Function Specification (FncS)

IVSU_Vehicle_Function_HMI

()

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1 Introduction

1.1 Purpose

The purpose of this functional specification is to provide the requirements for in Vehicle Software Update for HMI and flows, during and after software update. This specific includes all HMIs requirements such as user consent, schedule update, HMI notification, and software update details for USB, OTA, and check for updates.

1.2 Scope

The following set of functions is describe in this specification.

Function ID	Function Name	Owner	Reference
	Vehicle HMI		
	Ford Pass HMI		
	Legal User Consent		
	Cloud Consent		
	Consumer Website HMI		
	FMEA		

Table 1: Functions described in this specification

1.3 Audience

The Function specification defines OTA software update related in Vehicle HMI.

1.3.1 Stakeholder List

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

Function ID	Function Name	Owner
	John Vangelov	IVSU team
	Brunilda Caushi	IVSU team
	Balwinder Gill	IVSU team
	David Kulmaczewski	Vehicle Service
	Christina Michaels	Legal
	Shaymala Prayaga	Vehicle HMI Designer
	Ruth Jones	Vehicle HMI Supervisor
	Jason Mick	Vehicle HMI Designer
	Benjamin Hamacher	CCS Feature Owner
	Micha Kahlen	Vehicle Connectivity

Table 2: Stakeholder List

1.4 Document Organization

1.4.1 Document Context

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

Reference	Title	Doc. ID	Revision
	OTA Manager		
	Install Manager		
	Manifest Manager		
	IVSU Trigger Manager		

Table 3: Document Context

1.5 References

1.5.1 Ford Documents

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

Definition	Description
H31j	Connected Feature enable and disable
H31L	Master Reset
H33	Software update
H31a	Wi-Fi Prompts
CCS	Vehicle Connectivity Settings

Table 4: Ford Documents

1.5.2 Abbreviations

Abbr.	Stands for	Description
FS	Function Requirements Specification / Function Group Specification	The document describing, collecting and developing the requirements of a function or a group of functions.
SDN	Service Delivery Network	Service Delivery Network the non-vehicle based infrastructure by which Connected Services and Solutions are transmit and receive from the Vehicle for processing.
ASU	Automatic Software Update Settings	User Consents for automatic software update by enable or disable (there are different levels of user consent depending on software update type)
HMI	Human Machine Interface/Interaction	
FordPass	The FordPass App provides takes what you used to do with multiple apps and does it in one. This one-stop mobility	
AppLink	AppLink Connected Vehicle Library - AppLink Library that is included in FordPass app	
FCSD	Ford Customer Service Division	
FMC	Ford Motor Company	
MMOTA	Multi Module Over the Air update	
OTA	Over the Air	
IVSU	In vehicle software update	
CS	User Experience	

Table 5: Abbreviations used in this document

2 Function Group Description

2.1 Overview

The purpose of in vehicle HMI function specific is to provide details of the OTA and USB related HMIs with priorities and default values. This purpose of OTA in vehicle HMI specification is to provide corporate/legal requirements and default values for all region.
The OTA vehicle HMI specification will define safer and reliable user experience with IVSU

- Software types deliver via OTA
    - Recall, regulation, security update, improvements, etc.

2.2 Input Requirements

2.2.1 F-REQ-305324/C-###R_FNC_Veh_HMI_Input_001### OTA Policy Table Check – Condition 1

The OTA Policy table defines default setting for the OTA software updates.
The OTA Manager shall define default setting for the IVSU. The IVSU default values are configuration at EOL and/or through OTA/USB.

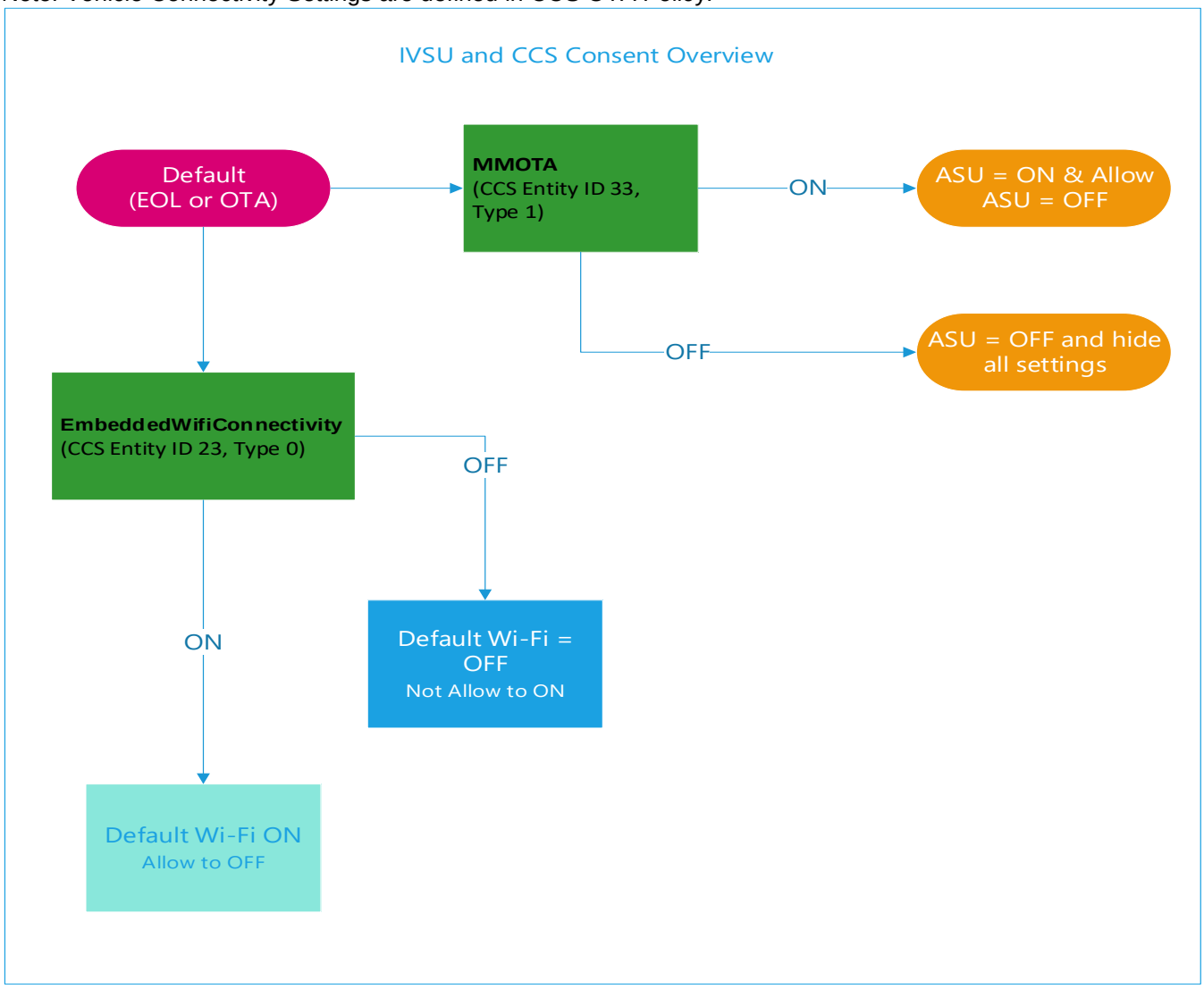
2.2.2 F-REQ-305325/D-###R_FNC_Veh_HMI_Input_002### Vehicle Connectivity Settings – Condition 2

The customer can change some of these setting thru in vehicle HMI, if the policy table allows it.
The HMI logic shall read policy table at EOL configuration, after a Master a Reset, and after a change in policy table.
Vehicle Connectivity Setting shall be enable for region and/or countries to allow OTA software updates.
If the Vehicle Connectivity Setting is disable, then in vehicle HMI shall hide all the OTA related prompts and settings.
For Example:

If Vehicle Connectivity = ON, then automatic software update is ON
If Vehicle Connectivity = ON, then automatic software update is OFF
- Automatic software update shall continue with limitation

If Vehicle Connectivity = OFF, then automatic software update is OFF
- All OTA activates are pause

Note: Vehicle Connectivity Settings are defined in CCS OTA Policy.



2.2.3 F-REQ-305319/C-###R_FNC_Veh_HMI_Input_003### Software Update Details – Condition 3

The Ford Backend shall have a text file containing description of software changes. This text files shall go thru governance and approval process before the software can be deliver thru OTA.
Software updates with improvements and security update shall have detailed description; where as other updates can be brief.
The software update details file shall be deliver with the software update. The owner website shall have more details and history of the software updates that were push to the vehicle

2.2.4 F-REQ-305320/B-###R_FNC_Veh_HMI_Input_004### Vehicle Connectivity – Condition 4

1. Onboard Modem Data Accounts: there shall be two separate accounts as following: -
   A. Consumer Owned Account – consumer pays for this account and if carriages allow consumer shall have access to vehicle hotspot for personal use.
   B. FMC Account – consumer does not have access to FMCA; Ford Motor Company pays this account and does not allow the consumer to access hotspot. FMCA account data is restricted to communicate with Ford backend for data transfer and OTA Software updates.

2. Wi-Fi Capability: - the vehicle shall have Wi-Fi capability to download software updates. The User shall have the ability to connect the vehicle to any chosen Wi-Fi access point as specified by WIR functional requirements
3. AppLink Capability – the vehicle shall have AppLink capability to download software updates.

2.2.5 F-REQ-305321/C-###R_FNC_Veh_HMI_Input_005### USB Parser Shall Notify HMI with Errors - Condition 5

The USB parser shall detect if USB contains OTA Software update file(s) and folder. If any errors occurring during initial parsing of the OTA files, then USB parser shall set a flag for HMI to indicate error.
The USB Parser shall valid the software files and set an appropriate HMI flag.

2.2.6 F-REQ-305322/C-###R_FNC_Veh_HMI_Input_006### Software Delivery Methods - Condition 7

The OTA Software update shall have delivered thru various channels such as Wi-Fi, cellular connection, AppLink, and USB. Vehicle shall follow the rules in the manifest for which connectivity to use for that download or upload thru embedded modem cellular; Wi-Fi AP
The in vehicle HMI shall have connection settings where user can select connect to available connections.
Connection Setting: -

Wi-Fi Data: - Wi-Fi connection will be defaulted to ON but user shall configure the Wi-Fi access point.
Cellular/Modem: - Allow the user to select Modem settings and connections

2.2.7 F-REQ-305323/B-###R_FNC_Veh_HMI_Input_007### Software Update Prioritization - Condition 8

The OTA Manager and USB Function specific has more details about software update priorities for USB and OTA Updates.

2.2.8 REQ-326585/A-###R_FNC_Veh_HMI_Input_008### OTA Manager input to HMI - Condition 9

The OTA manager shall set and clear HMI flags related to IVSU, such as user consent, software update notification, reminders, and activation etc.

2.3 Assumptions & Constraints

This specification is not limited to SYNC but also include sub system other **Infotainment Systems** with WiFi capability.

- Users who have appropriate consent for MMOTA updates
- Embedded Modem will use FMS capability for OTA
- Cloud is the overall connectivity master
- USB Updates are included in this specification
- The vehicle has connectivity thru FMS paid cellular connection, Customer Home Wi-Fi or Customer Data Plan
- Assumes that all activations of updated software will only occur on the next ignition cycle
- Ford Pass AppLink connection will be defaulted to OFF until the user pairs the phone and enables AppLink and pairs with Bluetooth

3 Functional Architecture

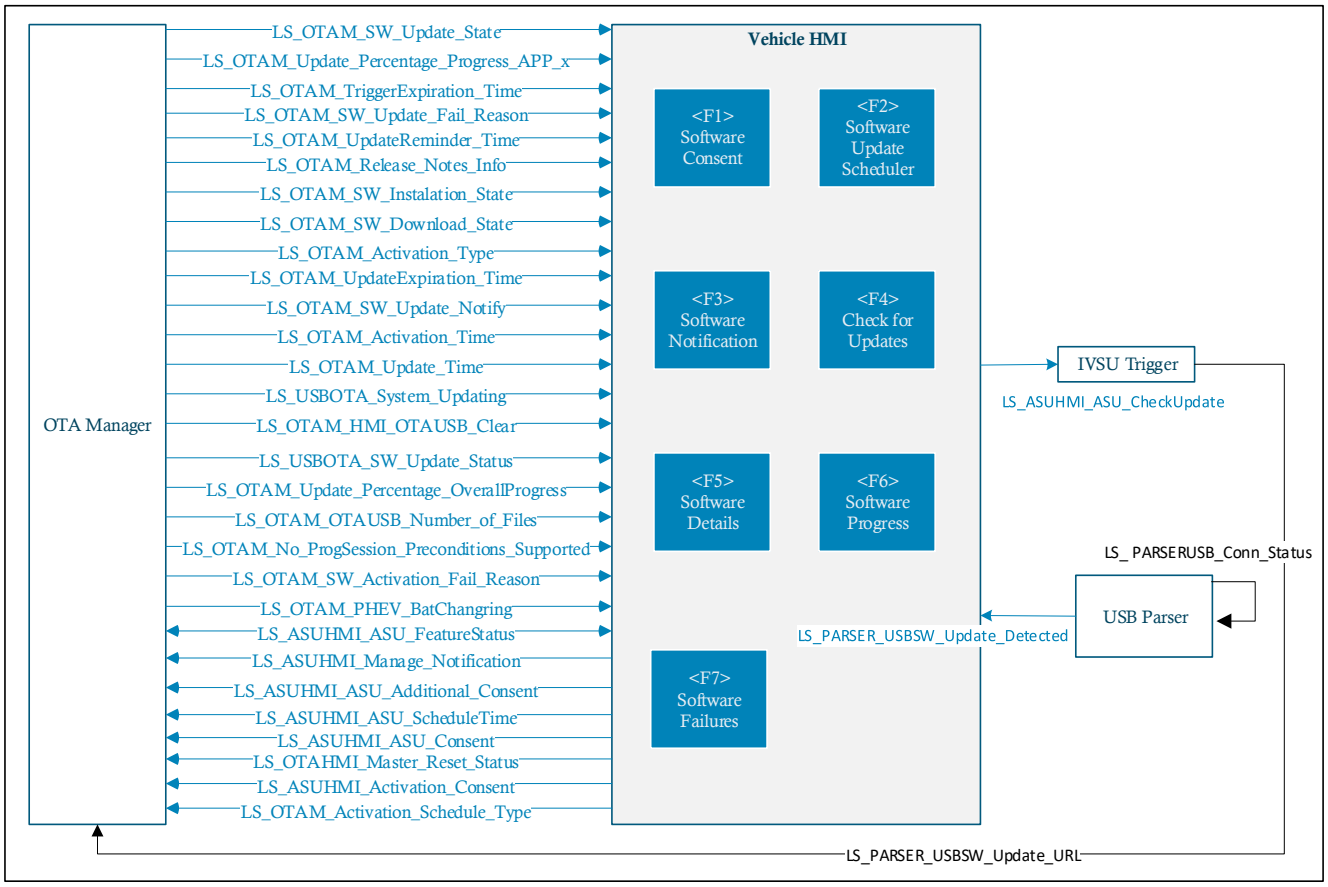


Figure 1: Function Group HMI Overall – Functional Architecture

3.1 Function List

3.1.1 List of Logical Functions

Function ID	Function Name	Function Description
<F1>	Software Consent	The authorization is required to update the software under the electronic & communication and privacy rules and product liability. The default setting for OTA Software updates are defined in the Policy table per region and/or country.
<F2>	Software Update Scheduler	The update scheduler function is required for all vehicle inhibits and once the schedule is set there is no action needed from the customer, vehicle automatically shall complete the software updates at schedule time. Once the update scheduler in process user cannot abort and shall wait until software update is complete.
<F3>	Software Notification	Software notification allows the user to get notification about updates, such as update is pending for activation, upcoming

		schedule reminder, successful update, and schedule is required etc.
<F4>	Check for Updates	HMI shall allow the customer to “Check for Updates” under Automatic software updates settings. Check for Updates button shall allow the customer to check for App updates and provide one time all level user consent to download the latest apps.
<F5>	Software Update Details	Software Update Details shall have description of contents of the updates and shall be deliver part of the OTA software update.
<F6>	Software Progress Bar	Software progress shall provide the customer the ability to monitor download, install, and activation certain types of software updates. Progress bar shall be capable to have single or multiple progress bars
<F7>	Software Failures	During OTA software updates if vehicle has reduced functionality or vehicle inhibit and USB update, the customer shall be notify in details for errors that occur with any action required from the customer.

Table 6: List of Logical Functions

3.1.1.1 Logical Inputs

Signal ID	Signal Name	Description
	LS_OTAM_Activation_Type	Software activation types: (1) No Ignition Cycle (2) Ignition Cycle (3) Inhibit
	LS_OTAM_SW_Update_State	The signal identify status of the software update as in progress, pending, successful, failed, up to date, none.
	LS_OTAM_SW_Activation_Fail_Reason	The signal identify types of failure and action for user such as permanent inhibit, USB failure, warning, partial, none.
	LS_OTAM_SW_Installation_State	The signal identify each state of the software install for USB or Check for updates as in progress, failed, paused, successful.
	LS_OTAM_SW_Update_Fail_Reason	The signal identify error codes for software failure reasons from OTA manager.
	LS_OTAM_SW_Download_State	The signal identify each state of the software download/transfer for USB or check for updates as in progress, failed, paused, successful.
	LS_OTAM_UpdateExpiration_Time	The signal identify time allowed to update the software.
	LS_OTAM_SW_Update_Notify	The signal can identify type of user consent required for software update.
	LS_OTAM_Release_Notes_Info	The signal identify release notes which will be displayed in vehicle HMI.
	LS_OTAM_Update_Percentage_OverallProgress	This signal identify overall progress of the software update in percentage.
	LS_OTAM_Activation_Schedule_Type	Identify the range of software update schedule as a week or a day, if automation software update default values is enable, then schedule default value = week. If automation software update default values is disable, then schedule default value is day.
	LS_OTAM_Activation_Time	Identify how long software activation time will take.
	LS_OTAM_OTAUSB_Number_of_Files	HMI shall display number of files OTA system processing
	LS_OTAM_Update_Percentage_Progress_APP_x	HMI shall show progress of the each Application update when user request Check for Update.
	LS_OTAM_HMI_OTAUSB_Clear	Reset all HMIs when software update is cleared
	LS_OTAM_No_ProgSession_Preconditions_Supported	If software activation is postponed due to vehicle precondition are not set then this flag is used to notify the customer with action item

	LS_USBOTA_SW_Update_Status	Details of USB software update during download, File Transfer, and installation
	LS_USBOTA_System_Updating	To determine if USB device contain valid software
	LS_OTAM_Update_Time	HMI shall display data and time after each software activation
	LS_ASUHMI_ASU_Consent	Vehicle Connectivity Settings

3.1.1.2 Logical Outputs

Signal ID	Signal Name	Description
HMI Only	LS_ASUHMI_ASU_Consent	Vehicle Connectivity setting for Automatic software update Feature consent = enabled or disabled. When Vehicle Connectivity has feature = disabled, this signal shall be use to hide all ASU related HMIs.
	LS_ASUHMI_Activation_Consent	Allow the customer chooses to activate time 1. NOW; 2. DATETIME; 3. UNDEFINED
	LS_ASUHMI_ASU_Additional_Consent	When ASU = OFF and Manage Notification = ON, then this signal can be used to require one-time consent
	LS_ASUHMI_ASU_ScheduleTime	Signal identify scheduled time/day for activation
	LS_ASUHMI_ASU_CheckUpdate	Customer checking for software updates and provided consent.
HMI Only	LS_ASUHMI_ASU_ReoccuringSchedule	HMI logic shall keep track of recurring schedule and display to customers as requested
	LS_ASUHMI_ASU_FeatureStatus	Feature enable or disable based on consumer desires or Vehicle Connectivity Settings. If software update is pending and trigger expires, then HMI shall disable the feature with how to enable prompt.
	LS_OTAM_TriggerExpiration_Time	Each software update is allow for a period of time, HMI logic shall use to clear the all HMIs and if user input was needed, then educate the user.
	LS_OTAM_UpdateReminder_Time	OTAM sets this flag, then HMI shall reminder the user. Time could come from cloud or user.
	LS_ASUHMI_Manage_Notification	This signal determines if user will get notifications thru HMI when software update is available
	LS_OTAHMI_Master_Reset_Status	Notify OTA Manager that Master reset is in progress
	LS_ PARSERUSB_Conn_Status	Status of the USB device connection
	LS_PARSER_USBSW_Update_Detected	To determine when to show Processing Update…transient message
	LS_PARSER_USBSW_Update_URL	Signal is used to set IVSU trigger with USB content details

4 Logical Functions

4.1 Logical Function Software Consent

4.1.1 Function Description

Software Updates in the vehicle require user consent, and default values are based on the global regions and/or centuries. Software updates does not get any personal data from the vehicle with the exception of vehicle unique number (VIN) and the software part numbers. In very rare cases, if a particular application update requires PII such as GPS, then the customer additional consent will be required from the user thru in vehicle HMI. The default setting for OTA Software updates are define in the OTA Policy table per region and/or country. HMI shall have one-time reminder after the vehicle is purchase (in Normal mode 1st time) and configurable ignition cycle = true, customer shall see notification to set a recurring schedule for faster updates.
In special cases when vehicles are in Ford Plants, no user consent is required for a software update.
When vehicle connectivity is enable, then customer shall also have the ability to turn ON and/or OFF IVSU feature.
Depending on the region and/or country, HMI will have been configuring for both changeable and/or unchangeable; HMI shall hide all the unchangeable settings.

4.1.2 Function Scope

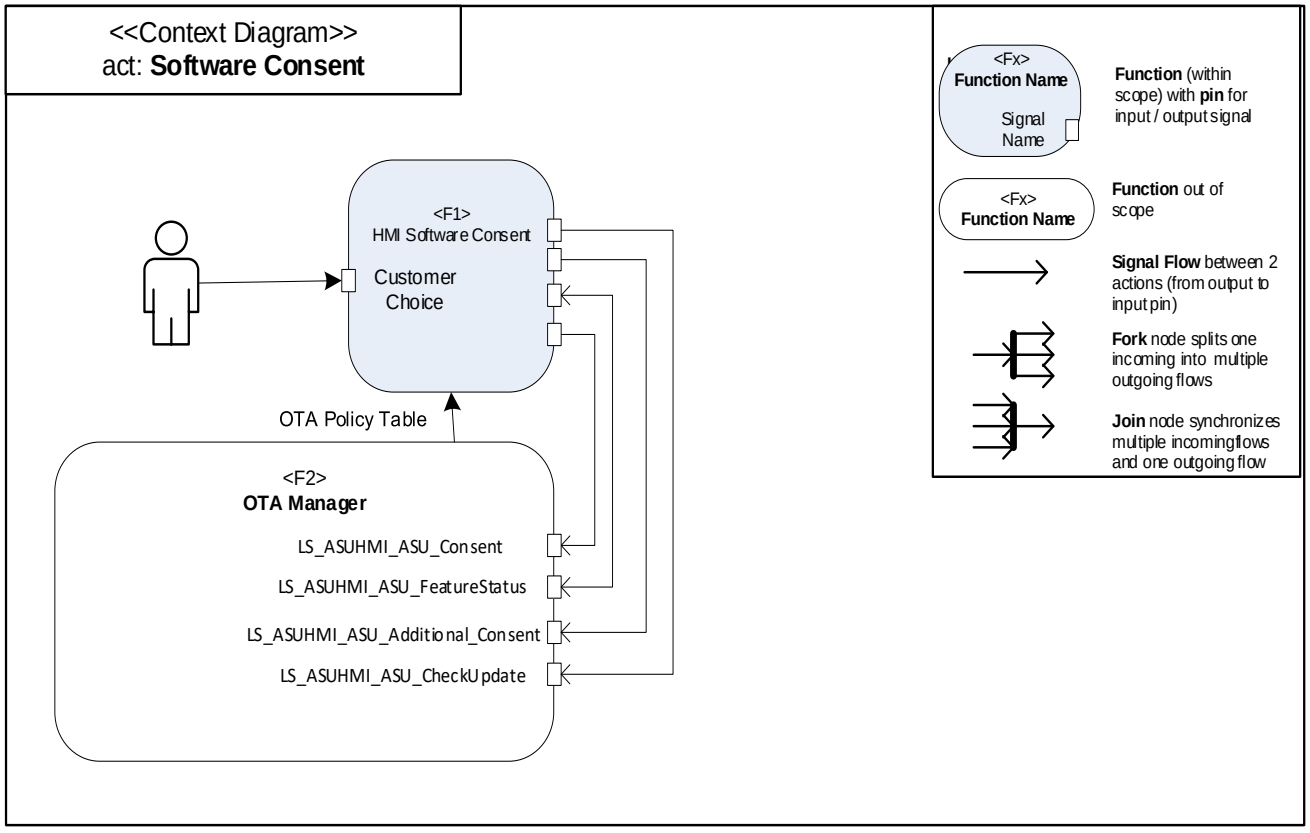


Figure 2: Context Diagram of Function Software Consent

4.1.3 Function Interfaces

4.1.3.1 Logical Inputs

Signal ID	Signal Name	Description
	Customer Choice	This is the customer selection of the consent settings that will be shown in the screen
	LS_OTAM_SW_Update_Notify	Type of Consent needed

4.1.3.2 Logical Outputs

Signal ID	Signal Name	Description
	LS_ASUHMI_ASU_Consent	Vehicle Connectivity setting True/False
	LS_ASUHMI_ASU_FeatureStatus	Automatic software update Feature enable or disable.
	LS_ASUHMI_ASU_Additional_Consent	Type of consent received from the user
	Vehicle Connectivity Settings	Vehicle Connectivity Settings

