requirements for Independence are necessary*	**F-S-Req.-ID**	
	F-S-Req. Title	
	ASIL	
	Rationale	

Table 23: Requirements Decomposition Table

7 FUNCTIONAL ARCHITECTURE

Remote Start and Schedule Remote Start requires the following onboard and off board system components listed below:

- Vehicle
  - ECG
  - Next Gen TCU
  - BCM
  - Sync
- IT Backend / Enterprise Systems
  - VSDN / TMC
- Consumer's Mobile Device
  - FordPass or Lincoln Way Mobile App

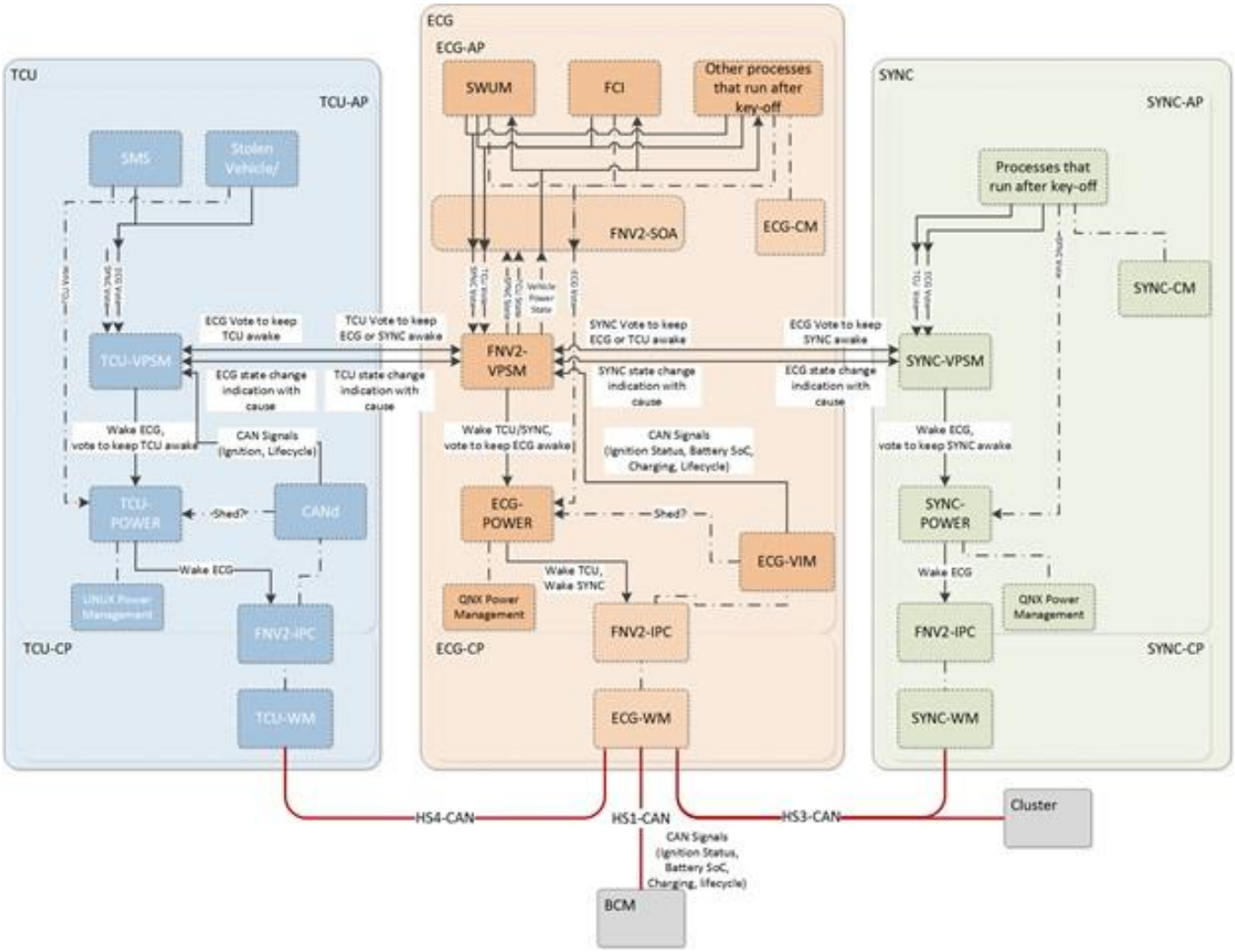

Figure 8: Functional Boundary Diagram

Figure 9: Functional Boundary Diagram

7.1 List of Functions

Function Name	Description
TCU	
SMS	VSDN / TMC shall send this SMS message prior to sending any command if the TCU is not connected to the broker. The payload of the SMS message shall be empty and SyncP encoded and signed.
Stolen Vehicle	Stolen Vehicle will disable remote functions when activated
TCU-VPSM	TCU controls data/radio connection based on power mode status published by VPSM on the SOA Middleware
TCU-Power	TCU Power Management supports normal, wakeup transition and sleep modes. **Normal Mode -** This is the typical operating mode of the TCU and provides full functionality. All functionalities of the ECG shall be available in normal mode. Cores run at full speed with WIFI support in normal mode. **Wakeup Transition Mode - T**he wakeup transition-operating mode is a low power mode to support wakeup events and to determine the transition to either normal or sleep mode. The TCU may have periodic / background tasks, network channels and ports active. Communication over LIN/CAN/CAN-FD may be active. **Sleep Mode -** This is the lower operating mode for TCU. All network channels/ports are inactive. The Can Processor enters sleep state with real-time clock and wake on interrupt with on-chip RAM powered (self-refresh). Application processor will be powered off. This is the lowest power mode and provides wake-on-CAN capability.
CANd	CAN database
UNIX Power Management	Operating system power management
FNV2-IPC	The IPC is responsible for bridging CAN information between the two chips. The primary category of data transported will be CAN PDUs. The shadow channel is used to send every message from the CAN bridge to application processor for further processing. The Interprocessor communication on the CAN Processor side is responsible for the following • Bring up/down IPC LINK and monitor health of link. • Create and handle IPC packet. • Handle all IPC remote service, request and response. • Control NXP Ethernet Switch via SPI (SJA1105REL). – 2 chips solution only It serves as a communication backbone between ECG and other ECU's connected to it over Ethernet. The middleware provides a mechanism to exchange data between different entities using publish-subscribe messaging pattern between the Service Providers and Service Consumers. The SOA middleware uses MQTT publish-subscribe messaging framework. The message format used to exchange information between Service Providers and Service Consumers contains a message header and payload.