4.1.4 Function Modeling

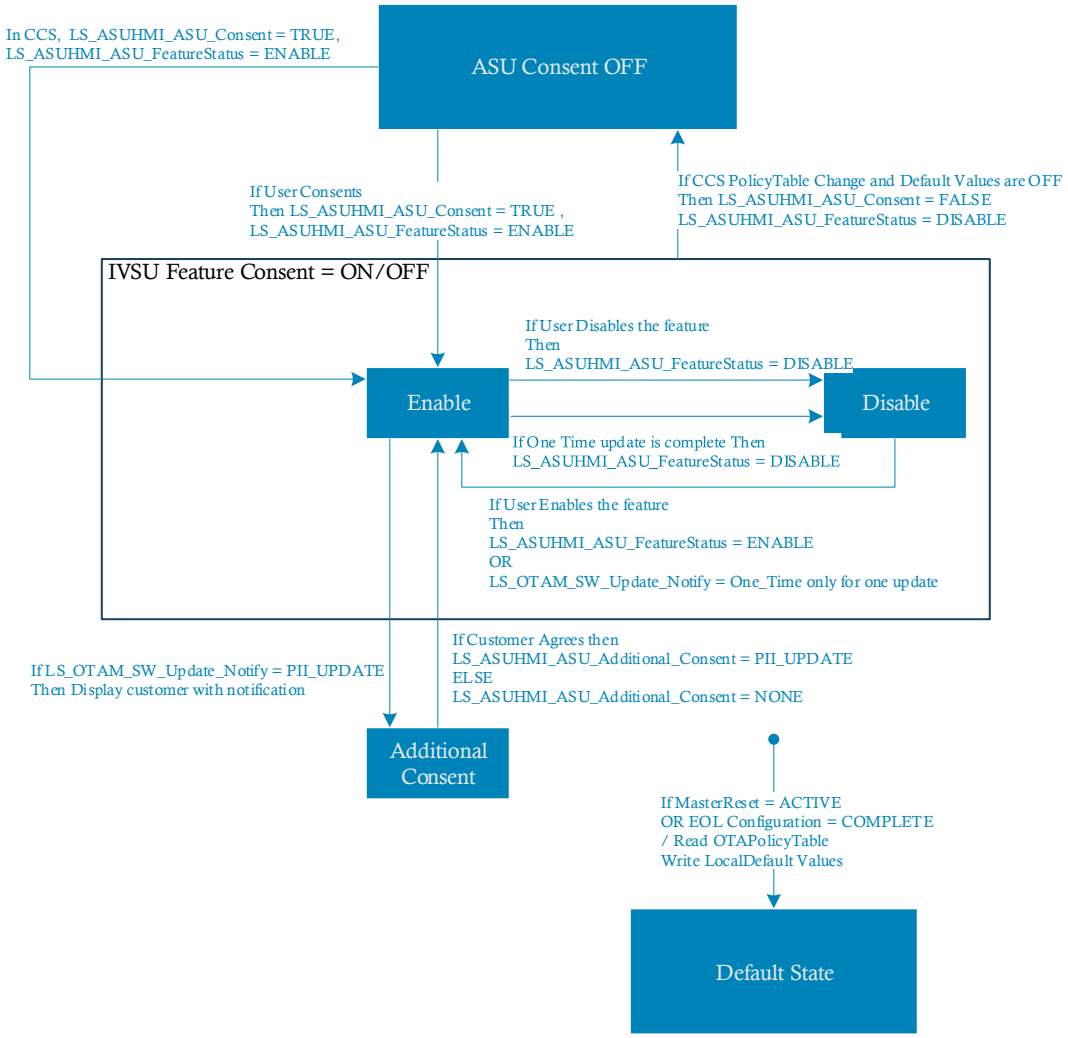


Figure 3: State Machine of Function Software Consent

4.1.5 Function Requirements

4.1.5.1 Functional Requirements

4.1.5.1.1 F-REQ-305211/C-###R_FNC_Veh_HMI_Consent_001### Appropriate User Consent Required for In Vehicle Software Update

In Vehicle Software Updates requires a customer authorization before vehicle can receive latest software form the Ford Backend. The software update shall require appropriate consent from the user thru in vehicle HMI or Ford mobile app or consumer website.

For the regions and/or countries where Automatic Software updates is default to ON.

- Vehicle is able to received software updates and if incremental consent is required, then user will be asked to provide additional consent thru in vehicle HMI or Ford mobile app

For some regions and/or countries where Automatic Software updates is default to OFF.

- Vehicle is not able to receive software updates but vehicle's ability to communicate with the Ford Backend.
    - Posting the current part numbers in order to get available software information
        - Download of the ODL file
    - Software Update Details
    - Download cloud authorization commands

  Software update setting shall allow the user to get notification of software update is available thru in vehicle HMI or Ford mobile app and given option to provide user consent before receiving the software updates.

During software activation vehicle will be inoperable for few minutes and customers shall set a one time or recurring schedule.

4.1.5.1.2 F-REQ-305316/E-###R_FNC_Veh_HMI_Consent_002### Feature Enable/Disable

The customer shall have the ability to change automatic system updates enable/disable. This is to allow more flexibility to the customer on how to manage the feature. IVSU feature default settings shall be input to the HMI and Vehicle Connectivity Settings. LS_ASUHMI_ASU_FeatureStatus = Enable/Disable (Reference flow in REQ-305287)
If software update is in progress downloading, installing, or pending for activation and vehicle lost vehicle connectivity then system shall pause all OTA activities.

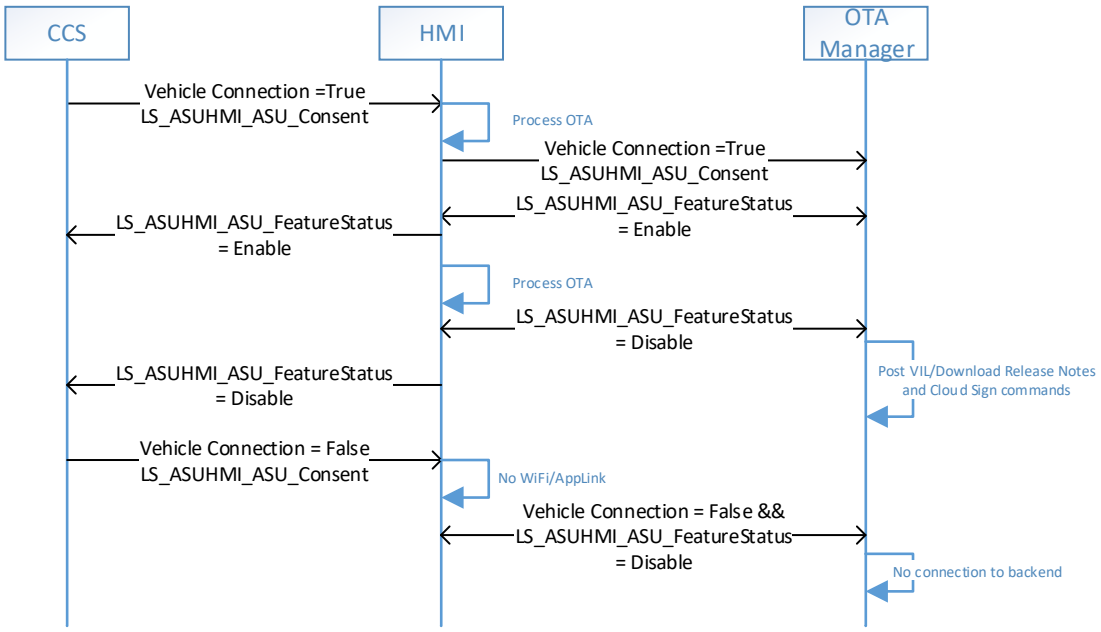
4.1.5.1.3 F-REQ-305221/D-###R_FNC_Veh_HMI_Consent_003### Vehicle Authorization State

The authorization is required to update the software under the electronic & communication and privacy rules and product liability. The default setting for OTA Software updates are define in the Policy table per region and/or country.
Automatic Software Updates settings can have enabled or disable or 'Ask me Later':

1. In some regions and/or countries, the software update **enabled** by default, customer has option to disable thru in vehicle HMI.
2. In some regions and/or countries, the software updates **disabled** by default but customer has option to enable through in vehicle HMI or ASK ME LATER option.
    - If user select 'Ask me Later', then HMI shall re-prompt the customer based on Ask me later configuration time = expire OR software update is available
3. FMC Owned vehicles shall have an OVERRIDE Op-Out options to update vehicle while in factory, Ford Fleet, and dealer, and other parking lots without in vehicle HMI inputs.
    - Ford backend shall OVERRIDE in vehicle consent
    - This update can be completely silent in the background
    - Schedule shall come from the Ford backed and share with HMI logic
4. Addition Consent: - Ford backend shall determine if software update requires additional consent from the user.
5. PII Consent: - Ford backend shall determine if software update requires additional consent from the user.
6. Direct Configuration may have special use case for user consent
    - If direct configuration is result of customer subscribing App, then change doesn't require consent.
7. USB Software update does not require vehicle authorization through in vehicle HMI.

4.1.5.1.4 REQ-326624/D-###R_FNC_Veh_HMI_Consent_004### Interface Between HMI, OTA, and Vehicle Connectivity Settings

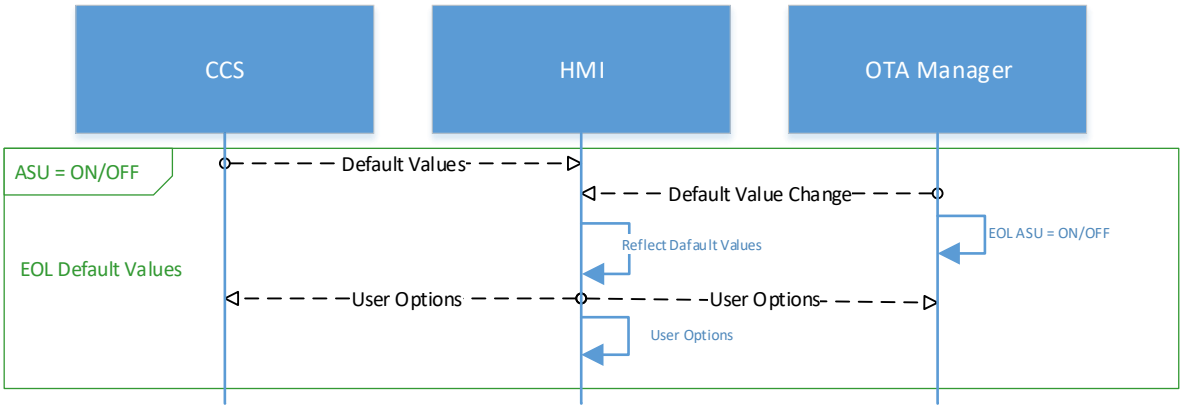
In Vehicle Software Update: then OTA manager shall share automatic software update settings current and update default setting, notify to HMI. HMI logic shall make sure new automatic software update default setting reflect under Vehicle Connectivity settings. LS_ASUHMI_ASU_FeatureStatus = new values.
Vehicle Connectivity Settings: If vehicle connectivity default setting is change, then HMI shall notify OTA Manager with new default values. When automatic software update any of the Vehicle Connectivity setting LS_ASUHMI_ASU_Consent = new value.



Flow 1: Interface between HMI, OTA, and Vehicle Connectivity

4.1.5.1.5 F-REQ-305287/C-###R_FNC_Veh_HMI_Consent_005### OTA and Vehicle Connectivity Settings and Other Default Settings

The OTA Manager shall store default values of vehicle authorization level. OTA default values are updateable through OTA. New default values shall be shared with HMI from OTA Manager.
HMI logic shall read the Vehicle Connectivity Settings (CCS policy table) for default settings per region and/or county.



Flow 2: OTA and Vehicle Connectivity (CCS) and Other Default Settings

4.1.5.1.6 F-REQ-305296/E-###R_FNC_Veh_HMI_Consent_006### Automatic Software Update Regional or/and Countries User Consent – Vehicle Authorization State

1. Loss of all connection – TCU Ford account is disabled and no Wi-Fi or smartphone parried without FordPass and Lincoln Way including AppLink enabled.

2. FMC Owned Vehicles – FMC shall be able to do OTA software update for All FMC owned vehicles without in vehicle HMI input.
3. Vehicle Connectivity Settings – as long as the vehicle has vehicle connection OTA Manager shall continue to do software updates LS_ASUHMI_ASU_Consent = True.
   3.1. Purchased agreement and if Wi-Fi and/or AppLink is available: -
      3.1.1. User Base Consent Default = OFF (LS_ASUHMI_ASU_FeatureStatus = Disable)
         - Vehicle has ability to communicate with the Ford Backend in order to get available software information, posting the current part numbers, download of the ODL file, download Software Release Notes, and download cloud authorization commands
         - One-time or recurring User consent is need in order to download the software files.
      3.1.2. User Base Consent Default = ON (LS_ASUHMI_ASU_FeatureStatus = Enable)
         - Depending on region and/or countries User Consent can be default to ON and in vehicle HMI allow the customer to disable consent.
         - In vehicle HMI shall have initial reminder after the vehicle is sold; vehicle mode = Normal && ignition_cycle_count = X, then prompt the user with consent reminder and allow to set a recurring schedule.
            - Notification shall have details that the vehicle's OTA Software updates feature is activated and able to receive software updates automatically, configure AP and set a recurring schedule for faster updates.
      3.1.3. Current Base Consent Values – HMI logic shall send a flag to OTA Manager each time it changes.
         - If User Consent changes from OFF → ON
            - Prompt the customer for Wi-Fi connection set recurring schedule for faster updates
         - If User Consent changed from ON → OFF during an OTA software update in process
         - If download is NOT complete, then pause the software update and wait for user input before resume the current download or start new download.
         - If download is hundred percent complete, then vehicle shall continue processing the current software update until completion based on the previous user consent.
   3.2. Additional Consent or PII – Ford Motor Company may require additional Consent and/or PII for specification type(s) of software (LS_ASUHMI_ASU_Additional_Consent = ONE_TIME or PII_UPDATE or Additional).
      - The OTA Manager shall notify the HMI if additional and/or PII User Consent as needed and it shall store user selection and post it to Ford backend
   3.3. One-time Consent – Customer can use **"Check Updates**" LS_ASUHMI_ASU_CheckUpdate = True and/or "**Update**" button as one-time consent LS_ASUHMI_ASU_Additional_Consent = One-time. In order to this option to work vehicle requires network connection; no additional user consent is required but it may require PII consent LS_ASUHMI_ASU_Additional_Consent = PII_UPDATE.
   3.4. Direct Configuration may have special use case for user consent
      3.4.1. If the change occurs because customer subscribe an App through in vehicle settings, then direct configuration update does not require user consent.
      3.4.2. For all direct configuration change occur automatically shall have software update base consent to update
4. USB Update User Consent – User consent is provided when customer login into consumer website and downloads the software.

Vehicle consent is stored in OTA Manager – HMI logic shall notify OTA manager with all consent related changes and OTA Manager shall notify user consent changes to Ford Backend.

4.1.5.1.7 F-REQ-305317/B-###R_FNC_Veh_HMI_Consent_007### User Consent Priority – Vehicle vs Ford Backend

For all non FMC owned vehicles, user consent stored in OTA Manager shall have higher priority, then what is stored in the Ford Backend.

For all FMC owned vehicles, user consent stored in Ford backend shall have higher priority, then what is stored in the OTA Manager.

4.1.5.1.8 F-REQ-305266/D-###R_FNC_Veh_HMI_Consent_008### Master Reset when Software Update is NOT in Progress

If customer initiate Master Reset when software update is not in progress and regardless of the IVSU default settings, then HMI shall restore the all Automatic Update settings feature consent to factory/default settings and over write user preference. After Master reset is complete, HMI shall prompt the customer to remind or accept Automatic Update settings.

- If Automatic Update settings default = OFF, then HMI shall ask the customer to accept the consent.
- If Automatic Update settings default = ON, then HMI shall remind the customer the consent is enable.

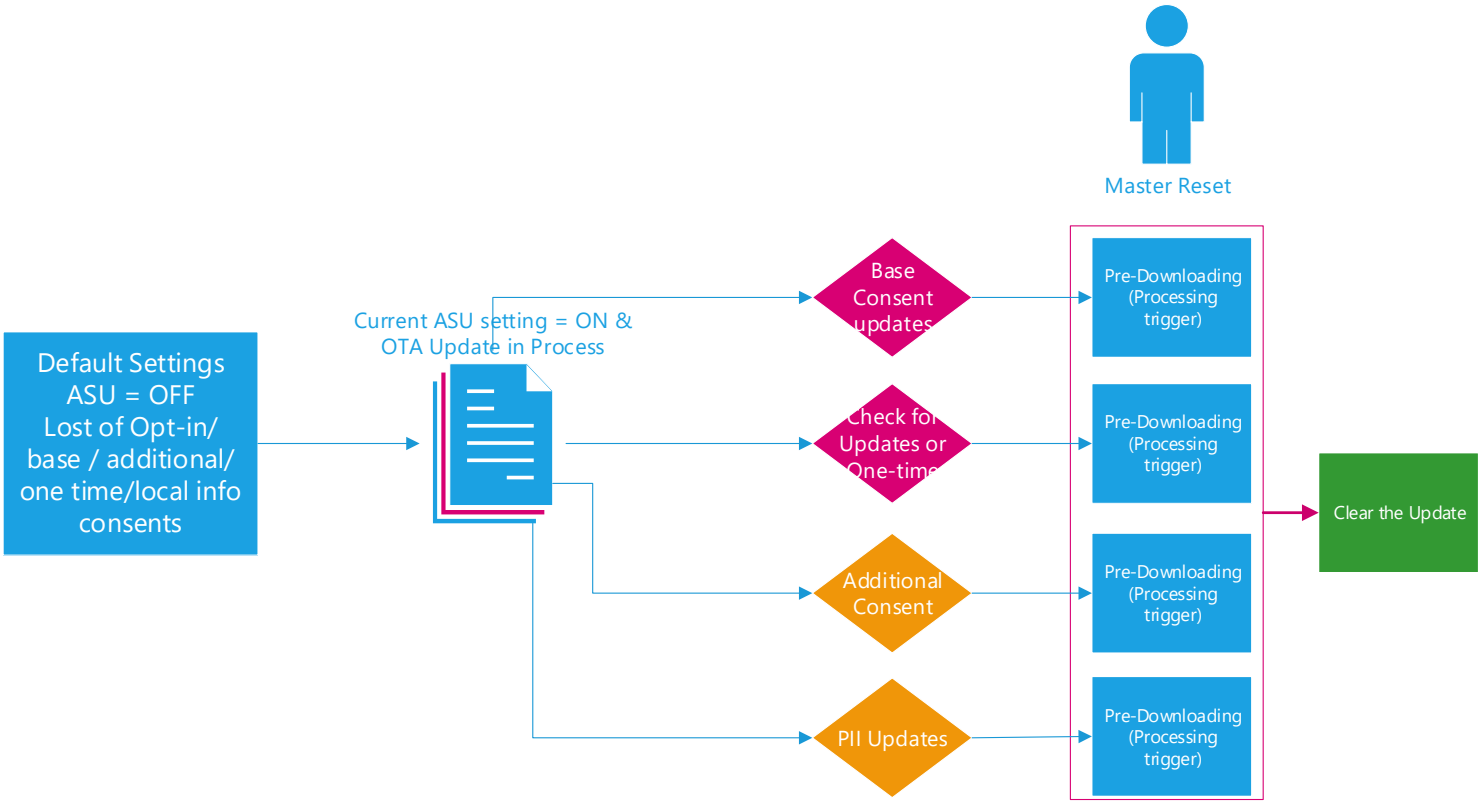
Example: -

❖ Default ASU Consent = ON
User selection = On → OFF
Master Reset shall restore the ASU default = ON

❖ Default ASU Consent = OFF
User selection = OFF→ ON
Master Reset shall restore the ASU default = OFF

4.1.5.1.9 REQ-347785/A-###R_FNC_Veh_HMI_Consent_009### Master Reset when Software Update is in Progress and Default ASU Setting is disabled

If Default ASO = OFF and software trigger is processing (pre-download) state with any consent level and customer initiate Master Reset, then Update shall cancel and HMI shall reset all IVSU related HMIs to factory/default settings. After system reboot is complete, then OTAM will set LS_OTAM_SW_Update_State = Clear_HMI and HMI shall clear all the OTA related HMIs, such as update button.



Flow 3: Master Reset when system was process trigger and Default ASU = OFF

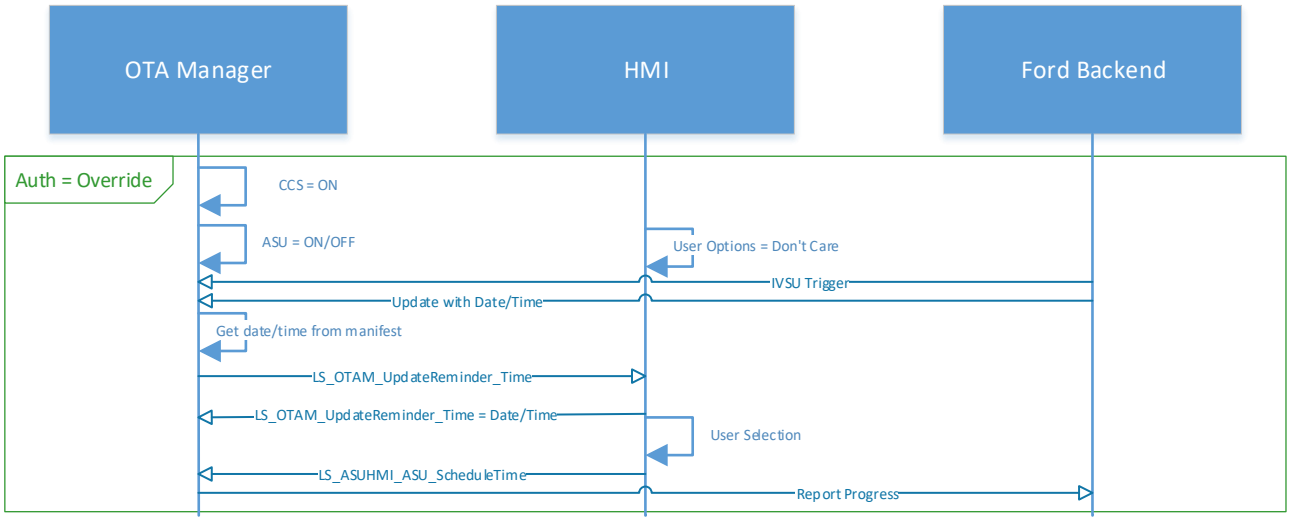
4.1.5.1.10 REQ-347787/A-###R_FNC_Veh_HMI_Consent_010###Additional Consent and PII Consent

If software update requires PII data for the update, then OTA Manager shall set a flag LS_OTAM_SW_Update_Notify = PII_UPDATE for HMI to prompt the user for PII Consent LS_ASUHMI_ASU_Additional_Consent = PII_UPDATE.

If the PII feature or (location sharing) is enabled, then HMI logic shall skip the popup and response OTA manager with consent is given by the user.
HMI shall have dynamic screen to display Additional/PII and other consents.

4.1.5.1.11 F-REQ-305210/E-###R_FNC_Veh_HMI_Consent_011### OVERRIDE – Vehicle Authorization State

For all FMC vehicle shall have capability to update software updates without user consent through in vehicle HMI.
Ford backend shall OVERRIDE in vehicle all level user consent and some HMI options. Software activation schedule timer come from the Ford backend and HMI shall reflect the choose time LS_OTAM_UpdateReminder_Time = time.



Flow 5: Override Vehicle Authorization

4.1.5.1.12 REQ-331790/C-###R_FNC_Veh_HMI_Consent_012### One-Time Consent

If software update is pending and requires one-time consent, then HMI shall prompt the user for one-time user consent is needed in order to complete the software update.

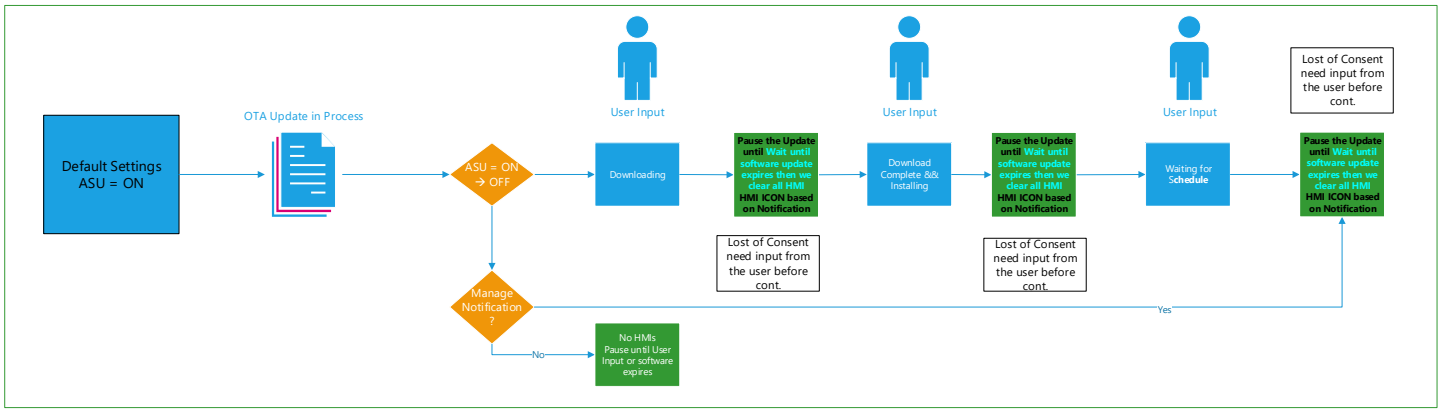
4.1.5.1.13 REQ-347788/B-###R_FNC_Veh_HMI_Consent_013### Automatic Software Updates Settings when Vehicle Connectivity is Off

If vehicle connectivity is off and customer try to access the “system update” then HMI shall prompt the user to enable vehicle connectivity (CCS Entity: MMOTA (ID 33, Type 1)) before continuing with “system update” tile.

- If MMOTA ID 33, Type 1 is off, then do not allow the user to access system updates tile, notify the user that vehicle connectivity is off and popup option shall allow the user to enable the vehicle connectivity.
- If MMOTA ID 33, Type 1 is on, then allow the user to access system updates tile

4.1.5.1.14 REQ-369545/A-###R_FNC_Veh_HMI_Consent_017### Software Update is in process and User Change the ASU to OFF

When ASU = ON and Software update is the progress, but customer change the ASU setting to OFF, then software update shall pause and wait for the user input.



Flow 24: User change the ASU setting when software update is in progress

4.1.5.1.15 Error Handling

4.1.5.1.15.1 F-REQ-305202/C-###R_FNC_Veh_HMI_Consent_014### Local Default Values

The component that hosts the vehicle HMI logic shall have local default values.

4.1.5.2 Non-Functional Requirements

4.1.5.2.1 F-REQ-305212/C-###R_FNC_Veh_HMI_Consent_015### Screen Refresh

If default values in the Vehicle Connectivity and OTA changes, then an ignition cycle is requiring to reflect the changes and the customer shall not able to visually detect any changes in the vehicle HMI settings.

4.1.5.2.2 REQ-347385/A-###R_FNC_Veh_HMI_Consent_016### Automatic System Updates Changes

The HMI manager shall provide the OTAMC with the status of the automatic software updates anytime the status is changed.

4.2 Logical Function Software Update Scheduler

4.2.1 Function Description

The update scheduler function shall allow the user to schedule a time when vehicle in inoperable to complete software update. This specific will cover both types OTA software updates erase and replace update and A/B memory swap. The update schedule function allows configurable day/time, which can be DAY (24hr) or WEEKLY (7days) depending on the default values. The update scheduler function is required for all vehicle inhibits and once the schedule is set there is no action needed from the customer, vehicle automatically shall complete the software updates at schedule time.
Once the software activation is in process user cannot abort but shall wait until software update is complete fail/pass.

4.2.2 Function Scope

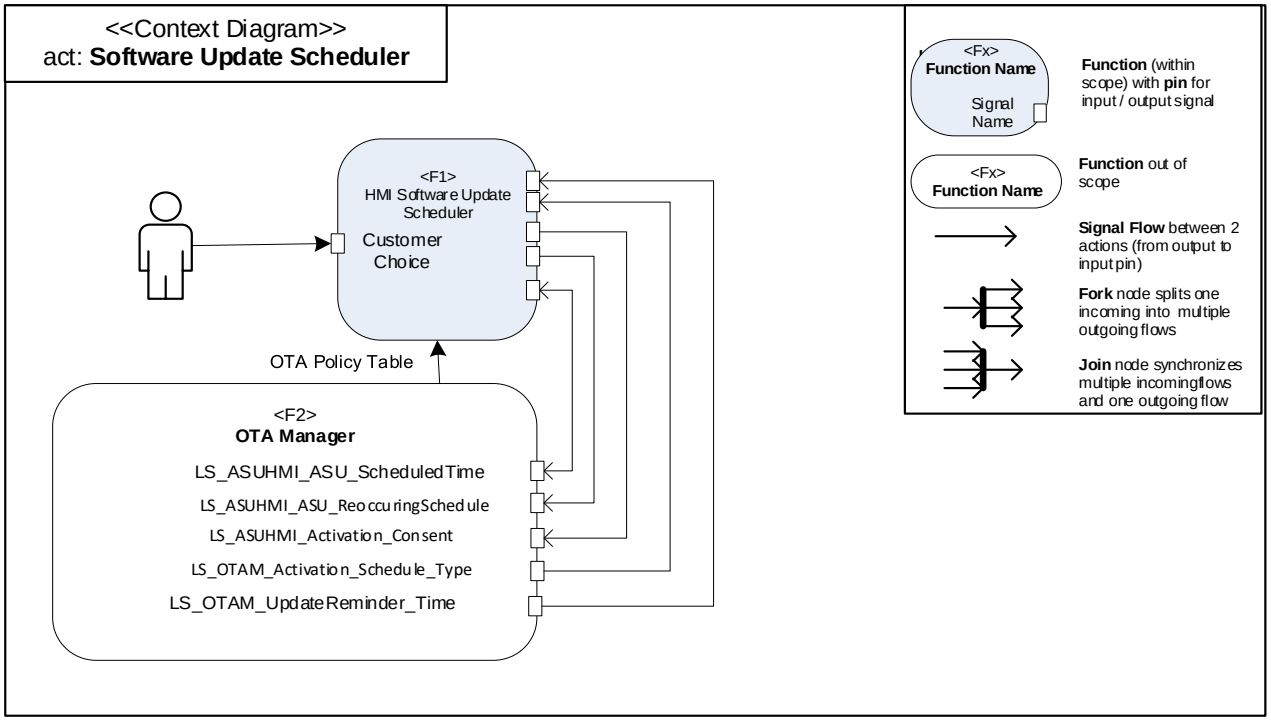


Figure 4: Context Diagram of Function Software Update Scheduler

4.2.3 Function Interfaces

4.2.3.1 Logical Inputs

Signal ID	Signal Name	Description
	CustomerChoice	This is the customer selection of the consent settings that will be shown in the screen

4.2.3.2 Logical Outputs

Signal ID	Signal Name	Description
	LS_ASUHMI_Activation_Consent	**Allow the customer chooses to activate time NOW; DATETIME; UNDEFINED**
	LS_ASUHMI_ASU_ScheduleTime	**Value in seconds for the scheduled time**
	LS_ASUHMI_ASU_ReoccuringSchedule	**Identify if it is a recurring schedule is True or False**
	LS_OTAM_Activation_Schedule_Type	**Based on software update priority HMI shall have options set recurring Weekly schedule or select onetime**
	LS_OTAM_UpdateReminder_Time	**Reminder Notification for upcoming software update (timer comes from the user or cloud)**

4.2.4 Function Modeling

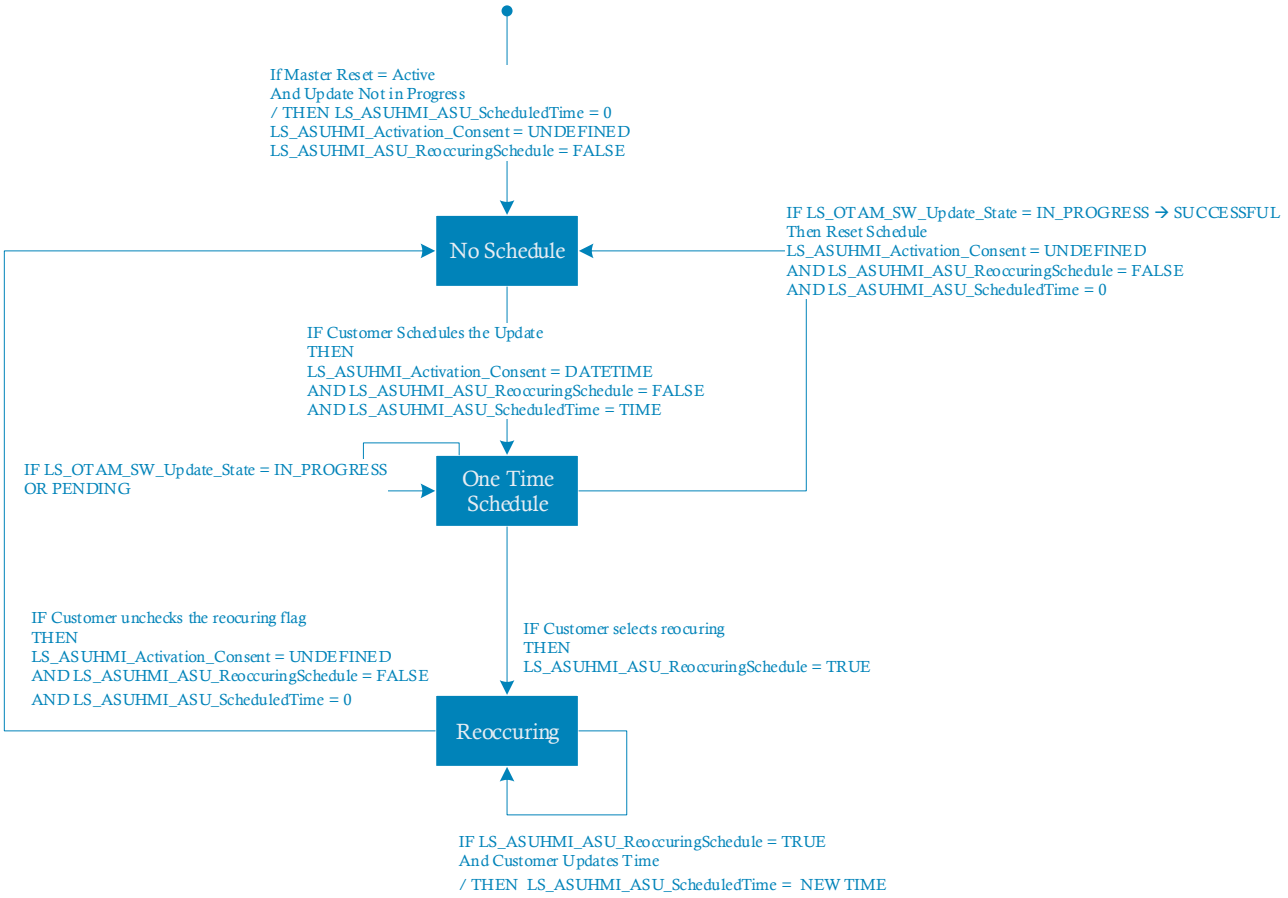


Figure 5: State Machine of Function Software Scheduling

4.2.5 Function Requirements

4.2.5.1 Functional Requirements

4.2.5.1.1 F-REQ-305213/C-###R_FNC_Veh_HMI_Sch_001### OTA Software Update Scheduler Range

The update schedule function is configurable day/time, which can be DAY or Weekly depending on the region's default values. The OTA Manager shall notify the HMI for the type of the range that it would prefer to display to the customer.
If LS_OTAM_Activation_Schedule_Type = DAY, then HMI screen shall have a DAY range to choose from. This variable is read and utilized when the customer is notified for a pending activation while the recurring schedule is OFF
If LS_OTAM_Activation_Schedule_Type = WEEKLY, then HMI shall have WEEKLY range to set day and time. Initial timer shall have increments of 30mins form the current onwards.

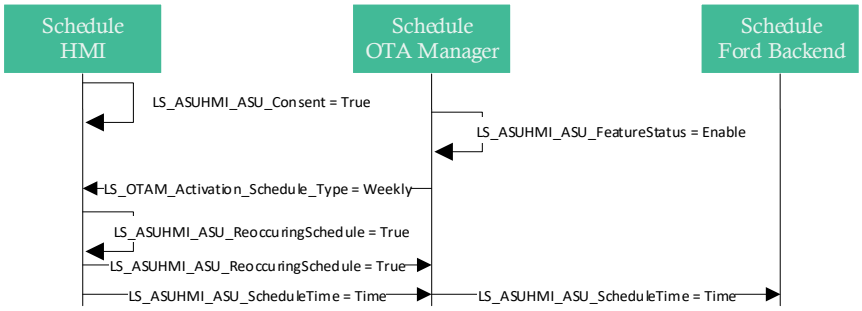
4.2.5.1.2 F-REQ-305214/C-###R_FNC_Veh_HMI_Sch_002### NOW Activation Options

If OTA software update type is E/R LS_OTAM_Activation_TypeSW_AB_ER = ER, then OTA manager shall set a flag for HMI to allow the user to update the software NOW or schedule it for Later LS_ASUHMI_Activation_Consent = NOW or Later.
All USB software update types A/B and/or E/R LS_OTAM_Activation_TypeSW_AB_ER = AB and ER, then OTA manager shall set a flag for HMI to allow the user to update the software NOW or schedule it for Later LS_ASUHMI_Activation_Consent = NOW or Later.

4.2.5.1.3 F-REQ-305215/C-###R_FNC_Veh_HMI_Sch_003### Set a Recurring Schedule to Complete New Software Update

HMI logic shall be allowing the user to set a recurring schedule to complete software updates. Whenever recurring schedule value change HMI logic shall notify the OTA Manager with change LS_ASUHMI_ASU_ReoccuringSchedule = True/False.

Under settings, HMI shall allow the user to have access to recurring schedule with current value and allow the user to change the current values as many time as needed. If customer decides to unselect the recurring schedule, then HMI logic shall keep track of user selection and update the HMI screen and notify the OTA Manager.
For most software updates vehicle preconditions can be met after 30min of cool down (such as PCM requires proper cool down before switching from memory A to B), so HMI logic shall allow the user to schedule activation 30mins from selection.
Example: Allow the customer to set recurring schedule minimum of 30mins from now onwards.
Now is 11:00 am and customer is trying to set schedule HMI shall only allow first time selection to be 11:30am onward.



Flow 6: Set Schedule

4.2.5.1.4 F-REQ-305216/E-###R_FNC_Veh_HMI_Sch_004### Set an One Time Schedule to Complete New Software Update

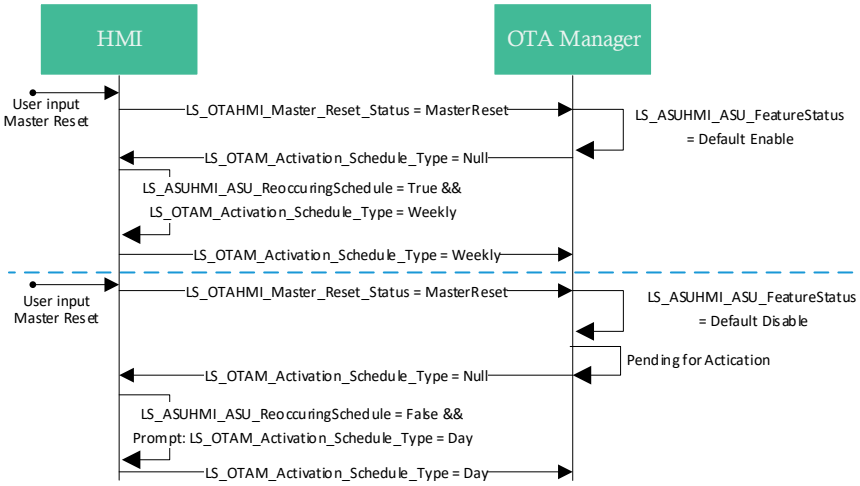
One-time schedule allows the user to complete software updates that requires vehicle inhibit.
If the recurring or one-time schedule is not set (schedule value = null) and OTA Manager required the software activation, then HMI shall set notify the user to set one-time schedule to complete the new software update within LS_OTAM_Activation_Schedule_Type = DAY. If software update is expired or user provided with day/time, then clear the HMI ICON.
HMI logic shall keep track of software activation is pending and schedule time LS_ASUHMI_ASU_ScheduleTime = null to show the ICON. If customer did not provide the input within 24hours, then HMI shall continue to show the ICON until software update expires LS_OTAM_TriggerExpiration_Time = expire.
When software activation is pending and requires one-time schedule time, then HMI shall prompt popup that schedule time is needed in order to complete the software update. HMI shall allow the user to disable the popup by selecting “Do not show this message again”.

4.2.5.1.5 F-REQ-305217/E-###R_FNC_Veh_HMI_Sch_005### Master Reset Clears Schedule Selection

When customer initiate a Master reset, then HMI shall clear the update schedule preferences and notify to OTAM with default values of following signals.
The schedule time shall go to default values of:

LS_ASUHMI_Activation_Consent = UNDEFINED
LS_ASUHMI_ASU_ScheduleTime = NULL
LS_ASUHMI_ASU_ReoccuringSchedule = FALSE

HMI logic shall check default user consent value if LS_ASUHMI_ASU_FeatureStatus = Enable, then prompt the user with reoccurring schedule LS_OTAM_Activation_Schedule_Type = Weekly otherwise feature is LS_ASUHMI_ASU_FeatureStatus = Disable → one-time schedule LS_OTAM_Activation_Schedule_Type = Day.



Flow 7: Master Reset and Prompt After Schedule is Cleared

4.2.5.1.6 F-REQ-305218/D-###R_FNC_Veh_HMI_Sch_006### Editing Schedule and Software Update expired

The customer shall have ability to change the day/time prior to activation starts. However, each software update shall have an expiration time LS_OTAM_TriggerExpiration_Time = expire.
If customer input was not received within allowed time, then HMI shall prompt the user with “Software update was cancelled because a time was not scheduled. Do you want to set up a recurring schedule for future updates?”

4.2.5.1.7 F-REQ-305220/C-###R_FNC_Veh_HMI_Sch_007### Activate Schedule Priority Recurring vs one time or Software updates

The OTA software activation shall have two options to activate the software. Based on default settings and user selection, HMI shall present the user with two options 24hrs as one-time or 7days as recurring.

4.2.5.1.8 F-REQ-305230/D-###R_FNC_Veh_HMI_Sch_008### Upcoming Software Update Schedule Reminder

HMI shall prompt with pre-activation reminder that the software update scheduled when it receives from the OTAM LS_OTAM_UpdateReminder_Time. HMI shall notify the user with schedule time and allow them to editing the schedule. If the schedule time in now, then HMI shall prompt the customer to ignition off and exit the vehicle and two minutes’ countdown.

4.2.5.1.9 F-REQ-305219/C-###R_FNC_Veh_HMI_Sch_009### Schedule Time Reached While Ignition RUN/START and Vehicle is in Park

If the Ignition status is RUN/START and vehicle is Park when the schedule time reaches, then HMI shall have notified then customer that software is ready to activated turn the ignition off or reschedule the software update to later time, then the HMI shall immediately notify the OTA Manager on the change of time.

4.2.5.1.10 REQ-326160/B-###R_FNC_Veh_HMI_Sch_010###HMI Display during Programming Session

In vehicle HMI shall have functional display during programming session and shall show progress of the software update with downtime of vehicle inhibit (LS_OTAM_Activation_Time = Seconds).
If OTA Manager set flag LS_OTAM_Vehicle_Inhibit_Type = ProgrammingSession or ActivatingNow, then HMI shall show programming screen with software activation progress bar. Other HMI notifies and user selections shall wait until software update complete pass or fail.

4.2.5.1.11 REQ-326157/E-###R_FNC_Veh_HMI_Sch_011###Precondition are not Met and Requires User Action

If software activation was postponed due to vehicle conditions not met and user input can fix the conditions, then prompt the uses to take an action (dynamic screen) and if needed reschedule for software updates.
HMI Logic shall check to see if schedule is required and prompt the user appropriately.

- If recurring schedule is set, then HMI shall show that when the system will retry.
- If the schedule was one time, then HMI shall allow to user to set a schedule.

If during software activation following preconditions are not complete and software update postponed LS_OTAM_SW_Update_Postpone = True, then HMI shall notify the customer to take action before reschedule to software activation again. For the conditions that are not displayed thru HMI, then HMI shall refer the customer to owner manual and/or consume website for more details.
1. If software update is postponed due to pre-conditions not met and user cannot change or fix these precondition due to system limitation, then HMI shall display “The update was cancelled because it was interrupted by another process vehicle will retry at later” and display the set schedule time and if required allow the user to set a schedule.
LS_OTAM_No_ProgSession_Preconditions_Supported: -

- ESCL Lock Pending
- Steering Pension Torque Out of Range
- Diagnostic Self-Test Active
- Charging Fault
- Ignition Status Out of Range
- Ignition Off / ACC Functionality Active
- Voltage Out of Range
- Park Brake Out of Range or Activation in Progress
- Unknown Precondition is not Met: The update was cancelled because it was interrupted by another process. <The vehicle will try again later>

2. If software update is postponed due to pre-conditions not met and user’s action can fix the preconditions, then HMI shall display following messages and display the set schedule time and if required allow the user to set a schedule.

LS_OTAM_No_ProgSession_Preconditions_Supported: -	
Vehicle Speed Too High	The update was cancelled because the vehicle was in motion. <The vehicle will try again later./Schedule a time to retry the update.>
Charging in Progress	The update was cancelled because the vehicle was charging. <The vehicle will try again later./Schedule a time to retry the update.>
PRNDL Out of Range	The update was cancelled because the vehicle was not in park (P). <The vehicle will try again later./Schedule a time to retry the update.>
Hazards On	The update was cancelled because the hazard lights were on. <The vehicle will try again later./Schedule a time to retry the update.>
Alarm Actively Sounding	The update was cancelled because the alarm sounded. <The vehicle will try again later./Schedule a time to retry the update.>
Engine RPM Too High (or Torque Available)	The update was cancelled because the vehicle was in motion. <The vehicle will try again later./Schedule a time to retry the update.>
Liftgate Ajar	The update was cancelled because the liftgate was open. <The vehicle will try again later./Schedule a time to retry the update.>
Park Lamps On	The update was cancelled because the parking lights were on. <The vehicle will try again later./Schedule a time to retry the update.>
Limp Home Active	The update was cancelled because the vehicle requires service. <The vehicle will try again later./Schedule a time to retry the update.>
Illuminated Exit Active	The update was cancelled because the Illuminated Exit system was on. <The vehicle will try again later./Schedule a time to retry the update.>
Door Ajar	The update was cancelled because a door was open. <The vehicle will try again later./Schedule a time to retry the update.>
Brake Pedal Pressed	The update was cancelled because the brake pedal was pressed. <The vehicle will try again later./Schedule a time to retry the update.>
Motor Movement Active	The update was cancelled because it was interrupted by another process. <The vehicle will try again later./Schedule a time to retry the update.>

4.2.5.1.12 REQ-329373/B-###R_FNC_Veh_HMI_Sch_012### Activation Postponed due to Vehicle Conditions not Met

If the update scheduler is, postpone due to vehicle conditions at time of schedule or vehicle is not ready to complete software activation and customer cannot fix the preconditions, then prompt the customer with a warning that vehicle update is not complete due to vehicle conditions LS_OTAM_SW_Update_Postpone = True and system shall automatically retry at next schedule time (show day/time).
If recurring schedule time = null, then prompt the user to set time.

4.2.5.1.13 REQ-326161/A-###R_FNC_Veh_HMI_Sch_013###OVERRIDE – HMI Notifications

Override update can be completely silent and does not require a schedule for software update to complete; vehicle shall update at first availability, and user shall not be allowing to interrupt.

4.2.5.1.14 REQ-346981/C-###R_FNC_Veh_HMI_Sch_014### When User Disable Recurring Schedule: clear the set date/time

If recurring schedule is set and user disables the recurring schedule option, then HMI shall clear the recurring set day/time and send notification to OTAM.
LS_ASUHMI_Activation_Consent = UNDEFINED
LS_ASUHMI_ASU_ScheduleTime = NULL
LS_ASUHMI_ASU_ReoccuringSchedule = FALSE

4.2.5.1.15 REQ-347386/A-###R_FNC_Veh_HMI_Sch_015### HMI allow the user to select and save the time before setting it to OTAM

HMI shall allow the user to select and save the time before sending it to OTAM.

4.2.5.1.16 REQ-347783/B-###R_FNC_Veh_HMI_Sch_016### Stolen Vehicle Service is Active

If stolen vehicle service is active OTAM will set flag LS_SVS_OTAM_Active = True, then HMI shall skip all software update related HMI notifications.
If software LS_SVS_OTAM_Active = True && LS_OTAM_SW_Update_Postpone = True, then HMI shall NOT notify the user the software update has postponed.

4.2.5.1.17 REQ-348242/C-###R_FNC_Veh_HMI_Sch_017### Stolen Vehicle Service is De-Active

If stolen vehicle service is de-active OTAM will set flag LS_SVS_OTAM_Active = False, then HMI can resume all notification.
If software LS_SVS_OTAM_Active = false && LS_OTAM_SW_Update_Postpone = True, then HMI shall notify the user the software update has postponed.

4.2.5.1.18 REQ-352881/A-###R_FNC_Veh_HMI_Sch_018### Update Expired and User Inputs Never Set Schedule

When software update requires a user input to apply the update LS_OTAM_Activation_Type = INHIBIT && LS_USBOTA_SW_Update_Status = PENDING && LS_ASUHMI_ASU_ScheduleTime = Null and user input was not provides and software update time expired LS_OTAM_TriggerExpiration_Time = Expire, then HMI shall show a popup to allow the user to set a recurring schedule.

4.2.5.1.19 REQ-369646/A-###R_FNC_Veh_HMI_Sch_019### Aloow the User to Clear then Schedule and Get Feedback

HMI shall allow the user to clear the schedule. When user click the clear schedule button, then HMI shall show a transient message with feedback of customer action.