Function Name	Description
TCU-WM	Wakeup Manager keeps track of the power states for both CP and AP. CP will keep running as long as AP is running. While AP is in sleep/OFF state, any IPC messages from CP to AP will need to wakeup AP first.
ECG	
SWUM	Software Updates Manager (SWUM) is ECG responsible for all software updates in the vehicle. SWUM is in charge of checking for updates with the Ford SDN based on triggers, download any updates and send the commands and data for installation to each ECU that needs updating. SWUM communicates with the ECU's using SOA messaging or IPC mechanisms.
FCI	FCI is responsible for the data communication between the Ford SDN and the modules in the vehicle. The Ford Cloud Interface establishes and manages the FTCP connection with the Ford SDN.
Other processes that work during key off	
FNV2-SOA	The SOA middleware layer is a centralized message broker for local and remote components on the Ethernet to exchange data in a secure and efficient manner.
ECG-CM	Wireless Interface Router also referred to as Connection Manager. The master controls and manages the IP data transport interfaces between the vehicle and external networks. It determines the appropriate routes for connection requests, monitors connection status and ensure the security of the connections. Ethernet modules that require connection with external networks will leverage Connection Manager Client API's to request and release connections.
ECG-VPSM	Component in the ECG Application Processor is responsible for broadcasting the power state information to the SOA Middleware. FCI consumes the power state information to decide establishing connectivity with the Ford Cloud.
ECG-Power	ECG Power Management supports normal, wakeup transition and sleep modes. **Normal Mode -** This is the typical operating mode of the ECG and provides full functionality. All functionalities of the ECG shall be available in normal mode. Cores run at full speed with WFI support in normal mode. **Wakeup Transition Mode - T**he wakeup transition-operating mode is a low power mode to support wakeup events and to determine the transition to either normal or sleep mode. The ECG may have periodic / background tasks, network channels and ports active. Communication over LIN/CAN/CAN-FD may be active. **Sleep Mode -** This is the lower operating mode for ECG. All network channels/ports are inactive. The Can Processor enters sleep state with real-time clock and wake on interrupt with on-chip RAM powered (self-refresh). Application processor will be powered off. This is the lowest power mode and provides wake-on-CAN capability.
ECG-VIM	The FNV2 Vehicle Information Manager (VIM) is a software module within the ECG that communicates with ECUs on