4.2.5.1.20 Error Handling

4.2.5.1.20.1 F-REQ-305203/C-###R_FNC_Veh_HMI_Sch_017### Master Reset shall Reset Schedule Values

The schedule time shall go to default values of:
LS_ASUHMI_Activation_Consent = UNDEFINED

LS_ASUHMI_ASU_ScheduleTime = NULL
LS_ASUHMI_ASU_ReoccuringSchedule = FALSE

4.2.5.2 Non-Functional Requirements

4.2.5.2.1 REQ-346761/A-###R_FNC_Veh_HMI_Sch_018### Count Down Timer when SYNC Display of Off

When HMI is displaying the two minutes of countdown timer and sync display turn off, then HMI logic shall continue to countdown with timer until it two minutes are expires.

4.3 Logical Function Software Notification

4.3.1 Function Description

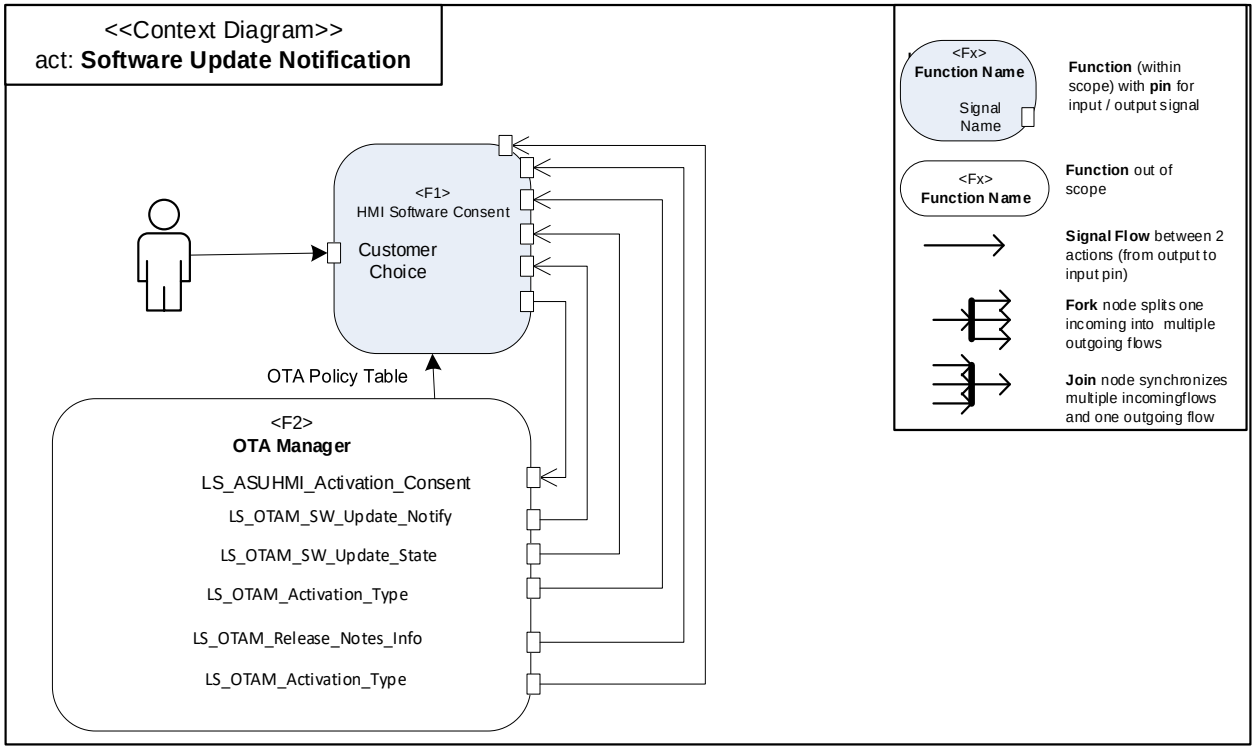
Software updates have different types of notifications based on the user consent level.

- Update successful:-
  - When an OTA software updates is successful, in vehicle HMI shall show clickable ICON, user can click this icon for more details about the update.
- Customer initiate software Update – in vehicle HMI shall allow the customer to check for software updates
  - Customer shall be notified if the update is available thru in vehicle HMI and shall be able to see update progress (including initial communication, downloading details such number of files and percentage complete, installation progress, activation and update successful.
- Completely Silent Mode
  - If Ford Backend requested completely silent then in vehicle HMI shall NOT display any HMIs such as activation schedule and update successful expect when vehicle requires inhibit. During vehicle inhibit if customer decide to start the vehicle then HMI shall display the countdown timer until the vehicle is de-inhibited.

Customer selection and Ford Backend (thru manifest) shall determine the HMI options for OTA software updates.

4.3.2 Function Scope

Figure 6: Context Diagram of Function Software Update Notification



4.3.3 Function Interfaces

4.3.3.1 Logical Inputs

Signal ID	Signal Name	Description
	CustomerChoice	This is the customer selection of the consent settings that will be shown in the screen

4.3.3.2 Logical Outputs

Signal ID	Signal Name	Description
	LS_ASUHMI_Activation_Consent	**Allow the customer chooses to activate time NOW; DATETIME; UNDEFINED**
	LS_OTAM_SW_Update_Notify	**If software update requires Personal Identifier Information or Not**
	LS_OTAM_SW_Update_State	**OTA software update status**
	LS_OTAM_Activation_Type	**Activation Type: - Non Ignition Cycle Ignition Cycle Inhibit**
	LS_OTAM_Release_Notes_Info	**Software**

	LS_OTAM_UpdateExpiration_Time	Maximum expiration time that a software is allowed to stay in pending state
	LS_OTAM_TriggerExpiration_Time	Maximum expiration time that is used for one-time consent

4.3.4 Function Modeling

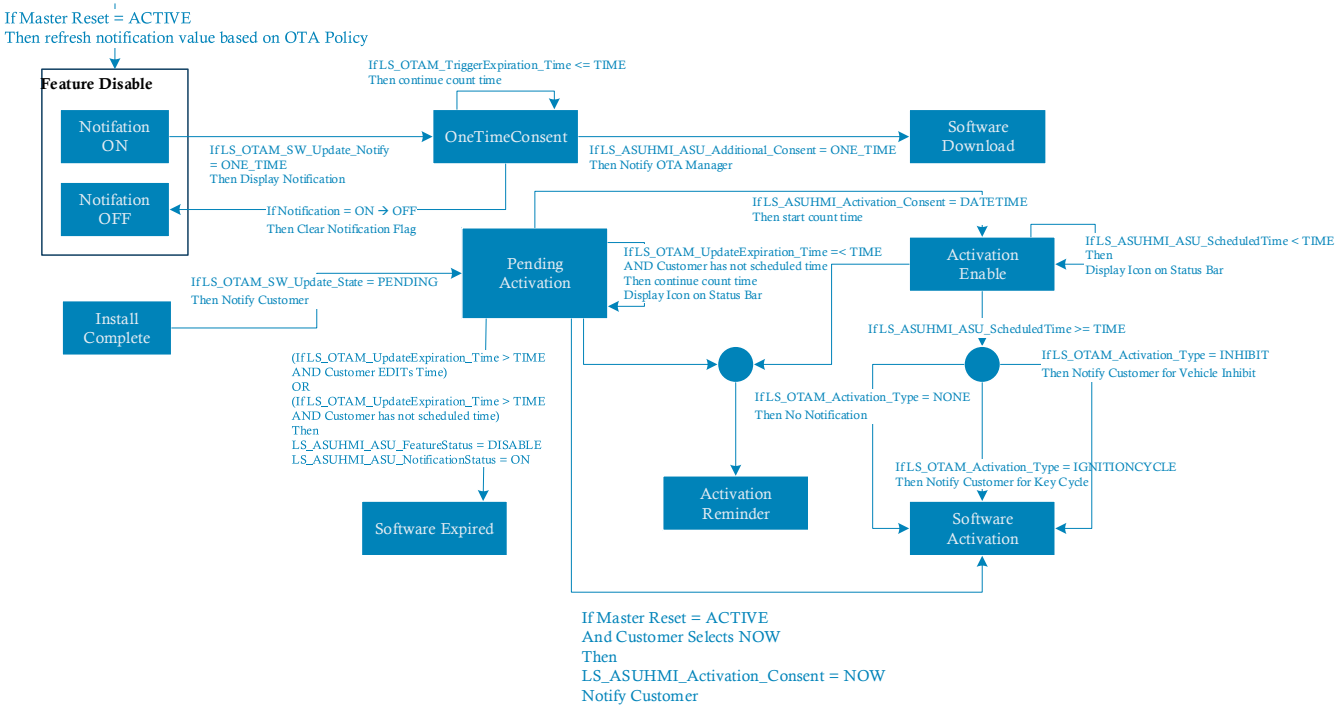


Figure 7: State Machine of Function Software Notification

4.3.5 Function Requirements

4.3.5.1 Functional Requirements

4.3.5.1.1 F-REQ-305222/D-###R_FNC_Veh_HMI_Notif_001### Additional User Consent Notification

If software update requires an additional consent, then OTA Manager shall set a flag LS_OTAM_SW_Update_Notify = Additional for HMI to prompt the customer to provide additional consent LS_ASUHMI_ASU_Additional_Consent = Additional.
Additional consent is used for recall or other purposes when we need to record customer acknowledgement in the cloud.
HMI logic shall notify OTA Manager with user sections LS_ASUHMI_ASU_Additional_Consent = One Time or additional, then HMI shall clear the additional consent icon.
HMI login shall prompt the customer for Additional User consent and an icon of notification stay on the HMI screen until software update expires or user input is received.

4.3.5.1.2 REQ-326784/B-###R_FNC_Veh_HMI_Notif_002### Vehicle in Private Mode

If customer has elected to be in a private mode, then IVSU shall only update software files that doesn't require any PII data.
HMI shall not prompt the user for software updates that are required additional/PII.

4.3.5.1.3 REQ-331788/C-###R_FNC_Veh_HMI_Notif_003### Wi-Fi Connection Reminder

If Customer select the one-time consent LS_ASUHMI_ASU_Additional_Consent = one-time, then HMI shall prompt the customer to connect to Wi-Fi for faster software update.

If customer give one-time consent when Wi-Fi is not connected, then HMI shall notify the customer that updates may take longer to download or in some cases may not download.
Wi-Fi is not connected can be determined based on following conditions.
If Wi-Fi = OFF, then HMI shall prompt the customer to enable Wi-Fi and connect to AP.
If Wi-Fi = ON and AP is connected, then skip the Wi-Fi prompts.
If Wi-Fi = ON and AP is preconfigured and it's out of range, then notify the customer that connecting to Wi-Fi will provide faster software updates.
If Wi-Fi = ON and AP is not configured and AP is in range, then show the available connections to connect to Wi-Fi.

4.3.5.1.4 F-REQ-305223/C-###R_FNC_Veh_HMI_Notif_004### Manage Software Update Notification Options

The Automatic software updates settings shall allow Manage Notification Options where customer can select to be notify if software update is available during Automatic software update setting OFF.
Manage in Vehicle HMI Notification Options: -

- If Default Automatic Software updates = OFF, then the Manage Notification Options shall be default ON but user shall have the option to choose notifications OFF
- Manage Notification = ON LS_ASUHMI_Manage_Notification = True && Automatic Software updates = OFF LS_ASUHMI_ASU_FeatureStatus = Disable → notify the user when the new software is available with contents of the available software and ask for user consent. This notification is thru in vehicle HMI ICON for (Configure time from OTA Manager). The available software shall be accessible thru in vehicle OTA setting until the trigger expires.
- The OTA_SM shall clear all OTA HMI related messages and icons when the trigger in process is expired as per dictated in the received trigger expiration time LS_OTAM_TriggerExpiration_Time = expire.
- Manage Notification = OFF LS_ASUHMI_Manage_Notification = False & Automatic Software updates = OFF LS_ASUHMI_ASU_FeatureStatus = Disable → HMI shall not show any notifications until user enables the ASU or manage notification.
- Automatic Software updates = ON LS_ASUHMI_ASU_FeatureStatus = Enable → Hide Manage Notification

The Ford Backend shall determine type of notification in vehicle HMI shall display thru OTA Manager.

4.3.5.1.5 F-REQ-305225/E-###R_FNC_Veh_HMI_Notif_005### Details Update Button

If OTA system is waiting for user consent, then OTA Manager shall set a flag LS_OTAM_SW_Update_Notify = One_time for HMI to display Update under setting → details and HMI ICON on main screen, HMI shall show Update button with software release notes (release notes shall be stored locally). If customer click Update button, then HMI shall notify the OTA Manager with flag LS_ASUHMI_ASU_Additional_Consent = One_time.
HMI shall clear the HMI ICON when LS_OTAM_TriggerExpiration_Time = Expire and/or LS_USBOTA_SW_Update_Status = Successful or LS_OTAM_SW_Update_State = FAILED or LS_OTAM_SW_Update_State = UP_TO_DATE.

4.3.5.1.6 F-REQ-305226/B-###R_FNC_Veh_HMI_Notif_006### Preferred Network

Preferred Network: - The customer shall have interface with the vehicle HMI to allow the user to select the preferred network for the software updates. This includes both hotspot and Wi-Fi (Consumer or public network).

4.3.5.1.7 F-REQ-305227/B-###R_FNC_Veh_HMI_Notif_007### OTA Software Notification Display Time

Vehicle HMI shall configure specification timers for OTA software popup notification so that the customer has the ability to read all the information displayed in it.

4.3.5.1.8 F-REQ-305228/B-###R_FNC_Veh_HMI_Notif_008### HMI ICON Action Notification

HMI logic shall keep displaying the ICON with notifications until the task has been complete or user action is done. HMI shall continue to show IVSU related ICONs even if vehicle is in motion. When user click on the ICON, then HMI shall show notify with detail of the user action.
All IVSU related information should be available for the customer to access under settings.

4.3.5.1.9 F-REQ-305229/B-###R_FNC_Veh_HMI_Notif_009### Activation Pending HMI Notification

OTA Manager shall set a flag for HMI to notify the user the software activation is pending LS_OTAM_Activation_Status = pending
If activation shall wait for the user action to complete the update.

- If software activation requires schedule time LS_OTAM_Activation_Type = INHIBIT, then it shall wait until user provide date and time.
- If software activation requires an ignition cycle LS_OTAM_Activation_Type = IGNITIONCYCLE, then is shall wait until user perform an ignition cycle.

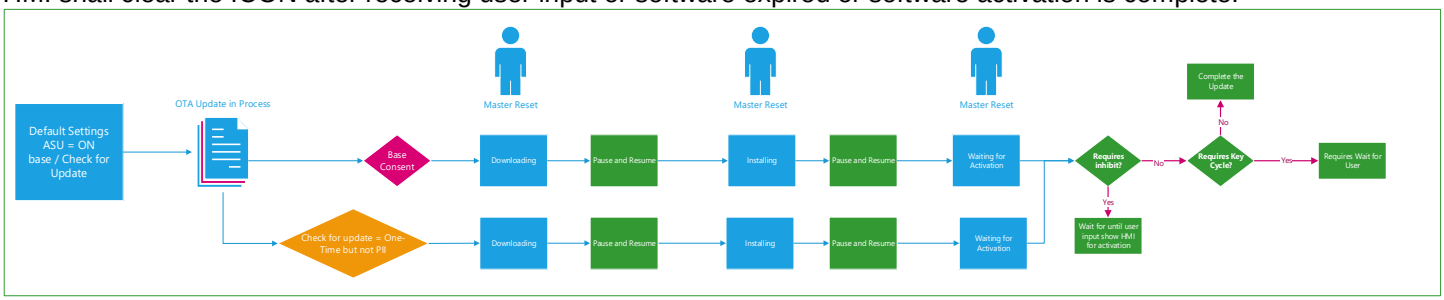
If user do not provide input and close the popup, then HMI shall continue to show an ICON until software update expires.

4.3.5.1.10 F-REQ-305231/B-###R_FNC_Veh_HMI_Notif_010### OTA Software Activate

All OTA software requires an ignition cycle to activate the software. The user shall have option to schedule a time for activation when vehicle is inhibited more than normal ignition cycle.
The OTA Manager shall have two flags for HMI (A/B swap readiness and E/R timer) before each OTA software activation takes place. LS_OTAM_Activation_Type = inhibit && LS_OTAM_Activation_TypeSW_AB_ER = (AB or ER or AB_and_ER).
When vehicle is inhibited and customer decides to start the vehicle, then HMI shall warn the user and show software activation progress.

4.3.5.1.11 F-REQ-305232/C-###R_FNC_Veh_HMI_Notif_011### Master Reset when Software is in Progress with Base level or One-time Consent & Default Consent ON

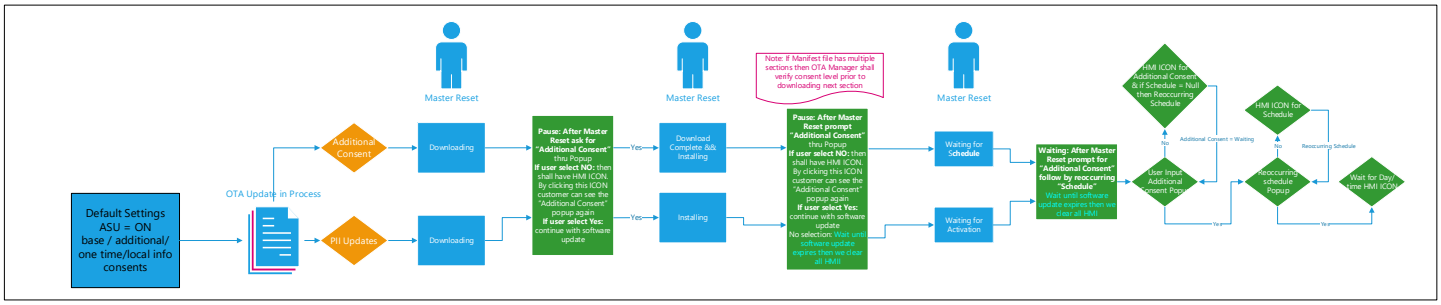
If the OTA software is in progress with base level or one-time consent (download, install, and activation), then HMI shall warn the customer that software update is in progress before continue with master reset or Cancel.
If customer choose to continue with master reset, then HMI shall notify OTA manager with LS_OTAHMI_Master_Reset_Status = MasterReset and during master reset OTA Manager shall pause software update until system reboot is complete before resuming with software update.
HMI shall prompt the user to set a recurring schedule and HMI ICON if software activation is pending and requires vehicle inhibit.
HMI shall clear the ICON after receiving user input or software expired or software activation is complete.



Flow 8: Master Reset when ASU = ON and update is in progress

4.3.5.1.12 F-REQ-305234/D-###R_FNC_Veh_HMI_Notif_012### Master Reset & SW is in Progress with Additional and/or PII Consent and Default Consent ON

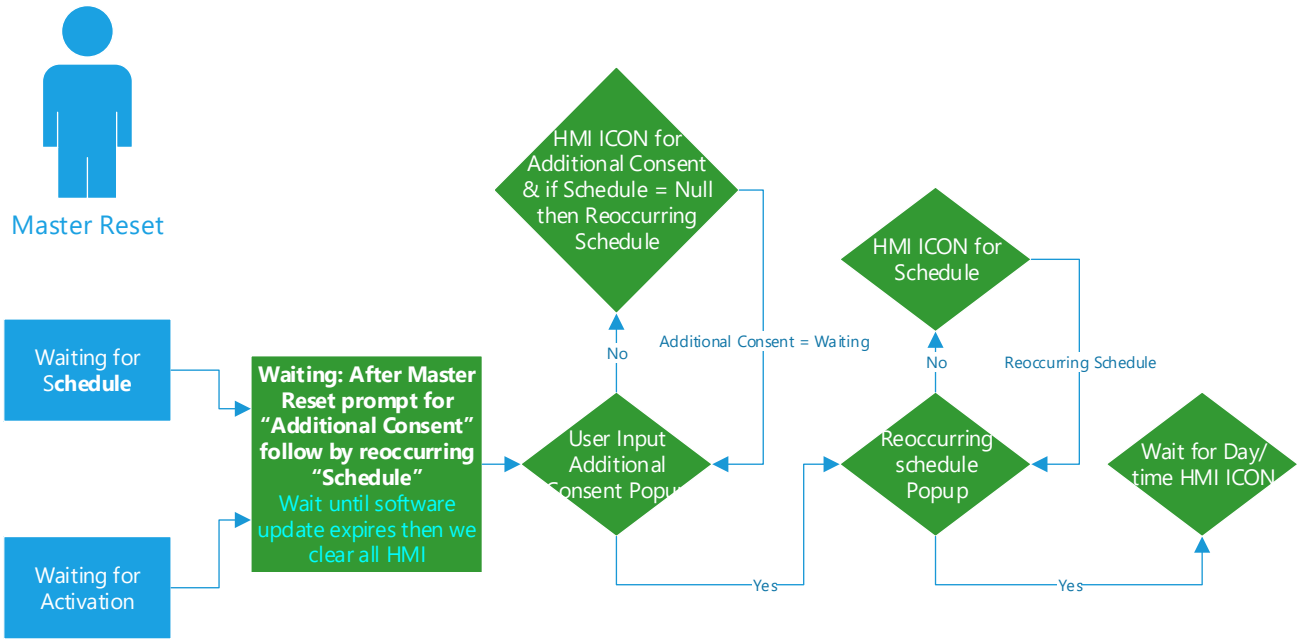
If the OTA software is in progress and user consent level is additional and/or PII, then
HMI shall warn the customer that software update is in progress before continue with master reset or Cancel.
If customer choose to continue with master reset, then HMI shall notify OTA manager with LS_OTAHMI_Master_Reset_Status = Master Reset and during master reset OTA Manager shall pause software update until system reboot is complete, HMI shall prompt the customer for consent an additional and/or PII before resuming with software update.
HMI shall prompt the user to set a recurring schedule.



Flow 9: Master Reset when ASU = ON and update is in progress through Additional and/or PII Consent

4.3.5.1.13 F-REQ-305240/B-###R_FNC_Veh_HMI_Notif_013### Master Reset when SW update is pending for activation with Additional and/or PII Consent

If the OTA software activation is pending, then HMI shall warn the customer that software update is in progress before continue with master reset or Cancel.
If customer choose to continue with master reset, then HMI shall notify OTA manager with LS_OTAHMI_Master_Reset_Status = Master Reset and if OTA Manager has schedule set time it shall clears the time.
After the system reboot is complete, HMI shall prompt the customer for additional and/or PII consent follow by set a schedule for software activation to complete.
If no selection is received, then HMI shall show ICON on the screen until software update expires or user input is received.

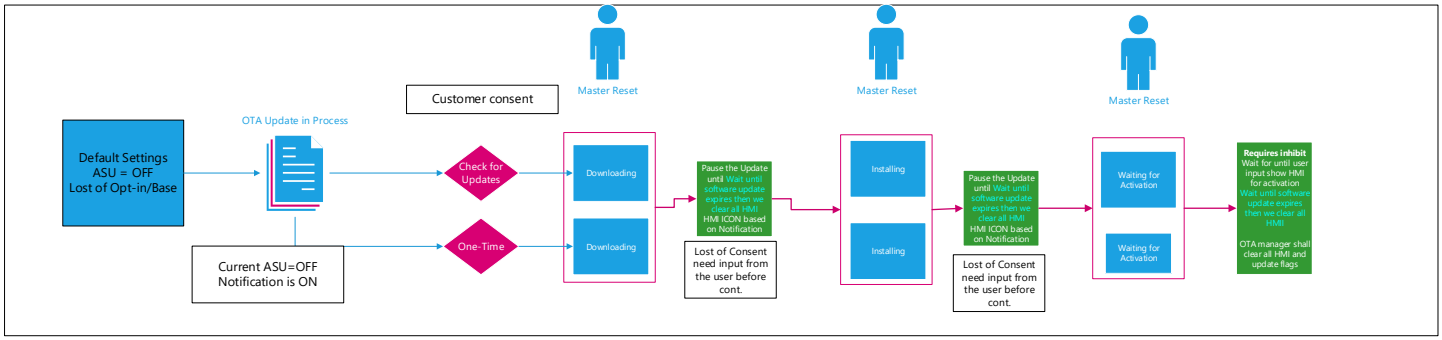


Flow 10: Master Reset when Software update is pending with Additional Consent

4.3.5.1.14 F-REQ-305236/D-###R_FNC_Veh_HMI_Notif_014### Master Reset when SW update is in process & ASU default OFF without Addtional/PII Consent

If software update is in progress (downloading, installing, and waiting for activation) and user consent default setting is OFF, then HMI logic shall prompt the customer for with warning that software update is in progress do you want continue or cancel.
If customer choose to continue with master reset, then HMI shall notify OTA manager with LS_OTAHMI_Master_Reset_Status = Master Reset and during master reset OTA Manager shall pause software update until system reboot is complete, HMI shall prompt the customer for consent before resuming with software update.

HMI shall show an ICON or Notify, if Manage notification are ON until software update expires or user input is received.



Flow 11: Master Reset when Software update is in process without Additional Consent

4.3.5.1.15 F-REQ-305238/B-###R_FNC_Veh_HMI_Notif_015### Master Reset when SW update is in process and ASU is OFF with Additional/PII Consent

If software update is in process and user consent default setting is OFF, then HMI shall prompt the customer for with warning that software update is in progress do you want continue or cancel.
If customer choose to continue with master reset, then HMI shall notify OTA manager with LS_OTAHMI_Master_Reset_Status = Master Reset and during master reset OTA Manager shall pause software update shall pause until system reboot is complete, HMI shall prompt the customer for Base consent and additional and/or PII consent before resuming with software update.

4.3.5.1.16 REQ-329375/A-###R_FNC_Veh_HMI_Notif_016### HMI Display during - Completely Silent OTA Software Updates

Backend request completely silent, then in vehicle HMI shall NOT display any OTA related HMIs, such as activation schedule and update successful expect when vehicle requires inhibit.

4.3.5.1.17 REQ-326177/B-###R_FNC_Veh_HMI_Notif_017### Software Update is in Process & Vehicle Lost Additional and/or PII User Consent

If software update is in progress LS_OTAM_SW_Installation_State = IN_PROGRESS && LS_OTAM_SW_Download_State = IN_PROGRESS && LS_OTAM_SW_Update_State = IN_PROGRESS and vehicle lost additional and/or PII consent due to user change the consent ON→ OFF then, HMI shall prompt the user with option to continue or cancel.
If user continue with the request, then HMI shall notify the OTA Manager that LS_ASUHMI_ASU_FeatureStatus = Disable.
OTA Manager shall treat this request as loss of One time and PII update consent LS_ASUHMI_ASU_Additional_Consent = ONE_TIME or LS_ASUHMI_ASU_Additional_Consent = PII_UPDATE and pause the update until user input or software update expires.
If Manage Notification = ON, then HMI shall show ICON until software update expires to notify the user that user consent is needed.
If Manage Notification = OFF, then HMI shall NOT show ICON and software update is available until it's expired.

4.3.5.1.18 REQ-326178/B-###R_FNC_Veh_HMI_Notif_018### Software Update is in Process & Vehicle Lost Base User Consent

If software update is in progress and user change the consent ON→ OFF then, HMI shall prompt the user with option to continue or cancel.
If user continue with the request, then HMI shall notify the OTA Manager that vehicle lost user consent LS_ASUHMI_ASU_FeatureStatus = Disable and software update shall pause and wait for the user consent before continuing with software update.
If Manage Notification = ON, then HMI shall show ICON until software update expires to notify the user that user consent is needed.
If Manage Notification = OFF, then HMI shall NOT show ICON and software update is available until it's expired.

Download Status	Update Status	Update type	HMI Prompts

Update is in progress	**In progress**	**All**	**User action ASU ON→OFF, HMI shall prompt the customer update was paused**
Download is less than 100%	**Download will pause and wait for the consent or update expire time**	**All updates**	**Notify the customer update will pause**
Download is 100%	**Update will continue based on the previous consent**	**Non-inhibit**	**Update will complete**
Download is 100%	**update will continue**	**Inhibit**	**If schedule is set, then complete per schedule If schedule is not set, then If notification = ON, then ask for the user schedule If notification = OFF, then HMI shall wait for user input**
Note: customer is allowed the clear the schedule			

4.3.5.1.19 F-REQ-305242/B-###R_FNC_Veh_HMI_Notif_019### Software Updates and Activation Types

All types of software updates require vehicle to be in park and some software updates requires an ignition ON/OFF or vehicle inhibit to successfully complete.
OTA software updates types: -

- Vehicle is fully functional – OTA Manager shall set flag LS_OTAM_Activation_Type = NOIGNITIONCYCLE, then HMI shall show ICON that software update is complete.
- Vehicle is fully functional – OTA Manager shall set flag LS_OTAM_Activation_Type = IGNITIONCYCLE, then software update is waiting for auto ignition cycle HMI shall NOT prompt the user.
- Vehicle inhibit is required for few minutes – to complete the software updates it requires to set a schedule when HMI receives flag LS_OTAM_Activation_Type = INHIBIT, then HMI shall prompt the customer with option to set a schedule time when vehicle will not be used, also with warning that vehicle shall not be able start the engine during this time.

4.3.5.1.20 F-REQ-305246/B-###R_FNC_Veh_HMI_Notif_021### HMI Temporary Vehicle Inhibit during Software Activation (Max time)

During OTA software activation, vehicle inhibits crank to prevent the customer from starting the engine.
During A/B swap and erase/replace software updates, the OTA Manager shall set a flag with inoperable max time to HMI LS_OTAM_Activation_Time = time, then HMI shall have a process bar display to show the software activation progress.

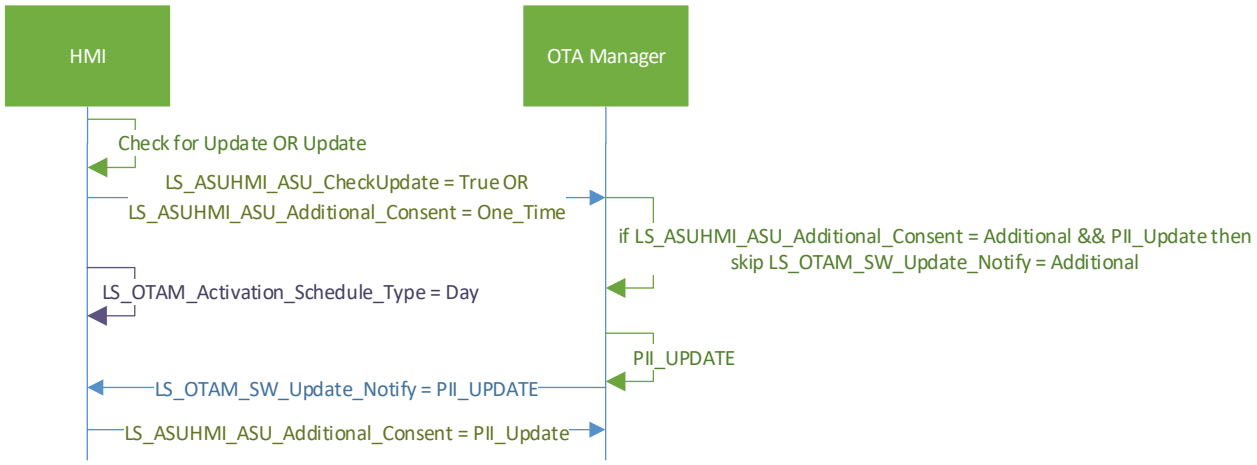
When LS_OTAM_Activation_Type = inhibit, then HMI shall display warning of vehicle inhibit and that key fobs will not work until software update is complete; follow by process bar in center stack display.

4.3.5.1.21 F-REQ-305248/D-###R_FNC_Veh_HMI_Notif_022### Clear Notification When Software Update Expires

When software update requires a user input to apply the update and user input was not provided and software update time expired, then OTA Manager shall send a flag LS_OTAM_TriggerExpiration_Time = Expire, then HMI shall clear all IVSU related HMIs/ICONs.

4.3.5.1.22 F-REQ-305250/B-###R_FNC_Veh_HMI_Notif_023### ONE TIME Consent

The customer shall have the option to provide a ONE-TIME Consent thru **"Check Updates"** LS_ASUHMI_ASU_CheckUpdate = True and/or "**Update**" button LS_ASUHMI_ASU_Additional_Consent = ONE_TIME.
If customer selects one-time consent ICON, then HMI shall show popup that software update is available and it may take few days to complete the update depending on the vehicle connection speed.
One-time consent shall supersede additional user consent.
If customer selects one-time consent, then HMI flow shall allow the customer to navigate to set a one-time schedule to complete the software update.

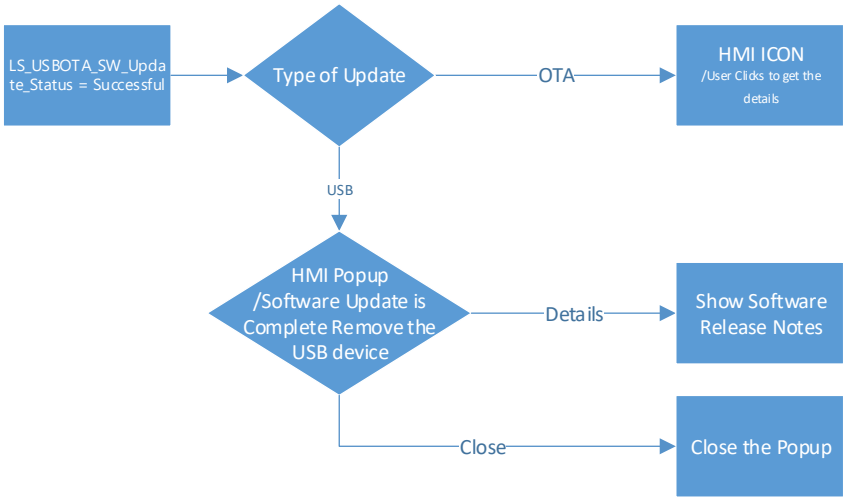


Flow 10: One Time User Consent

4.3.5.1.23 F-REQ-305252/B-###R_FNC_Veh_HMI_Notif_024### Software Update Activation is Successful with latest Software

OTA software update: once the activation is successful LS_USBOTA_SW_Update_Status = Successful and vehicle is update successfully, HMI shall show a clickable icon where user can see the details of the update. This ICON shall stay on the HMI for configurable ignition cycles or until the user clicks the ICON.
For USB software update is successful LS_USBOTA_SW_Update_Status = Successful, then

(1) Popup Software update is complete remove the USB device with two options Close and Show Details, show details shall now release notes
(2) Prompt the customer to remove the USB device when LS_USBOTA_SW_Update_Status = Successful



Flow 11: Software Update is Successful

4.3.5.1.24 F-REQ-305224/D-###R_FNC_Veh_HMI_Notif_025### Details Software Release Notes

After software update is successful LS_OTAM_SW_Update_State = SUCCESSFUL OR LS_USBOTA_SW_Update_Status = SUCCESSFUL and customer clicks on details options from “Successfully Updated” screen, then the vehicle HMI shall display a release notes text file.
Each ECU software release shall provide the update release notes as text file. Before releasing the release notes text file into IVS, it shall go thru governance and approval process.
If Automatic Software updates = OFF and LS_ASUHMI_Manage_Notification = True && LS_OTAM_SW_Update_Notify = Additional, then HMI shall display the software release notes part of notifying the customer that there is a software update available and requires user consent to update the system.

4.3.5.1.25 F-REQ-305254/B-###R_FNC_Veh_HMI_Notif_026### Erase and Replace Software Installation

If the OTA software type is erase and replace, then HMI shall prompt the customer to turn the key on in order to continue with software update.
HMI shall notify the customer that the vehicle inhibited due to software update, and display a warning message that during software update vehicle will not response to key forbs and lock/unlock commands.

4.3.5.1.26 F-REQ-305256/E-###R_FNC_Veh_HMI_Notif_027### Dynamic HMIs

In vehicle HMI shall have OTA software update related dynamic screens and OTA Manager shall trigger the HMI dynamic popups by setting a flag.
For additional consent, SYNC shall download and store HMI text locally.

4.3.5.1.27 F-REQ-305258/B-###R_FNC_Veh_HMI_Notif_028### Set DATA Usage Limited

The vehicle HMI shall allow the user to Set Data Usage Limit and Usage cycle reset data to be use for OTA software updates per month.
Set Data Usage Limit: - allow the user to set MB/GB data can be use per usage cycle.
Usage cycle reset data: - allow the user to set cycle.

4.3.5.1.28 REQ-326785/B-###R_FNC_Veh_HMI_Notif_029### Vehicle Inhibit for Software Activation vs. Vehicle Programming Session

Determine vehicle inhibit type if it’s A/B swap software activation and/or Erase and replace programming session.
Vehicle Inhibit for Programming Session: If LS_OTAM_Activation_TypeSW_AB_ER = (ER or AB_and_ER), then show LS_OTAM_Vehicle_Inhibit_Type = ProgrammingSession. Vehicle is in programming sessions HMI shall display Software Update in Progress as a progress bar.

Vehicle Inhibit for Software Activation: If LS_OTAM_Activation_TypeSW_AB_ER = AB, then show LS_OTAM_Vehicle_Inhibit_Type = ActivatingNow, Vehicle is activating the software.

4.3.5.1.29 F-REQ-305244/C-###R_FNC_Veh_HMI_Notif_030### Software Activation Failed and HMI Notification

If software activation failed due to critical failures LS_OTAM_SW_Activation_Fail_Reason = PERMANENT_INHIBIT, then vehicle shall notify the user that update has failed and required service.
If software activation failed due to partial failures LS_OTAM_SW_Activation_Fail_Reason = PARTIAL, then HMI shall notify the user that vehicle has limited functionality and requires service.
If software activation failed due to partial failures LS_OTAM_SW_Activation_Fail_Reason = warning, then HMI shall notify the user that then vehicle will automatically try to update the software at a later time.

4.3.5.1.30 REQ-326179/C-###R_FNC_Veh_HMI_Notif_031### Software Activation Failed and ASU = OFF or Vehicle Connectivity Settings = OFF

If software activation is failed, then HMI Logic shall make sure prompt the customer for user consent if required.
When LS_OTAM_SW_Activation_Fail_Reason = warning or LS_OTAM_SW_Activation_Fail_Reason = USB_FAILURE
And LS_ASUHMI_ASU_FeatureStatus = disable or LS_ASUHMI_ASU_Consent = false, then HMI shall prompt the customer for vehicle connectivity settings.

When LS_OTAM_SW_Activation_Fail_Reason = warning or LS_OTAM_SW_Activation_Fail_Reason = USB_FAILURE And LS_ASUHMI_ASU_FeatureStatus = disable or LS_ASUHMI_ASU_Consent = True, then HMI shall prompt the customer for user consent.

4.3.5.1.31 REQ-326171/C-###R_FNC_Veh_HMI_Notif_032### Software Activation During AC Charging

If software activation requires a vehicle inhibit LS_OTAM_Activation_Type = INHIBIT, then OTA Manager requests charging system to disable PHEV battery charging to activate the software. HMI logic shall keep track of charging system and software update notifications and priorities to notify the customer when battery charging time and software update schedule time overlays.

4.3.5.1.32 F-REQ-305262/D-###R_FNC_Veh_HMI_Notif_033### Critical Errors during Software Update & Service

Service: -
For Wi-Fi updates and AppLink updates are silent, therefore poses some difficulties for technicians to troubleshoot these errors. The software logic for the updates shall capture each exception and assign an error code to it. This code will be populated into a DID that technicians can look it up. LS_OTAM_SW_Update_Fail_Reason = error code

4.3.5.1.33 F-REQ-305264/C-###R_FNC_Veh_HMI_Notif_034### Reset of Wi-Fi and AppLink Setings

The Reset options shall allow the user to have an ability to reset system settings selectively e.g. Wi-Fi without de-authorizing the Automatic Software updates etc.
Add capability for user to perform reset without going through de-authorization, and also to select and reset the settings.

- Decouples the settings reset and de-authorization process
- Enhances the user's ability to select and reset settings
- User doesn't have to go through authorization process again in case of settings reset e.g. Wi-Fi, Vehicle Connectivity
- Improve user experience

If software update is in progress and downloading software files at a time of customer initiates Reset, then HMI shall notify the customer that continue with reset will impact software update.

4.3.5.1.34 REQ-347583/A-###R_FNC_Veh_HMI_Notif_035### Crash during software update in progress (OTA/USB)

If vehicle is in crash and CAN signal is present, then USB parser/SFTP Transfer shall clear the software update LS_OTAM_HMI_OTAUSB_Clear = ClearHMIs. USB update shall restart from beginning once the CAN signal clears the crash alert.

4.3.5.1.35 REQ-347584/A-###R_FNC_Veh_HMI_Notif_036### eCall during software update in progress (OTA/USB)

If eCall occurs when software is in progress, then system shall pause and resume the software update.
LS_OTAM_SW_Instalation_State = Pause
LS_OTAM_SW_Download_State = Pause
LS_OTAM_SW_Update_State = Pause
LS_USBOTA_SW_Update_Status = Pause

4.3.5.1.36 REQ-326180/C-###R_FNC_Veh_HMI_Notif_037### In Vehicle Date and Time_Formate

HMI logic shall display the software update date and time LS_OTAM_Update_Time = date/time in bytes. Date and time display to the customer shall be depended on the region and/or user selected format, such as if clock format is 24hrs, then software update time and date shall be 24hrs.

4.3.5.1.37 REQ-347585/A-###R_FNC_Veh_HMI_Notif_038### Software File Size and Channel for Update in Release Notes

Release notes shall include file size (some kind of feedback to the customer how long it will take to download the file) and Channel that update is coming thru

4.3.5.1.38 REQ-347586/A-###R_FNC_Veh_HMI_Notif_039### Maximum Time Allow for Software Activation

If software will be going to expire less than 7days, then HMI shall only show days left before the software update will expire {LS_OTAM_UpdateExpiration_Time = date/time}.

4.3.5.1.39 REQ-347587/B-###R_FNC_Veh_HMI_Notif_040## APP Updates that Requires User Consent

If software update requires APP to shut down before continuing with the update, then HMI shall receive a flag from OTAM LS_OTAM_APP_Update_DOWN = App_Name and HMI shall notify the user to get user consent before continuing with software updates. HMI shall continue to display the ICON until software update expires. Once the user consent is received HMI shall notify the OTAM to continuing with the update LS_ASUHMI_APP_DOWN = True.
OTAM Shall provide estimate time that will take to resume the APP after shutting down LS_OTAM_APP_UPDATE_Timer = Minutes.
For Example: map updates could take about {XXXX minutes} to complete: do you want to continue with the update?

4.3.5.1.40 REQ-348141/B-###R_FNC_Veh_HMI_Notif_041## Double Lock During Software Activation

As a safety precaution, double-locked doors will revert to central lock when the software update starts. Digital Owner's Manual shall cover this info.

4.3.5.1.41 REQ-368888/A-###R_FNC_Veh_HMI_Notif_042### During Update if APP is Required to be Shutdown then HMI shall show Transient Message "System Upda

If software is update requires APP to shut down during the update LS_ASUHMI_APP_DOWN = True, then HMI shall show transient message that "system is updating".

4.3.5.1.42 REQ-369536/A-###R_FNC_Veh_HMI_Notif_048### Wi-Fi Connection is Required for OTA Updates

HMI Manager shall receive a notification LS_OTAM_ConenctionType_WiFi = True from OTAM when OTA update requires a Wi-Fi connection, then HMI shall notify the customer to connect to Wi-Fi.

4.3.5.1.43 Error Handling

4.3.5.1.43.1 F-REQ-305204/C-###R_FNC_Veh_HMI_Notif_042### Power Reset

Power reset shall not affect any OTA software settings and values. After a power reset, all the settings shall be re-stored to the values that they were prior to the power reset.

4.3.5.2 Non-Functional Requirements

4.3.5.2.1 F-REQ-305267/C-###R_FNC_Veh_HMI_Notif_043### Icon Design

The status bar icon shall design to be intuitive to the customer so they can understand the difference between a pending activation and a one-time consent

4.3.5.2.2 REQ-344157/A-###R_FNC_Veh_HMI_Notif_044### Display Release Notes

In vehicle HMI shall display the release notes with in 500ms of the software activation complete. Or allow the user to see the release notes when consent is needed.

4.3.5.2.3 REQ-344158/A-###R_FNC_Veh_HMI_Notif_045### Display Release Notes when Vehicle Connectivity Settings is Off

When Vehicle Connectivity is disable vehicle shall continue to display the release notes of last software update complete within 500ms. Release notes shall be stored locally on the vehicle so it can be displayed when vehicle is disconnected from the backend due to connection lost, low connectivity or no connectivity.

4.3.5.2.4 REQ-347388/B-###R_FNC_Veh_HMI_Notif_046### Reference to Owner's Manual

Some of the popups DO NOT cover the details of the software update behavior when asking for user input, for more information HMI shall have link to Owner's Manual.

4.3.5.2.5 REQ-348141/B-###R_FNC_Veh_HMI_Notif_041## Double Lock During Software Activation

As a safety precaution, double-locked doors will revert to central lock when the software update starts. Digital Owner's Manual shall cover this info.

4.3.5.2.6 REQ-347839/B-###R_FNC_Veh_HMI_Notif_047### Do Not Show this Popup Again

For all non-critical notification popup is displayed instead of notification ICON, then HMI shall allow the user to disable the popup by selecting "Do not show this message again".

4.3.5.2.7 REQ-348141/B-###R_FNC_Veh_HMI_Notif_041## Double Lock During Software Activation

As a safety precaution, double-locked doors will revert to central lock when the software update starts. Digital Owner's Manual shall cover this info.

4.4 Logical Function Check for Updates

4.4.1 Function Description

HMI shall allow the customer to "Check for Updates" under Automatic software updates settings. Check for Updates button shall allow the customer to check for App updates and provide one time all level user consent to download the latest apps. In order to use "Check for Updates" option vehicle requires on board modem and/or WiFi connection; if no connection is found prompt the user to connect to WiFi or make sure vehicle has network connection.
When user request for new software then OTA system shall response in timely manner. Check for software updates shall be limited to software delivery that can download and installed in reasonable time.

4.4.2 Function Scope

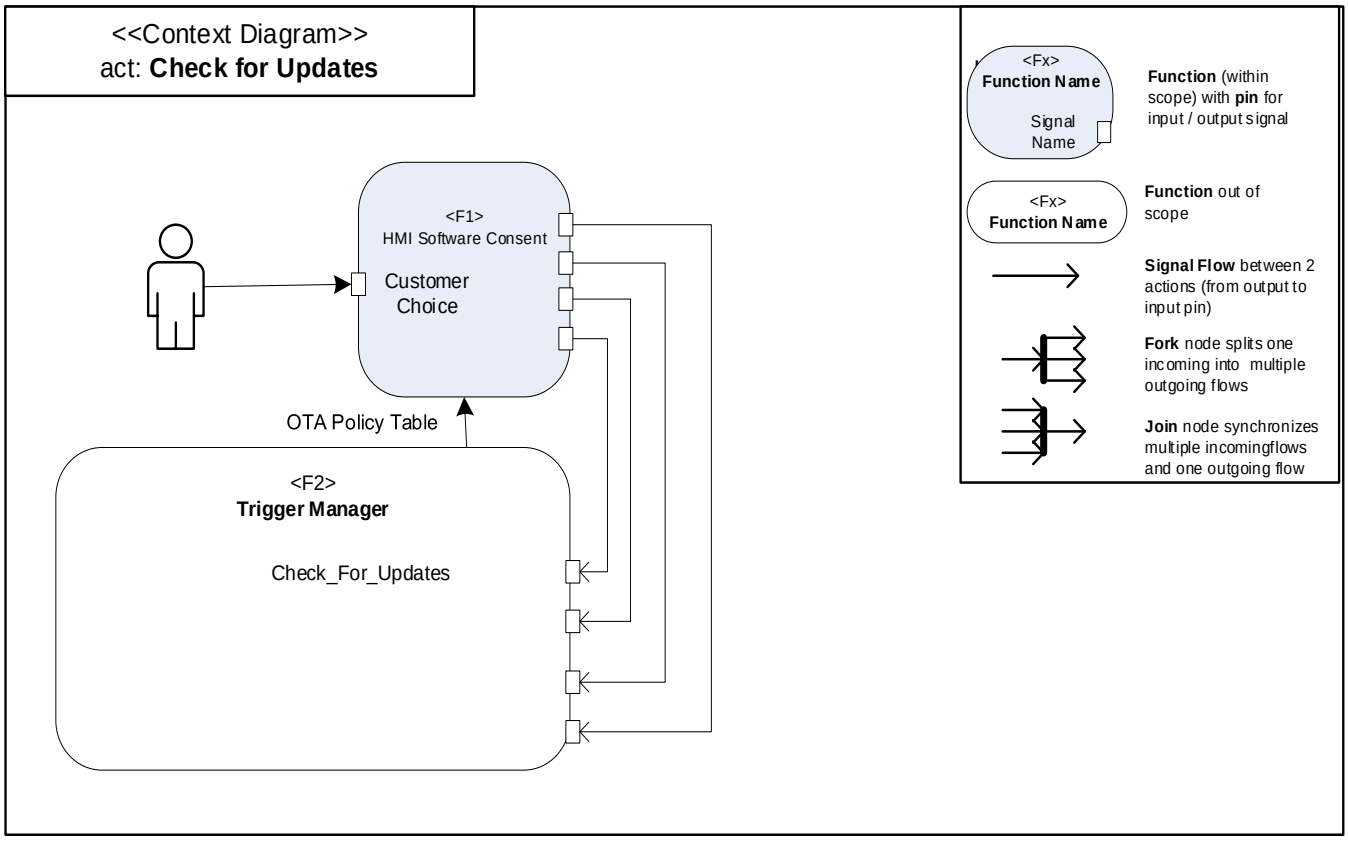


Figure 8: Context Diagram of Function Check for Updates

4.4.3 Function Interfaces

4.4.3.1 Logical Inputs

Signal ID	Signal Name	Description
	CustomerChoice	This is the customer selection of the consent settings that will be shown in the screen

4.4.3.2 Logical Outputs

Signal ID	Signal Name	Description
	Check for updates	HMI button to request application updates

4.4.4 Function Modeling

N/A

4.4.5 Function Requirements

4.4.5.1 Functional Requirements

4.4.5.1.1 REQ-326181/A-###R_FNC_Veh_HMI_CheckUpdates_001### Direct Configuration Update

When customer request to change the direct configuration thru in vehicle HMI, then update shall not require consent. The customer request does not require any additional consent; this shall be treated as one-time consent.

4.4.5.1.2 F-REQ-305268/B-###R_FNC_Veh_HMI_CheckUpdates_002### Application List Display

HMI shall display a list of all the active applications in the vehicle. The application name displayed shall the marketing name of that application.

4.4.5.1.3 F-REQ-305269/B-###R_FNC_Veh_HMI_CheckUpdates_003### Check for Updates

HMI shall be configurable to Check for all applications at the same time or for each application independently.

4.4.5.1.4 F-REQ-305270/B-###R_FNC_Veh_HMI_CheckUpdates_004### User Check for Updates during OTA software APP(s) Update is in Process

Vehicle is updating APP(s) thru OTA and customer “Check for Updates”, then prompt the customer that an OTA update is in progress and try again after sometime LS_OTAM_ECU_App_reside = APP_ECU_Updating.