Function Name	Description
	CAN/CAN-FD/LIN networks and translates data into information making it available to other FAST modules and ECG apps via the SOA middleware. VIM is responsible to • Send and receive CAN PDUs on traditional CAN networks. • Provide access to cached Primitives and CAN PDUs to SOA clients. • Convert from CAN Signaling PDUs to Primitives. • Provides native processing of the primitives, through "Static Calculations" that create new dynamic service(s).
QNX Power Management	Operating system services power management
FNV2-IPC	The IPC is responsible for bridging CAN information between the two chips. The primary category of data transported will be CAN PDUs. The shadow channel is used to send every message from the CAN bridge to application processor for further processing. The Interprocessor communication on the CAN Processor side is responsible for the following • Bring up/down IPC LINK and monitor health of link. • Create and handle IPC packet. • Handle all IPC remote service, request and response. Control NXP Ethernet Switch via SPI (SJA1105REL). – 2 chips solution only
ECG-WM	Wakeup Manager keeps track of the power states for both CP and AP. CP will keep running as long as AP is running. While AP is in sleep/OFF state, any IPC messages from CP to AP will need to wakeup AP first.
SYNC	
Processes that run after key-off	
SYNC-VPSM	Component in SYNC Application Processor is responsible for broadcasting the power state information to the SOA Middleware. FCI consumes the power state information to decide establishing connectivity with the Ford Cloud.
SYNC-CM	
SYNC-POWER	SYNC Power Management supports normal, wakeup transition and sleep modes. Normal Mode - This is the typical operating mode of the SYNC and provides full functionality. All functionalities of the ECG shall be available in normal mode. Cores run at full speed with WFI support in normal mode. Wakeup Transition Mode - The wakeup transition-operating mode is a low power mode to support wakeup events and to determine the transition to either normal or sleep mode. The SYNC may have periodic / background tasks, network channels and ports active. Communication over LIN/CAN/CAN-FD may be active. Sleep Mode - This is the lower operating mode for SYNC. All network channels/ports are inactive. The Can Processor enters sleep state with real-time clock and wake on interrupt with on-chip RAM powered (self-refresh). Application processor will be powered off. This is the lowest power mode and provides wake-on-CAN capability.
QNX Power Management	Operating system services power management
FNV2-IPC	The IPC is responsible for bridging CAN information between the two chips. The primary category of data transported will be CAN

Function Name	Description
	PDUs. The shadow channel is used to send every message from the CAN bridge to application processor for further processing. The Interprocessor communication on the CAN Processor side is responsible for the following • Bring up/down IPC LINK and monitor health of link. • Create and handle IPC packet. • Handle all IPC remote service, request and response. Control NXP Ethernet Switch via SPI (SJA1105REL). – 2 chips solution only
SYNC-WM	Wakeup Manager keeps track of the power states for both CP and AP. CP will keep running as long as AP is running. While AP is in sleep/OFF state, any IPC messages from CP to AP will need to wakeup AP first.
Cluster	Contains comfort settings and duration timer