4.4.5.1.5 F-REQ-305271/B-###R_FNC_Veh_HMI_CheckUpdates_005### User Check for Updates during OTA software Update is in Process (non-APPs)

If OTA software update is in process (non-APPs) and customer "Check for Updates", then vehicle shall check for updates and provide the feedback to the customer with status LS_OTAM_ECU_App_reside = None

4.4.5.1.6 F-REQ-305272/B-###R_FNC_Veh_HMI_CheckUpdates_006### User Check for Updates during OTA software Update is in Process Where APPs Reign

If OTA software is updating APPs ECU and customer "Check for Updates", then HMI notify the customer that that an OTA update is in progress and try again after sometime once the current update is complete LS_OTAM_ECU_App_reside = APP_ECU_Updating.
For Example:

1. SYNC and ECG has apps
2. OTA software Updating SYNC and ECG

4.4.5.1.7 F-REQ-305273/B-###R_FNC_Veh_HMI_CheckUpdates_007### User Check for Updates during USB APP Update is in Process

If USB software update in is progress (downloading/installing/activating) and customer "Check for Updates”, then the HMI shall have a pop up to inform the customer that USB update is in progress LS_USBOTA_SW_Update_Status = updating retry after the USB update is complete.

4.4.5.1.8 F-REQ-305274/B-###R_FNC_Veh_HMI_CheckUpdates_008### User Check for Updates during USB non-APP Update is in Process

If USB software update is paused LS_USBOTA_SW_Update_Status = pause and customer "Check for Updates”, then HMI shall have a popup to inform the customer that USB update is paused due to USB device is unplugged please re-plug LS_PARSERUSB_Conn_Status = USB_unPlug the USB and retry after the USB update is complete.

4.4.5.1.9 F-REQ-305275/B-###R_FNC_Veh_HMI_CheckUpdates_009### User Check for Updates during APPs OTA Activation is pending & ACT Schedule is NOT Set

If OTA software activation is pending LS_USBOTA_SW_Update_Status = pending for activation and an activation schedule is NOT set and customer “Check for Updates”, then the HMI shall notify the customer that software update is in process and waiting to set a schedule time to complete the software update and retry again after the software activation is complete.

- Prompt to set schedule a time to complete the update that is in process

4.4.5.1.10 F-REQ-305276/B-###R_FNC_Veh_HMI_CheckUpdates_010### User Check for Updates during non-APPs OTA Activation is pending & Act Sch is NOT

If OTA non-APP software activation is pending and an activation schedule is NOT set and customer “Check for Updates”, prompt the customer to set an activation schedule before continue with the request and then vehicle shall check for updates and provide the feedback to the customer with status.

4.4.5.1.11 F-REQ-305277/B-###R_FNC_Veh_HMI_CheckUpdates_011### User Check for Updates during APPs OTA Activation is pending and Act Sch is Set

If APPs OTA software activation is pending at a set time and customer “Check for Updates”, then the HMI shall notify the customer that activation is already schedule at set time and you can retry again after the software is complete.

- Show the time and day for pending activation

4.4.5.1.12 F-REQ-305278/B-###R_FNC_Veh_HMI_CheckUpdates_012### User Check for Updates during non-APPs OTA Activation is pending & Act Sch is Set

If non-APPs OTA software activation is pending at a set time and customer “Check for Updates”, then vehicle shall check for updates and provide the feedback to the customer with status.

4.4.5.1.13 F-REQ-305279/B-###R_FNC_Veh_HMI_CheckUpdates_013### Customer Check for Updates when NO APP is enabled

Check for update is only for APPs and requires the APP(s) to be enable before it can update. If customer “Check for Updates” and all APPs are disable, then HMI shall prompt the customer to enable APPs before checking for update.

4.4.5.1.14 F-REQ-305280/B-###R_FNC_Veh_HMI_CheckUpdates_014### Timestamp HMI for Check for OTA Software Updates

HMI shall have timestamp display for OTA software update, which have display the following: -

- When last software activation was complete for both OTA and USB updates.
- Customer check for updates and cloud response back with no updates OTA Manage shall send flag to HMI and HMI shall display this time.

The OTA Manager shall send a timestamp of software activation time or clouds response time with no updates to HMI.
Master Reset shall not affect update and/or change the timestamp display.

4.4.5.1.15 F-REQ-305281/C-###R_FNC_Veh_HMI_CheckUpdates_015### Master Reset when User Check for Update & SW download started but Consent Default is OFF

When software update is in progress with one-time consent and customer indicate Master reset, then HMI shall prompt the customer that software Update will pause if you continue with the Master Reset. LS_OTAM_HMI_Master_Reset = Pause
If the “Check for Update” trigger activity is in the downloading files stage or after, then the OTA _SM shall pause the update If the vehicle is in a region where IVSU default values of ASU is “OFF”.
And if no consent received after, the OTAM shall delete the files and the clear the HMI icon display when the trigger expires.

If the vehicle is in a region where IVSU default values of ASU is “ON” and the trigger does not require another consent (PII consent), then Master reset shall not affect “Check for Update” trigger activities (May pause during the master reset and resume after) and shall continue as dictated in the manifest. (Ref OTAM spec REQ-305522)

4.4.5.1.16 REQ-326182/A-###R_FNC_Veh_HMI_CheckUpdates_016### Master Reset when User Check for Update when SW download has NOT started

When software update is in progress with one-time consent and customer indicate Master reset, then HMI shall prompt the customer that software update will cancel if you continue with the Master Reset. LS_OTAM_HMI_Master_Reset = Cancel

4.4.5.1.17 REQ-326183/A-###R_FNC_Veh_HMI_CheckUpdates_017### Master Reset when User Check for Update & SW download started but Consent Default is ON

Prompt the customer that software update is in progress continue or cancel but customer choose to continue, then update shall resume after the system restart is complete, HMI shall show the progress of the software update.

4.4.5.1.18 Error Handling

4.4.5.2 Non-Functional Requirements

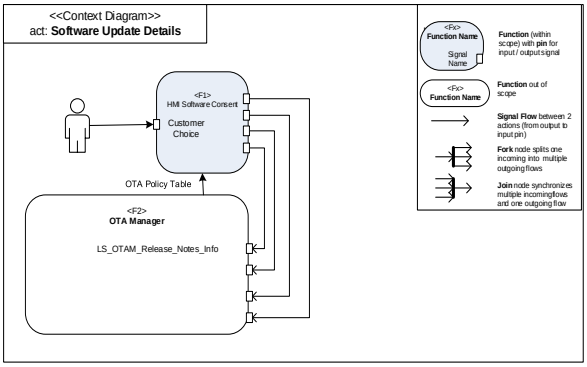
4.4.5.2.1 F-REQ-305282/C-###R_FNC_Veh_HMI_CheckUpdates_018### Progress after a user click Check for Updates

Progress of the search shall be display within 1-2 seconds after the customer has clicked on the Check for Update.

4.5 Logical Function Software Update Details

4.5.1 Function Description

The Ford Backend shall have a text file containing description of release software changes. This text files shall go thru governance and approval process before the software can be deliver thru OTA.
Software releases with improvements and security update shall have detailed description, where as other releases can be brief.
The software release description shall be deliver with the software update. The only exception to this rule is if an update is



completely silent to the customer. The owner website shall have more details and history of the software updates that were push to the vehicle.

4.5.2 Function Scope

Figure 9: Context Diagram of Function Software Update Details

4.5.3 Function Interfaces

4.5.3.1 Logical Inputs

Signal ID	Signal Name	Description
	CustomerChoice	This is the customer selection of the consent settings that will be shown in the screen

4.5.3.2 Logical Outputs

Signal ID	Signal Name	Description
	LS_OTAM_Release_Notes_Info	Software update release notes

4.5.4 Function Modeling

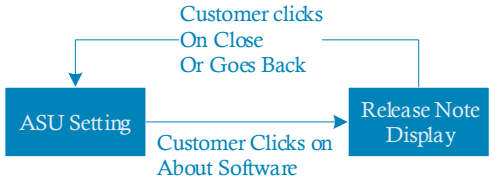


Figure 10: State Machine of Function Software Update Details

4.5.5 Function Requirements

4.5.5.1 Functional Requirements

4.5.5.1.1 F-REQ-305283/C-###R_FNC_Veh_HMI_SW_Details_001### Software Update Details Settings

HMI shall allow to customer to access the software release notes of the last software update. Software releases can also be access thru software update reminders as following:

- Software Update is available: - HMI shall show software release notes with one-time consent reminder.
- Activation is pending: - HMI shall show software release notes with schedule day/time reminder.
- Successful Complete ICON: - click the icon to access software release notes

For steps A and B if the customer fails to consent and/or schedule an activation day/time and HMI receives software expire flag from OTA Manager, then HMI shall revert to the release notes to the previous update.

4.5.5.1.2 F-REQ-305284/D-###R_FNC_Veh_HMI_SW_Details_002### Software Update Details after Successful Update

After each successful OTA software update HMI shall display ICON on the display for customer to access the software release notes, this ICON shall be clickable and stays on the display for configurable time = x ignition before clearing it.
If customer clicks on the ICON HMI shall show popup and clear the ICON.

4.5.5.1.3 F-REQ-305285/B-###R_FNC_Veh_HMI_SW_Details_003### Software Activation is Pending on About Software Updates

If OTA software activation is pending, then Update Details display shall allow the customer to schedule an activation day/time for the software that is pending.

4.5.5.1.4 REQ-326576/B-###R_FNC_Veh_HMI_SW_Details_004### Software Update Date and Time

After each software activation HMI shall display date and time flag LS_OTAM_Update_Time = date/time received from OTA Manager. Master Reset shall not effect date and time.

Date and time display to the customer shall be depended on the region and/or user selected format, such as if clock format is 24hrs, then software update time and date shall be 24hrs.

4.5.5.1.5 REQ-348831/C-###R_FNC_Veh_HMI_SW_Details_005### Software Update is Pending but Waitng for Schedule Time Shall Show on Update Details Display

When software update is pending but waiting for upcoming schedule date/time {OTAM sets this flag LS_OTAM_UpdateReminder_Time}, then HMI shall show a reminder of upcoming schedule date/time from the “Update Details” screen.

4.5.5.1.6 REQ-353220/B-###R_FNC_Veh_HMI_SW_Details_006### If Software Activation Failed, HMI shall Revert Back to Previous Update Details

Software update details is download and displayed prior to software activation and if new software activation failed due to any reason and OTAM sets the flag LS_USBOTA_SW_Update_Status = Failed, then HMI shall revert back to previous release notes and delete the failed software release notes.

4.5.5.1.7 REQ-368886/A-###R_FNC_Veh_HMI_SW_Details_006### Progress Bar when User Clicks the Update Details from ASU Settings

In vehicle HMI shall show the progress bar for X secs (x; 2) every time user clicks the “update details” button under ASU settings.

4.5.5.1.8 Error Handling

4.5.5.1.8.1 F-REQ-305205/C-###R_FNC_Veh_HMI_SW_Details_007### No Blank Display for Software Details

There shall never be a blank display for the customer. If there are no release notes present, then the display shall display a default text such as “Your system is up to date and there is no software available for your system”

4.5.5.2 Non-Functional Requirements

4.5.5.2.1 F-REQ-305288/C-###R_FNC_Veh_HMI_SW_Details_008### Software Update Details Display Time Out

Display screen of release notes should not timeout but have an option to close or go back. Customers can read at different speeds and depending on the length of the release notes, we might have undesired timeouts.

4.6 Logical Function Software Update Progress Bar

4.6.1 Function Description

Software updates thru a USB and/or in vehicle HMI “Check for Updates” option in setting shall provide the customer the ability to monitor the progress of the download, install and activation.
When user initiates OTA software updates thru USB or by in vehicle HMI then the progress bar shall show the software update details.
An OTA update is a silent update; meaning that there shall be no display to the customer in regards to the progress of the download or install.

4.6.2 Function Scope

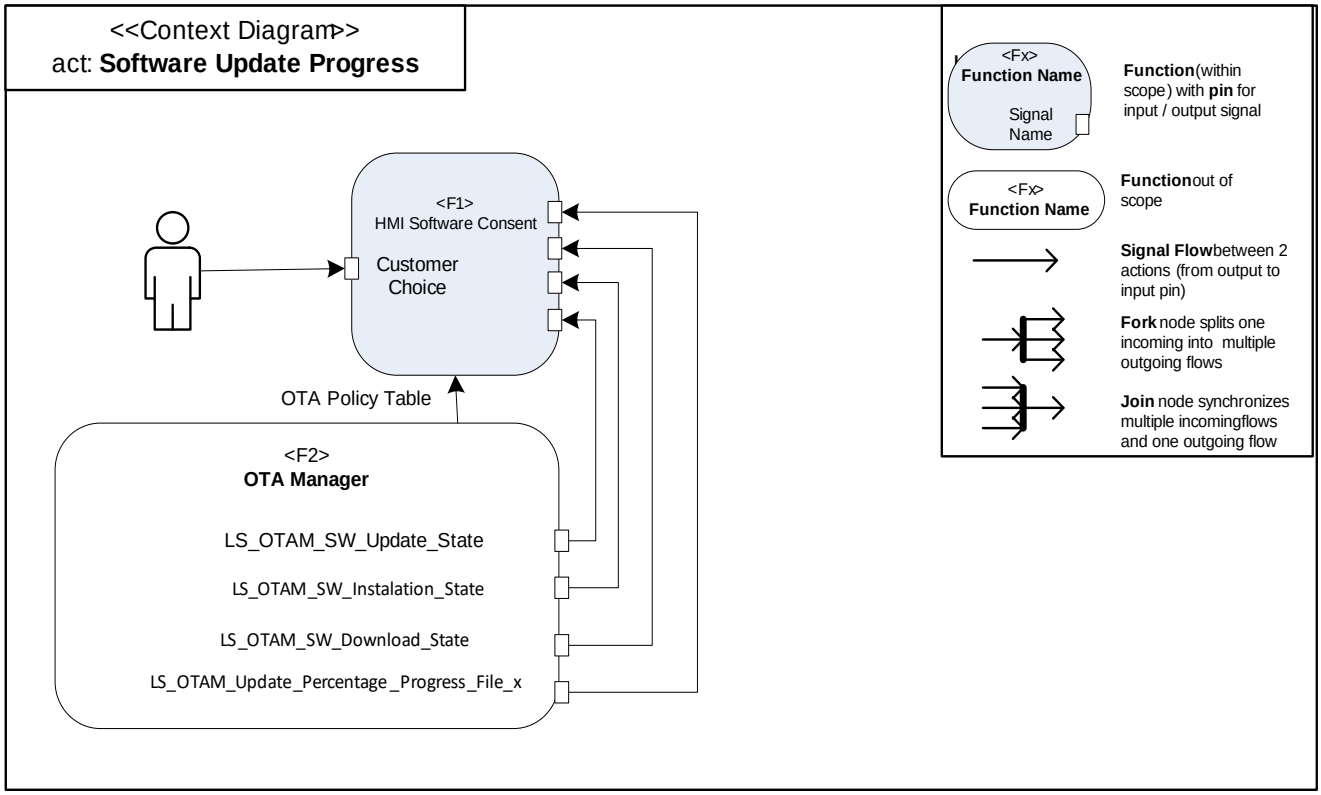


Figure 14: Context Diagram of Function Software Update Progress

4.6.3 Function Interfaces

4.6.3.1 Logical Inputs

Signal ID	Signal Name	Description
	CustomerChoice	This is the customer selection of the consent settings that will be shown in the screen

4.6.3.2 Logical Outputs

Signal ID	Signal Name	Description
	LS_OTAM_SW_Update_State	The activation status of the software update
	LS_OTAM_SW_Instalation_State	The installation status of the software update. During a USB update, the OTA Manager shall provide installation status per each parallel software file that is occurring.
	LS_OTAM_SW_Download_State	The download status of the software update. During a USB update, the OTA Manager shall provide download status per each parallel software file that is occurring.

	LS_OTAM_Update_Percentage_OverallProgress	This signal shall show overall progress of the software update.
	LS_OTAM_OTAUSB_Number_of_Files	This signal shall show total and remaining number of files

4.6.4 Function Modeling

N/A

4.6.5 Function Requirements

4.6.5.1 Functional Requirements

4.6.5.1.1 F-REQ-305289/B-###R_FNC_Veh_HMI_Prog_Bar_001### Progress Bar for USB and Application Updates

When user initiates OTA software updates thru USB or by in vehicle HMI, then the progress bar shall show the software update details.
HMI shall display the number of total files with details of downloading and programming, paused, and pending for activation.
During USB update, system is updating do not unplug the USB until update is complete.
Progress bar shall be capable to have multiple progress as following: -

1. Target ECUs (connected thru Ethernet port): - OTA Manager shall provide the feedback to the HMI with progress of the download and file transfer to target ECUs
2. Client ECU (that has direct connection with USB port): - Client ECU shall provide the feedback to HMI with progress of the OTA software update.
3. OTA Manager shall provide over all progress time estimation of the software update.

4.6.5.1.2 F-REQ-305290/B-###R_FNC_Veh_HMI_Prog_Bar_002### Progress Bar Accuracy

The progress bar accuracy shall be very detailed so that the customer can understand how much data has been downloaded, the status of the installation and how much time is left until the completion of the update.

4.6.5.1.3 F-REQ-305291/B-###R_FNC_Veh_HMI_Prog_Bar_003### Master Reset during Check for Updates in process

If the OTA software is in progress, then warn the customer that software update is in progress before continue with master reset.
If customer chooses to continue with Master reset and software update is downloading, install, and activating
and HMI shall not reset progress bar
if user default consent = on, then continue with software updates after the system restart is complete.
if user default consent = off, then pause the software update and HMI shall show an ICON if Manage notification are ON until software update expires or user input is received.

4.6.5.1.4 F-REQ-305292/B-###R_FNC_Veh_HMI_Prog_Bar_004### Reset Progress Bar

If the USB update is incomplete due to customer unplugged the USB, then prompt the customer to insert USB; the system shall allow 24hrs for the customer to re-plug the same USB but after 7day OTA manager shall clear the software and HMI shall reset the progress bar to default.
When an error occurs during USB update, the progress bar shall reset to default.
If a USB software update interpret current OTA software update, then the HMI progress bar shall reset to reflect the new software update process.

Example: - if OTA update is downloading, Apps for SYNC and user plugged in USB device with SYNC update, then OTA Manager shall clear the OTA update and continue with USB update and reflect the changes in progress bar.

When in progress software is erase by service and/or engineering tools, then the progress bar shall reset.

4.6.5.1.5 F-REQ-305293/B-###R_FNC_Veh_HMI_Prog_Bar_005### Progress Bar for Check for Update is in Process

Under setting, if system is processing previous Check for Updates request and customer again pressed check for updates, then customer shall see the progress bar.

If software update is in process and customer clicks Check for Updates, then it shall take the customer to progress bar.

4.6.5.1.6 F-REQ-305294/B-###R_FNC_Veh_HMI_Prog_Bar_006### Progress Bar during USB update

The HMI team shall design a System Updates ICON when USB update or check for updates is in progress, then customer shall be able to click “system updating” icon to go to progress bar or under settings customer can access the progress bar.

4.6.5.1.7 F-REQ-305295/B-###R_FNC_Veh_HMI_Prog_Bar_007### Progress Bar when System is Checking for Updates

When customer click for Check for Updates then OTA Manager shall provide a feedback within 60 seconds, with details of system is updating, up to date or start downloading.

Updating: 60 seconds in percentage
Up to date: LS_OTAM_SW_Update_State = UP_TO_DATE
Progress of the download
LS_OTAM_Update_Percentage_Progress_APP_x, HMI shall show progress bar of each APP
LS_OTAM_OTAUSB_Number_of_Files = number of file(s), for example 1 of 5
LS_OTAM_Update_Percentage_OverallProgress = Over all percentage

4.6.5.1.8 REQ-326187/A-###R_FNC_Veh_HMI_Prog_Bar_008### Reset Progress Bar when software update Failed

If software update is incomplete or failed and system clear the software update, then system shall reset the HMI progress bar. When Check for updates or USB software update LS_USBOTA_SW_Update_Status = Failed, then HMI shall show failed on progress bar for configurable value = three ignition cycles.

4.6.5.1.9 REQ-326188/A-###R_FNC_Veh_HMI_Prog_Bar_009### Master Reset

During USB software update in progress, HMI shall not reset progress bar LS_OTAM_Update_Percentage_OverallProgress = overall progress && LS_OTAM_OTAUSB_Number_of_Files = show number of files.

4.6.5.1.10 REQ-368885/A-###R_FNC_Veh_HMI_Prog_Bar_010### Progress Bar During OTA Updates

In vehicle HMI shall show OTA update progress and percentage complete when software is activating based on the OTA max inhibit time.
For OTA, 100% = Max Time {LS_OTAM_Activation_Time = Domain: 2 bytes (In seconds)}.
Customer shall NOT be able to access any other screen from the software activation progress bar and after the update is complete, SYNC shall go back to default state.

4.6.5.1.11 REQ-368889/A-###R_FNC_Veh_HMI_Prog_Bar_011### Download and File Trasnfer Progress Bar

During USB update, in vehicle HMI shall show a progress bar that system to transferring the files from USB to sync/ECG and another progress bar to shoe ECG to target ECU.

4.6.5.1.12 Error Handling

4.6.5.1.12.1 F-REQ-305206/B-###R_FNC_Veh_HMI_Prog_Bar_010### Reset while in update in progress is displayed

The HMI screen shall synchronize with the progress of the update from the OTA Manager within 500 ms of the screen powering up. The progress display shall pick up on that state that it was prior to a reset (either power or master reset)

4.6.5.2 Non-Functional Requirements

4.6.5.2.1 F-REQ-305297/B-###R_FNC_Veh_HMI_Prog_Bar_011### Progress Bar Details

The HMI team shall design a progress bar that is always able to display some progress. Even though, it might be difficult to calculate the exact percentage of completion some progress on estimation. The customer should not feel like the progress bar is stuck in a particular task.

4.7 Logical Function Software Failures

4.7.1 Function Description

During software updates via USB the customer shall be notified in details for errors that occur. For software updates via OTA, the customer shall be notified only for failures that occurred after a scheduled activation.