Table 24: List of Functions

7.2 Logical Architecture

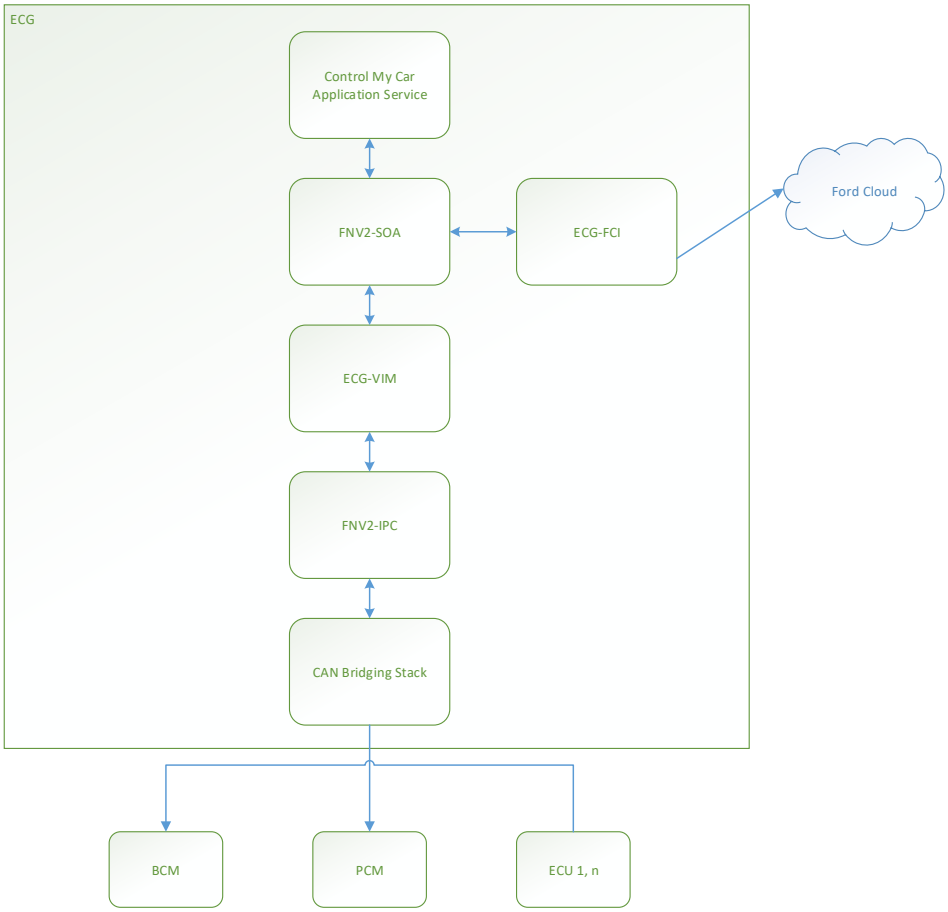

Figure 10: Logical Architecture

7.2.1 Logical Architecture Descriptions

Interface	Description
ECG-FCI to FNV2-SOA	Subscribe and decode command to SOA message and publish to FNV2-SOA
FNV2-SOA to Control My Car	Subscribe to SOA message and publish to Control My Car
Control My Car to ECG-VIM	Subscribe to SOA message and publish to ECG-VIM
ECG-VIM to ECG-IPC	Convert SOA message to primitive, primitive to CAN PDU and publish to the IPC
ECG-IPC to CAN Bridging Stack	Publish CAN PDU to CAN Bridging Stack
CAN Bridging Stack to BCM, PCM, ECU 1, n	CAN Bridging Stack will look up forwarding address and send CAN signal to appropriate ECU

Table 25: Feature Interactions

8 OPEN CONCERNS

ID	Concern Description	e-Tracker / Reference	Responsible	Status	Solution
1					
2					
3					
4					
5					
6					
7					
8					
9					

Table 26: Open Concerns

9 REVISION HISTORY

Revision	Author	Description	Sections Affected	Release Date
2.0	Audriene Bell	Initial Draft	All	
2.1	Audriene Bell	Change format of document to match PSD	All	
2.2	Audriene Bell	-Remove CR 530, 411 -Add more detail for each CR -Removed Power Management section as it is explained in Deep Sleep PRD -Change rule in 9.3 specific for SRS -Updated Control My Car SPSS Requirement Links -Added Control My Car Client TCU Implementation Guide Links -Added precondition requirements -Updated time requirement for mobile app banner display -Added requirements for FOTA	All	
2.3	Audriene Bell	Removed references to C1MCA and CGEA for clarification	All	9/26/18
2.4	Audriene Bell	Added updated CCS requirements	Section 17	10/11/2018
2.5	Audriene Bell	Updated PRD template	All	1/28/2019
2.6	Audriene Bell	Added Change Request Requirements	5.1.16	2/26/2019
2.7	Audriene Bell	Updated pre-conditions Added requirements for CR 706	5.1.16	3/18/2019
2.8	Audriene Bell	-Clarification on when push notifications are sent to the mobile app -Updated CCS settings for effect of disabling vehicle data	All	6/12/2019
2.9	Audriene Bell	Updated requirement ID numbers to match with PSD	All	8/22/2019
3.0	Audriene Bell	Updated CCS Settings requirements	5.1.10	11/06/2019
3.1	Mana Mohan	- Updated EV/PHEV Cross-functional Requirements - Added Use cases for EV/PHEV	5.1.1	12/12/2019
3.1	Audriene Bell	Updated requirement to indicate that when a scheduled remote start ends a push notification is not displayed		2/25/2020
3.2	Audriene Bell	Updated requirement for MMOTA (replaces FOTA requirement)		3/13/2020

10APPENDIX

Document ends here.