4.7.2 Function Scope

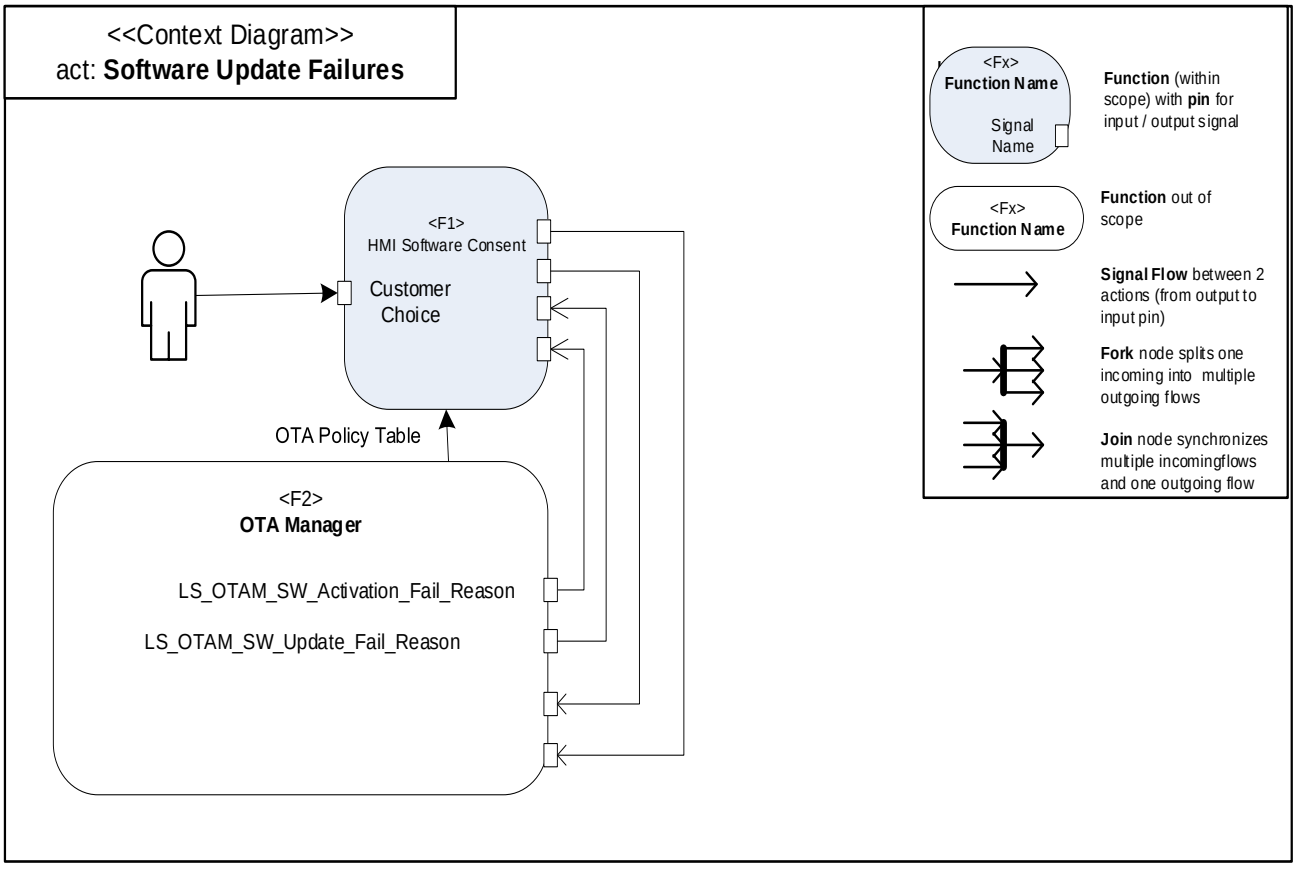


Figure13: Context Diagram of Function Software Update Failures

4.7.3 Function Interfaces

4.7.3.1 Logical Inputs

Signal ID	Signal Name	Description
	CustomerChoice	

4.7.3.2 Logical Outputs

Signal ID	Signal Name	Description

	LS_OTAM_SW_Activation_Fail_Reason	
	LS_OTAM_SW_Update_Fail_Reason	

4.7.4 Function Modeling

N/A

4.7.5 Function Requirements

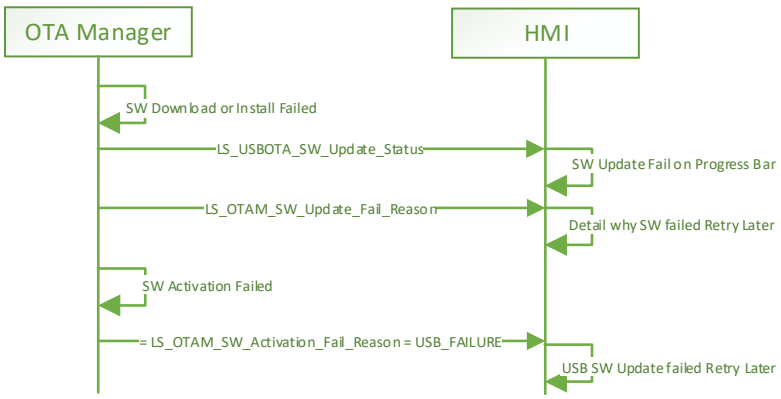
4.7.5.1 Functional Requirements

4.7.5.1.1 F-REQ-305298/B-###R_FNC_Veh_HMI_SW_Failure_001### Error Code for Failure

The OTA Manager shall provide a unique Error Code for each failure LS_OTAM_SW_Update_Fail_Reason = Error Code. The software logic for the updates shall capture each exception and assign an error code to it. This code will be populated into a DID that technicians can look it up

4.7.5.1.2 F-REQ-305299/C-###R_FNC_Veh_HMI_SW_Failure_002### Software Failure Notification

The customer shall have a unique notification based on the error that occurred.
If LS_OTAM_SW_Activation_Fail_Reason = PERMANENT_INHIBIT then, the vehicle cannot be started anymore. The notification shall announce to the customer that the failed update is the cause for this failure.
If LS_OTAM_SW_Activation_Fail_Reason = WARNING; then the customer shall be notified that the update will be automatically retried by Ford Motor Company.
If LS_OTAM_SW_Activation_Fail_Reason = PARTIAL; then the customer shall be notified that vehicle has limited functionality and requires service.
If LS_OTAM_SW_Activation_Fail_Reason = USB_FAILURE; the customer shall be notified of the error code and the brief description along with it.
If LS_USBOTA_SW_Update_Status = Failed, then notify the customer software download or installation failed



Flow 12: Software Update Failed

4.7.5.1.3 REQ-330195/A-###R_FNC_Veh_HMI_SW_Failure_003### When software download failed

If customer initiate software update with “update” button and software update download or install failed LS_OTAM_SW_Download_State = Failed && LS_OTAM_SW_Instalation_State = Failed, then HMI shall show transient message and if customer click on the transient message the HMI shall have popup to notify the customer with reason why update failed, such as “vehicle is operable normally and it shall retry the update at later time, no action is required from the user.”

4.7.5.1.4 Error Handling

4.7.5.2 Non-Functional Requirements

4.7.5.2.1 F-REQ-305300/B-###R_FNC_Veh_HMI_SW_Failure_004### HMI Failure

If the vehicle HMI fails to display any of the required messages/pop ups/settings than the errors should be logged in the status logger and send to the cloud for evaluation.

4.7.5.2.2 F-REQ-305301/B-###R_FNC_Veh_HMI_SW_Failure_005### USB Progress after a Check for Update

The HMI shall immediately (within 100 ms) display progress for the USB update even if it is currently displaying progress for the check for update.
After the USB update is complete, it shall synchronize with OTA Manager to immediately display any progress for the previous 'Check for Update' task.

4.8 Logical Function USB Software Updates

4.8.1 Function Description

For USB software update progress, in vehicle HMI shall provide detailed step by step feedback to the customer, unless the manifest file explicitly disables notifications. HMI shall provide status update with percentage of the download, install, activation, and errors occur during the USB update.
When the vehicle detects an USB with OTA software, then HMI shall provide feedback that OTA USB is detect with valid OTA software packages. If USB is disconnecting during software copying (transfer the software file from USB or writing to USB), then HMI shall prompt the customer to reconnect the USB to proceed with the software update.
USB Function spec have more details about USB Update.

4.8.2 Function Scope

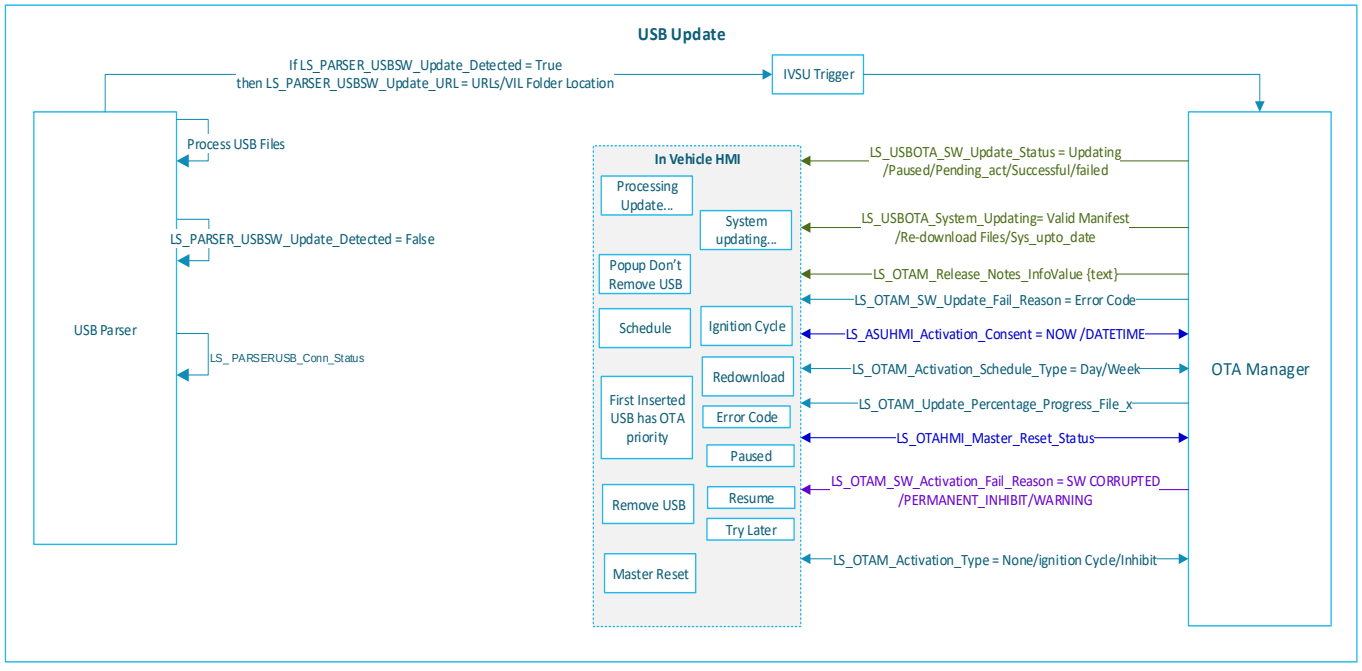


Figure14: Context Diagram of Function USB Software Update

4.8.3 Function Interfaces

4.8.3.1 Logical Inputs

Signal ID	Signal Name	Description
	LS_USBOTA_System_Updating	Valid Manifest– Invalid Manifest Files Re-Download Files – same manifest file which was updated late time System update to date – Valid manifest
	LS_USBOTA_SW_Update_Status	USB software update status
	LS_OTAM_Activation_Type	Activation Type: - No Ignition Cycle Ignition Cycle Inhibit
	LS_OTAM_Release_Notes_InfoValue	Software Release Notes
	LS_ASUHMI_Activation_Consent	NOW DATETIME
	LS_OTAM_SW_Update_Fail_Reason	Error Code
	LS_OTAM_SW_Activation_Fail_Reason	Software activation failed reasons
	LS_OTAM_Update_Percentage_OverallProgress	Overall software update progress
	LS_OTAM_OTAUSB_Number_of_Files	This signal shall show total and remaining number of files.
	LS_OTAM_Activation_Schedule_Type	Day or Week
	LS_OTAM_Activation_Time	Progress of activation
	LS_OTAM_HMI_OTAUSB_Clear	USB update is paused and USB configuration time expire or OTA Manager abort the update, then set this signal to clear progress bar and other USB related HMIs.

4.8.3.2 Logical Outputs

Signal ID	Signal Name	Description
	LS_ PARSERUSB_Conn_Status	Maintain USB connection status (plugged, unplugged, and re-plugged (same or different) USB device.
	LS_PARSER_USBSW_Update_Detected	The USB Parser shall notify the Event trigger with files types and location of software files and VIL folder. USB parser shall provide an initial flag to HMI when validating the USB for OTA software updates. True/URLs/VIL upload location (VIL Folder creation or default location)
	LS_OTAHMI_Master_Reset_Status	Master Reset or No Master Reset

4.8.4 Function Modeling

N/A

4.8.5 Function Requirements

4.8.5.1 Functional Requirements

4.8.5.1.1 FUR-REQ-326801/A-###R_FNC_Veh_HMI_USB_SW _001### USB Parser Validating Software Exist on USB device and HMI Notification

After detecting USB device with software updates, USB parser shall notify in vehicle HMI shall provide initial feedback such as transient message “Processing Update...”, LS_PARSER_USBSW_Update_Detected = True.

4.8.5.1.2 REQ-326788/A-###R_FNC_Veh_HMI_USB_SW _002### Invalidating Software Updates and HMI Notification

If software update is invalid and OTA manager set flag LS_USBOTA_System_Updating = Re-download Files, then HMI shall prompt the user shall try again after re-downloading the latest software files from consumer website.
If software update is same as previously update though OTA/USB and OTA manager set flag LS_USBOTA_System_Updating = Sys_to_update_date, then HMI shall prompt the user “System is up to date and try later with latest files from consumer website.

4.8.5.1.3 REQ-326789/A-###R_FNC_Veh_HMI_USB_SW _003### Software Update is in Progress and Lost USB Connection

During USB software update if update status LS_USBOTA_SW_Update_Status = Paused and USB device status is PARSERUSB_Conn_Status = USB_Unplug, then prompt the user that to insert USB device to continue with software update.

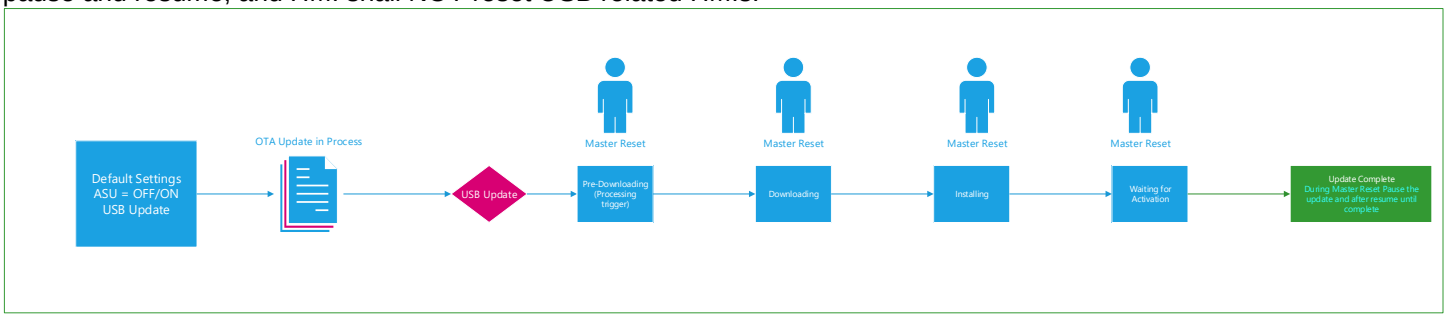
4.8.5.1.4 REQ-329660/A-###R_FNC_Veh_HMI_USB_SW _004### Download Software Files Keep USB Plugged in until Update is Complete

When OTA Manager finds LS_USBOTA_System_Updating = Valid Manifest && LS_USBOTA_SW_Update_Status = Updating, then HMI shall display “keep USB plugged in until software update is complete”.

4.8.5.1.5 REQ-329661/A-###R_FNC_Veh_HMI_USB_SW _005### During USB software Update or Check for Software is in progress HMI shall show System Updating

4.8.5.1.6 F-REQ-305314/B-###R_FNC_Veh_HMI_USB_SW _006### Master Reset During USB Update

If the USB software update is in progress and customer initiate Master reset, then HMI shall prompt the customer that software update is in progress, do you want to continue or cancel. If customer choose to continue, then software update shall pause and resume, and HMI shall NOT reset USB related HMIs.



Flow 13: Master Reset during USB Update

4.8.5.1.7 F-REQ-305306/B-###R_FNC_Veh_HMI_USB_SW _007### Errors during USB Software Update

If any errors occur during USB software update, then OTA Manager shall set a flag for HMI to indicate error code LS_OTAM_SW_Update_Fail_Reason = Error Code. Each error code shall have a brief string that can display on the HMI for the action that the customer can take action.

4.8.5.1.8 FUR-REQ-326791/A-###R_FNC_Veh_HMI_USB_SW _008### USB Software Files Are Corrupted

If any of the software file(s) are corrupted, then OTA Manager shall set flag LS_OTAM_SW_Activation_Fail_Reason = SW CORRUPTED; and HMI shall prompt the customer to re-download the software files and retry.

4.8.5.1.9 REQ-326192/A-###R_FNC_Veh_HMI_USB_SW _009### Software Activation with Vehicle Inhibit

OTA Manager shall set a flag for HMI with software type and HMI shall use these flags to determine type of inputs needed from the customer.
If LS_OTAM_Activation_TypeSW_AB_ER = AB, then software is A/B swap
If LS_OTAM_Activation_TypeSW_AB_ER = ER, then software is erase and replace
If LS_OTAM_Activation_TypeSW_AB_ER = AB and ER, then software update is coordinated with A/B swap and erase and replace.

4.8.5.1.10 F-REQ-305307/B-###R_FNC_Veh_HMI_USB_SW _010### Software Activation with Ignition Cycle

When USB software update is ready for activation, then OTA Manager shall require an ignition cycle LS_OTAM_Activation_Type = IGNITIONCYCLE, HMI shall prompt the user to activate the software by preforming an ignition cycle or automatically restart the system.

4.8.5.1.11 F-REQ-305308/B-###R_FNC_Veh_HMI_USB_SW _011### HMI during USB Update in Progress

USB software activation does NOT require ignition cycle, prompt the user that software update is complete.
LS_OTAM_Activation_Type = NONE

4.8.5.1.12 REQ-329624/A-###R_FNC_Veh_HMI_USB_SW _012### USB Software Activation with Vehicle Inhibit

USB software update is ready for activation are requires vehicle inhibit LS_OTAM_Activation_Type = INHIBIT && LS_USBOTA_SW_Update_Status = PENDING_Activation, then HMI shall prompt the user to activate the software by selected NOW or schedule for later. (Reference USB_Fun_Spec F-REQ-304782)
- If customer choose schedule for later, then HMI shall show schedule options.
- If reoccurring schedule is set, then show the date/time and allow the user to change it.
- If one-time schedule is required then prompt the user to set one-time schedule.

4.8.5.1.13 F-REQ-305309/B-###R_FNC_Veh_HMI_USB_SW _013### USB Software Activation with Vehicle Inhibit

4.8.5.1.14 F-REQ-~~305309~~ 326802/A-###R_FNC_Vehicle_HMI_097### USB Software Update for Self Install ECU

Self-install ECU shall report the progress to OTA Manager and HMI shall receive software update progress from the OTA Manager LS_OTAM_Update_Percentage_OverallProgress = Overall
LS_OTAM_OTAUSB_Number_of_Files = remaining out of total.

4.8.5.1.15 F-REQ-305310/B-###R_FNC_Veh_HMI_USB_SW _014### USB Update for same ECU that is currently being updating through OTA and files are 100% DW

USB Update for the same ECU that is currently being updated through OTA and software package is 100% downloaded and installation is in process, then OTA Manager shall set a flag for HMI to prompt the user that OTA installation is in progress and wait until software update is complete and try again. LS_OTAM_SW_Instalation_State = IN_PROGRESS

4.8.5.1.16 REQ-326193/A-###R_FNC_Veh_HMI_USB_SW _015### HMI During Vehicle is programming session or Software is Activation

HMI shall determine if vehicle is in programming mode or vehicle inhibit is active
- If LS_OTAM_Vehicle_Inhibit_Type = ProgrammingSession, vehicle is in programming session
- If LS_OTAM_Vehicle_Inhibit_Type = ActivatingNOW, then vehicle is activating the software

4.8.5.1.17 F-REQ-305311/B-###R_FNC_Veh_HMI_USB_SW _016### USB Update for Same ECU that is Pending for Software Activation

The customer inserts an USB device with OTA software updates to update the same ECU that is pending for activation LS_USBOTA_SW_Update_Status = Pending_Activation.
If schedule is set for activation, then HMI shall show popup schedule time and day. If schedule is NOT set for activation, then HMI shall prompt the customer to set a time to complete the update.
For Example: -

ECG is wait for set schedule – download installation is already done
Use has USB with ECG updates
Prompt the user that activation the pending software before continuing.

4.8.5.1.18 F-REQ-305312/B-###R_FNC_Veh_HMI_USB_SW _017### Multiple USB Device Found with Software Update

If USB update is LS_USBOTA_SW_Update_Status = paused and user insert same USB, then software update shall resume.
If USB update is LS_USBOTA_SW_Update_Status = paused and user insert different USB, then HMI shall reset the HMI LS_OTAM_HMI_OTAUSB_Clear = ClearHMIs and continue with update.

If more than one USB devices are inserted with software update, then USB parser shall start updating with first USB

4.8.5.1.19 F-REQ-305313/B-###R_FNC_Veh_HMI_USB_SW _018### USB Software Activation is Pending

If USB update is paused LS_USBOTA_SW_Update_Status = paused for a configured time = 7days
LS_OTAM_HMI_OTAUSB_Clear = ConfigtimeExpire, then system shall abort the update and
LS_OTAM_HMI_OTAUSB_Clear = ClearHMIs HMI shall reset.

4.8.5.1.20 FUR-REQ-326798/A-###R_FNC_Veh_HMI_USB_SW _019### USB Software Activation is Pending

If user try to do USB update while previous USB software is pending for activation LS_USBOTA_SW_Update_Status = PENDING_Activation, then in vehicle HMI shall prompt the user to “Complete the pending software before continuing with another software update”.
Prompt can be specific depending on type of activation:

If software activation requires vehicle INHIBIT and schedule was set, then HMI logic shall show upcoming schedule and allow the user to update NOW or change the schedule.
OR
If software activation requires vehicle INHIBIT and schedule was Not set, then HMI logic shall prompt the user to update NOW or set a schedule day/time.
OR
If software activation requires an ignition cycle, then prompt the user to do ignition cycle.

4.8.5.1.21 FUR-REQ-326799/A-###R_FNC_Veh_HMI_USB_SW _020### USB Update triggered while target ECU is in installation

If there is a USB trigger for an ECU and that ECU is in the installation process
LS_OTAM_SW_Installation_State= In_Progress, then the HMI shall display a message to the customer to retry after the current OTA installation is completed.

4.8.5.1.22 REQ-368887/A-###R_FNC_Veh_HMI_USB_SW _020### Update is Not Successful Notification

In vehicle HMI shall receive a flag from OTAM that update is not successful, then HMI shall continue ICON until the issue exists.

(1) Service is done on the vehicle
(2) Vehicle received and successfully installed the OTA updates to fix the existing failure.

4.8.5.1.23 Error Handling

4.8.5.2 Non-Functional Requirements

5 HMI Functions

5.1 HMI Function in Vehicle HMI

5.1.1 Function Description

The function specification will cover in OTA related Vehicle HMI flows, default values.

5.1.2 Function Requirements

5.1.2.1 Functional Requirements on HMI

5.1.2.1.1 REQ-326786/A-###R_FNC_Vehicle_HMI_001### Type of messaging ICON vs. Transient Message

HMI shall notify the customer with user required action for software update and these messages can be done thru ICON and/or transient messages.
This documents reference as an ICON but HMI shall make sure software update has highest priority in messaging other can use transient message instead.

5.1.2.1.2 REQ-326787/A-###R_FNC_Vehicle_HMI_002### Hide unchangeable HMI options

In Vehicle HMI shall hide all the OTA related HMIs that are unchangeable.

5.1.2.1.3 F-REQ-305315/B-###R_FNC_Vehicle_HMI_003### Setting Layer Depth

The ASU Setting should be on the first layer of settings for easy access to the consumer.

5.1.2.1.4 REQ-329380/A-###R_FNC_Vehicle_HMI_004### Extend Display

Software activation shall override the extended display when customer selects NOW options

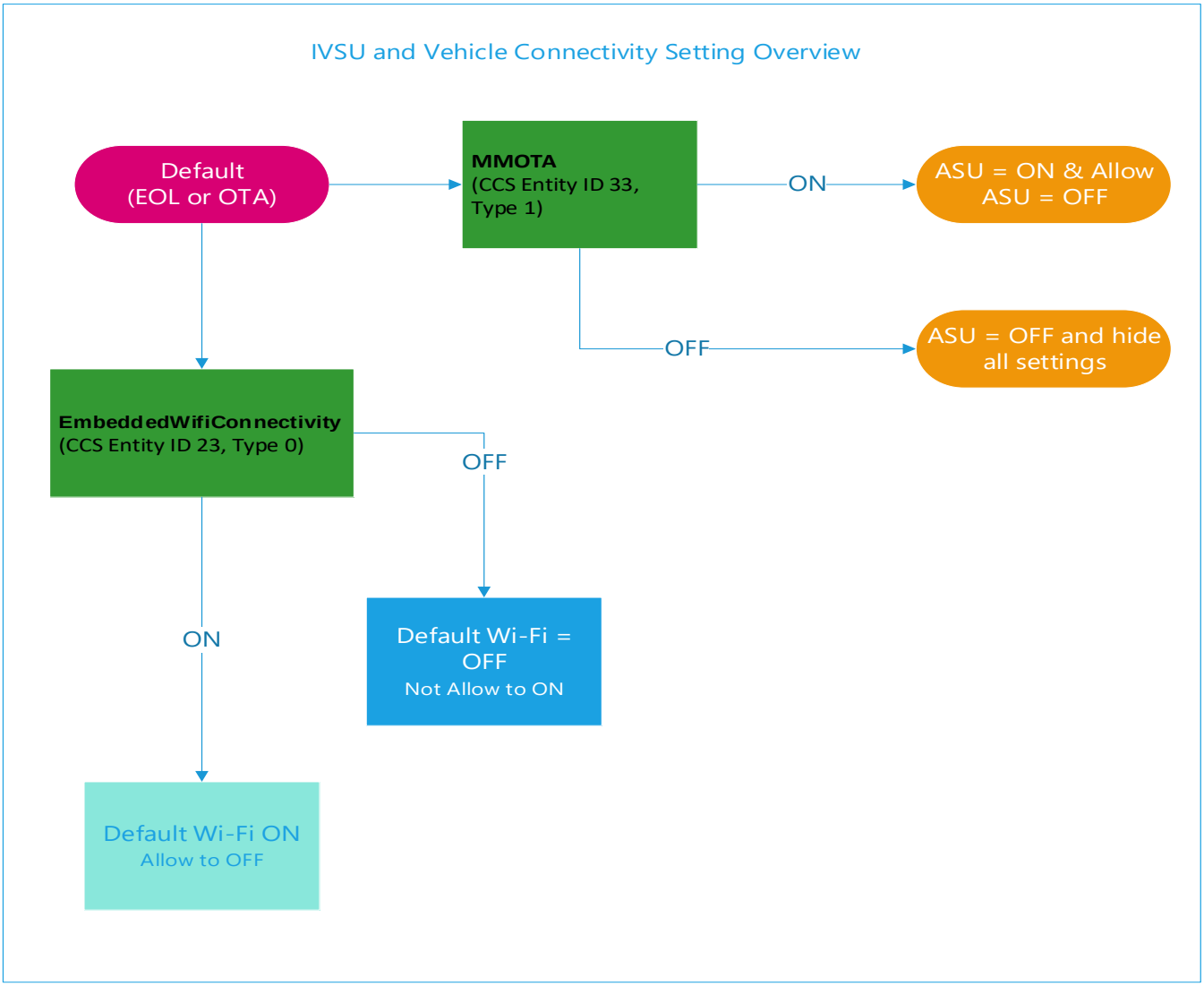
5.1.2.1.5 ###R_FNC_Vehicle_HMI_005### Automatic Software Updates Setting

5.1.2.1.6 F-REQ-305207/B-###R_FNC_Vehicle_HMI_006### Automatic Software Updates Setting

The automatic software update setting should be on the first layer of settings for easy access to the consumer.

5.1.2.1.7 F-REQ-305208/C-###R_FNC_Vehicle_HMI_007### Legal Consent

HMI shall have a cohesive flow with Vehicle Connectivity Setting and ASU so that the consumer does not get confused on what is providing consent for per region/country.



Flow 14: Vehicle Connectivity and ASU Settings

5.1.2.2 Other Requirements

5.1.2.2.1 F-REQ-305318/B-###R_FNC_Vehicle_HMI_008### Privacy Mode

Privacy Mode shall disconnect all connection types (AppLink, Wi-Fi, Modem etc.). If vehicle losses connection due to privacy mode and required software files are 100% downloaded, the software update shall continue until complete.

5.1.3 Function Scope

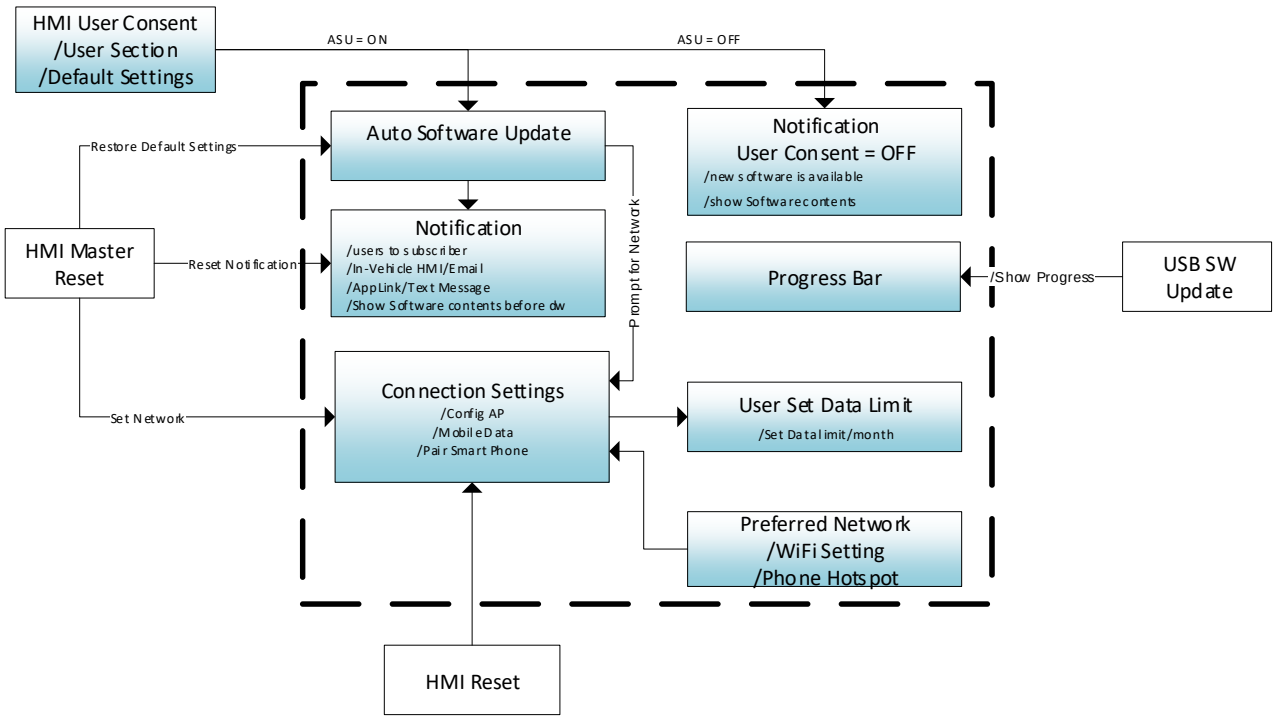


Figure 10: Overall In vehicle HMI

5.1.4 Function Modeling

5.1.5 OTA Software Update Requirements

5.1.6 Function Requirements

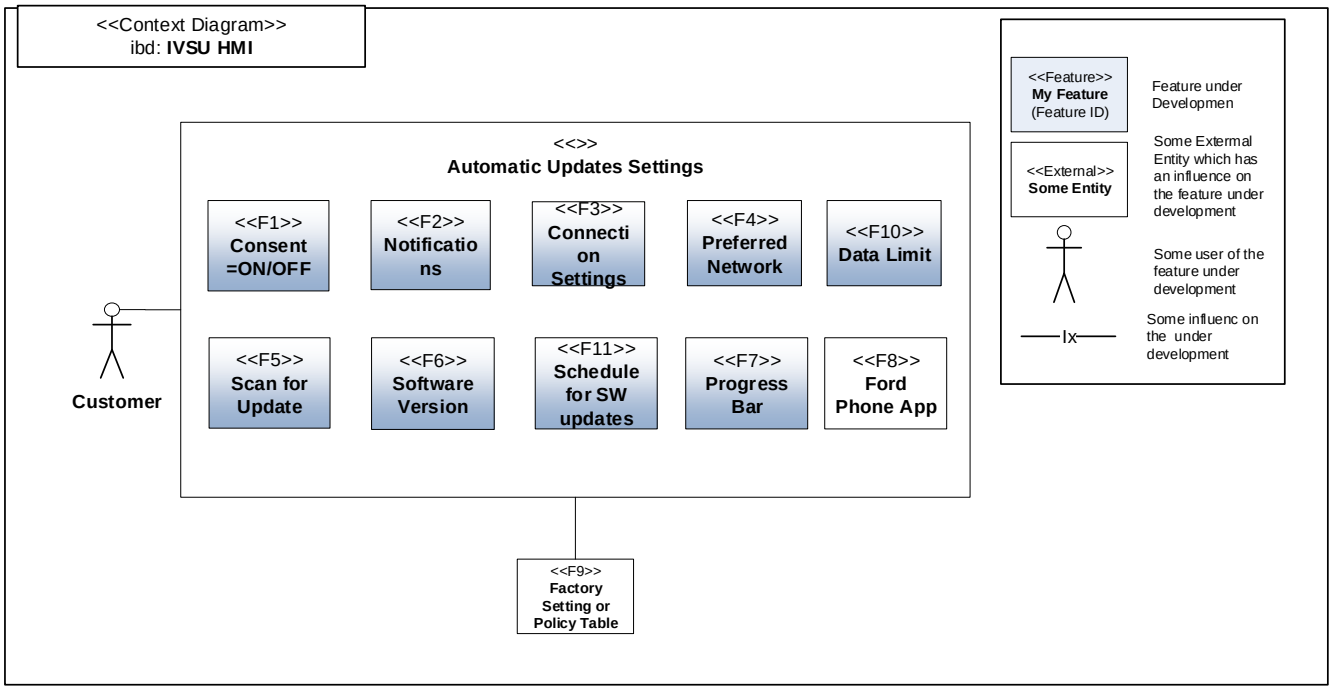
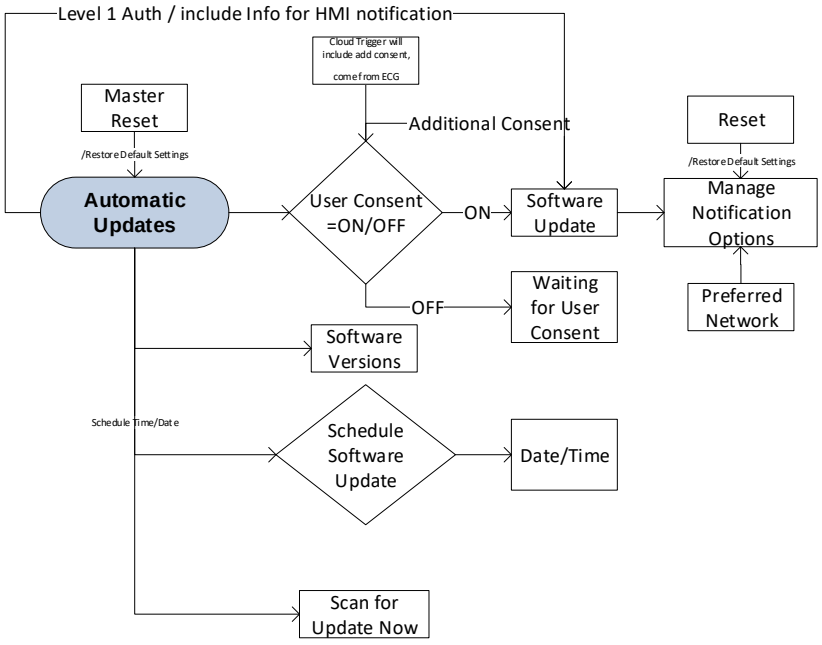


Figure 11: IVSU HMI

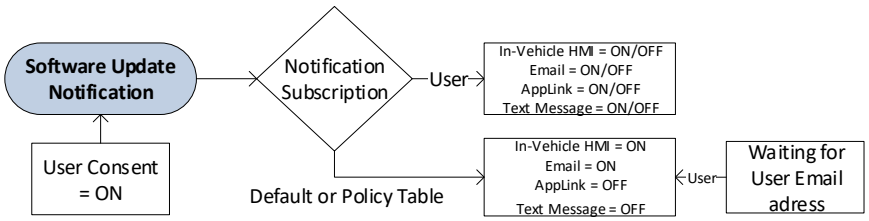
5.1.6.1 Requirements on HMI Views

5.1.6.1.1 Automatic Updates for Software



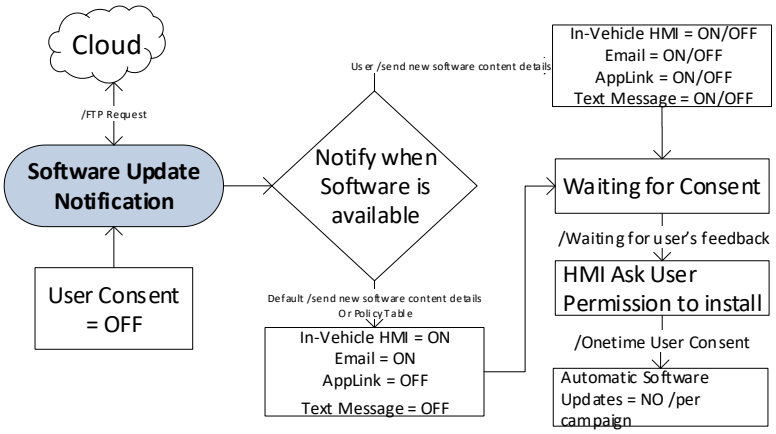
Flow 15: IVSU Prompts

5.1.6.1.2 Notifications Subscription when User Consent = ON



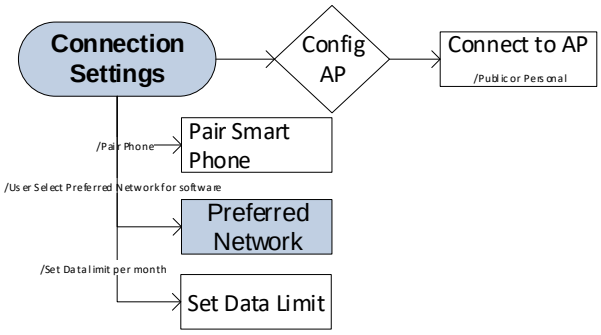
Flow 16: User Consent = ON

5.1.6.1.3 Notifications Subscription when User Consent = OFF



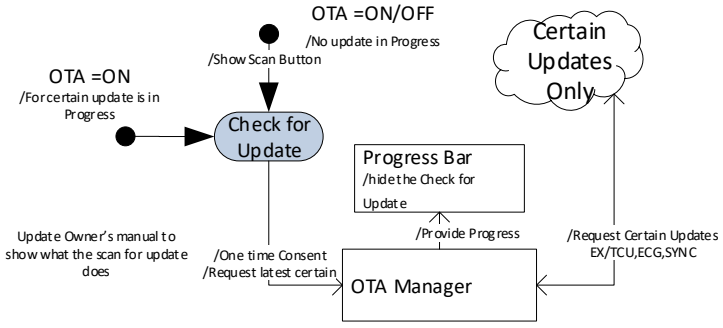
Flow: 17: User Consent = OFF

5.1.6.1.4 Connection Preferred Network Settings



Flow 18: Connection Settings

5.1.6.1.5 Check Updates

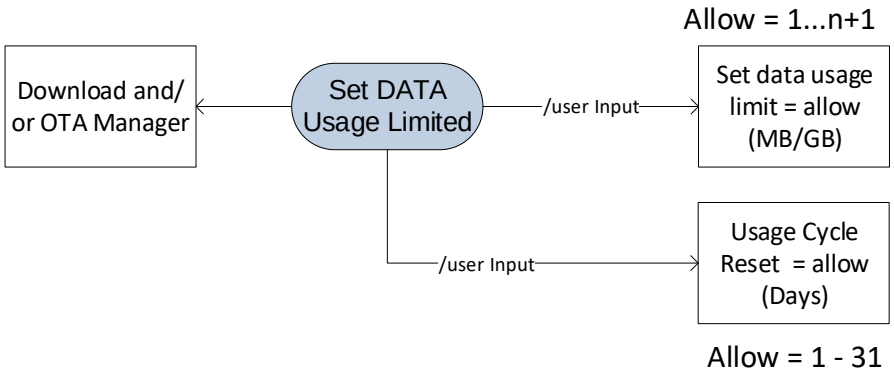


Flow 19: Check for Updates

5.1.6.1.6 Software Version

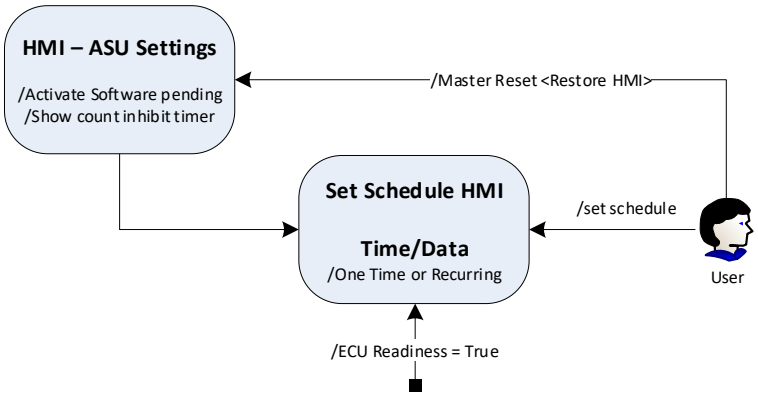
Flow 20: Software Version

5.1.6.1.7 Set DATA Usage Limited



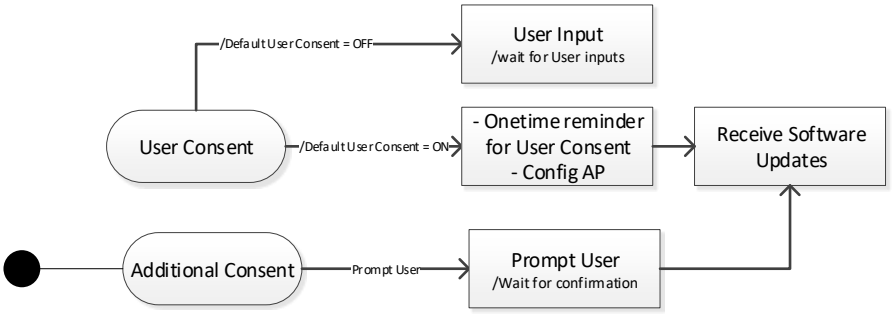
Flow 21: Set Data Limit

5.1.6.1.8 Update Schedule



Flow 22: Set Schedule

5.1.6.1.9 Manage Software Update Notification Options



Flow 23: User Consent Prompts

5.1.7 Non-Functional Requirements

5.1.7.1 REQ-352126/A-###R_FNC_Vehicle_HMI_009### User Input Shall be Captured by Designed Buttons

HMI shall not dismiss the popup while user is touching the screen anywhere outside the borders of the popup. Popup shall capture the desired input from the user before dismissing the popup or allow the user to back out of the display.

6 Open Concerns

ID	Concern Description	e-Tracker / Reference	Responsible	Status	Solution
1	Check for updates			Post Job1	
2	Preferred network			Post Job1	
3	Set Data limit			Post Job1	
4	PII Consent			Post Job1	
5	Update Now			Post Job1	
6	One-time Schedule			Post Job1	
7					
8					
9					

Table 2: Open Concerns

7 Revision History

Rev. (revision)	Date	Description	Responsible
1.0	*3/15/18*	*Initial version*	*BGill51*
1.9.9	*8/31/18*	*Erase and Replace*	*BGill51*
		PHEV Battery charging during software activation	
		Added logical signals inputs and outputs from HMI	
		Type of messaging ICON vs. Transient Message	
		Extend Display	
		Software Activation Failed and HMI Notification	
		Master Reset – if type of consent is lost then HMI shall ask for same type of consent again	
		Added details how HMI logic shall make decisions	
		Clarification for eCall and Crash	
		HMI shall display date and time after activation is complete	
		Separate some of the requirements to clarify the signals	
		Add warning of key fobs and door unlock/lock won't work during E/R	
		Reschedule prompt shall be clear when to display 24hrs or 7days	
		ASU can be enable/disable thru HMI	
		Vehicle connectivity settings are tried with ASU – OTA Manager, HMI, and CCS shall have interface	
		Inhibit types Programming Session vs software activation *Added flows to clarify*	
		Triggers during update in progress	
		FMC owned vehicle – no HMIs needed schedule comes from the cloud	
		OTA manager can share with HMI and allow to change it	
2.0	*10/12/18*	*Updated section 8.1.1*	*BGILL51*
		LS_ASUHMI_ASU_ScheduleTime *LS_OTAM_Update_Time* *LS_OTAM_HMI_Master_Reset* *LS_OTAM_Activation_Status* *LS_OTAM_SW_Exceeded_Limit* *LS_OTAM_SW_Update_Notify*	
		Added Popup for Consent and Schedule reminder, additional to ICON *REQ-331790 One-Time Consent Reminder*	
2.1	*12/03/18*	*Updated based on HMI team feedback: F-REQ-331790/B, F-REQ-305214/C, F-REQ-305216/C, REQ-326157/B, REQ-326784/B, REQ-331788/B, F-REQ-305225/C, REQ-329658/B, REQ-326171/B, F-REQ-305262/C, F-REQ-305264/B, REQ-326180/B, REQ-326576/B* *Removed F-REQ-305260/B,* *Added New Requirements FUR-REQ-336400/A & FUR-REQ-336401/A*	
3.0	*3/12/19*	Updated the education display REQ-305248	
	3/19/19	*Updated* REQ-*527060,* REQ-*305221*, REQ-305217, REQ-305218, REQ-305230, REQ-326157, REQ-346981, REQ-305222, REQ-305225, REQ-305224, REQ-347587, REQ-347387, REQ-347388, and 527295 Added three new signals	

		LS_OTAM_APP_Update_DOWN LS_OTAM_APP_UPDATE_Timer LS_ASUHMI_APP_DOWN *Added SVS REQ*-347783	
3.1	*4/9/2019*	Added a signal for unknown preconditions	
3.7	*5/6/2019*	Show reminder button on Release notes display Disable Recurring Schedule: clear the set date/time Stolen Vehicle Service is Active Stolen Vehicle Service is De-Active APP Updates that Requires User Consent	
3.8	*10/21/2019*	Added clarification Manage notifications, HMI shall not show any HMI when manage notification is disabled. Added clarification if software update is in progress and customer disable ASU than software update behavior. Removed the yellow highlights Added clarification about system update progress bar	

8 Appendix

8.1 Data Dictionary

8.1.1 Logical Signals

fLogical Signal Name	Value	OUTPUT	Description
LS_OTAM_Update_Percentage_Progress_APP_x	Value {percentage}	OTA	Check for Update progress
LS_ASUHMI_ASU_ReoccuringSchedule	Value{ 01 - FALSE; 02 - TRUE}	HMI	Input to OTA Manager

LS_ASUHMI_ASU_CheckUpdate	Value{
	01 - True
	02 - False
	}
		HMI	One time consent

LS_OTAM_TriggerExpiration_Time	Values{
	01 - Not_expired
	02 - Expire
	}
		OTA	Software update expired clear all HMIs

LS_OTAM_UpdateReminder_Time	Values{
	date/time
	}
		OTA	SW Activation Reminder and timer from the manifest
			Input from user or cloud

LS_OTAM_UpdateExpiration_Time	Value { date/time }	OTA	Max time shown in the schedule screen, if expire time is 3days from now then HMI shall only show 3days to activation the software because 4th day SW is not available.
LS_ASUHMI_Manage_Notification	Value{TRUE, FALSE}	HMI	

LS_ASUHMI_ASU_FeatureStatus	Values{
	01 - Enable
	02 - Disable
	}
		HMI/OTA	HMI Automatic software updates enable or disable
			OTA After Master reset or OTA default values change

LS_ASUHMI_ASU_Consent	Value{TRUE, FALSE}	HMI	Vehicle Connectivity settings True or False
LS_OTAM_SW_Update_Postpone	Value{TRUE, FALSE}	OTA	

LS_OTAM_SW_Update_Notify	Value {
	01 - PII_UPDATE;
	02 – Additional
	03 – One-Time
	}
		OTA	HMI to display for consent

LS_OTAM_ECU_App_reside	Value {
	01 -
	APP_ECU_Updating
	}
		OTA	Customer check for update when App ECU is updating then HMI shall prompt the customer try later

LS_ASUHMI_ASU_Additional_Consent	Value{
	00 - Additional;
	01 - ONE_TIME;
	02 - PII_UPDATE;
	}
		HMI	OTA: One time skip additional but may need PII

fLogical Signal Name	Value	OUTPUT	Description

LS_ASUHMI_ASU_ScheduleTime	Values{
	00 – Null
	01 – Bytes - date/time
	}
		HMI	Signal identify scheduled time/day for activation. Comes from the user

LS_OTAM_Update_Time	Values{
	00 – None
	01 – Bytes - date/time
	}
		OTA	OTA manager Last SW update time and date. Update HMI after every activation

LS_OTAHMI_Master_Reset_Status	Value{
	00 - NONE
	01 - MasterReset
	02 - NoMasterReset
	}
		HMI	HMI shall notify OTA Manager for Master Reset

LS_ PARSERUSB_Conn_Status	Values{
	01 - USB_Plug
	02 - USB_unPlug (download)
	}
		HMI	USB device status

LS_PARSER_USBSW_Update_Detected	Values{
	01 - False
	02 - True
	}
		HMI	True: Processing Update…transient message

LS_PARSER_USBSW_Update_URL	Values {
	URLs/VIL Folder Location
	}
		HMI	if LS_PARSER_USBSW_Update_Detected = true, then Set IVSU trigger with content

LS_USBOTA_System_Updating	Values{
	01 - Older_Software
	02 - Valid Manifest
	03 - Redownload Files
	04 - Sys_to_update_date
	}
		OTA	Determine if USB device is with valid software

LS_USBOTA_SW_Update_Status	Values{
	01 - Updating (Downloading/Installing/ Resumed)
	02 - Failed
	03 - PENDING_Activation,
	04 - SUCCESSFUL,
	05 - Paused
	}
		OTA	If updating (download/install) failed then use "Failed" for USB Software update Status

LS_ASUHMI_Activation_Consent	Value{
	00 - UNDEFINED
	01 - NOW;
	02 - DATETIME;
	}
		HMI	One time schedule and NOW

LS_OTAM_Update_Percentage_Overall Progress	Value {percentage}	OTA	OTA/USB overall progress bar
LS_OTAM_OTAUSB_Number_of_Files	Value { 01 - file remaining	OTA	Total number of files in the manifest

fLogical Signal Name	Value	OUTPUT	Description
	02 - total files }		

LS_OTAM_Activation_Schedule_Type	Value {
	01 - WEEKLY;
	02 - DAY;
	}
		HMI	Schedule weekly or daily share with OTA Manager

LS_OTAM_SW_Activation_Fail_Reason	Values{
	00_ NONE
	01 - SW CORRUPTED;
	02 - PERMANENT_INHIBIT;
	03 - USB_FAILURE;
	04 - WARNING;
	05 - PARTIAL
	}
		OTA	IF USB software activation failed then Use "USB_Failure"

LS_OTAM_SW_Update_Fail_Reason	{ErrorCode; }	OTA	USB Software update failed reason
LS_OTAM_Release_Notes_Info	Value {text}	OTA	Release Notes

LS_OTAM_Activation_TypeSW_AB_ER	Value{
	01- AB
	02- ER
	03 - AB and ER
	}
		OTA	OTA Manage sharing type of software update

LS_OTAM_Activation_Type	Value{
	01- NOIGNITIONCYCLE
	02- IGNITIONCYCLE
	03- INHIBIT
	}
		OTA	Activation Type

LS_OTAM_Vehicle_Inhibit_Type	Value{
	00 - NONE
	01 - ProgrammingSession
	02 - ActivatingNOW
	}
		OTA	Vehicle in Programming Mode or activating the software
			HMI Logic shall make decision
			if LS_OTAM_Activation_TypeSW_AB_ER = AB-ER
			then show LS_OTAM_Vehicle_Inhibit_Type = ProgrammingSession
			
			if LS_OTAM_Activation_TypeSW_AB_ER = AB
			then show LS_OTAM_Vehicle_Inhibit_Type = ActivatingNow
			
			if LS_OTAM_Activation_TypeSW_AB_ER = ER
			then show

fLogical Signal Name	Value	OUTPUT	Description
			LS_OTAM_Vehicle_Inhibit_Type = ProgrammingSession
LS_OTAM_Activation_Time	Domain: 2 bytes (In seconds).	OTA	Activation for both E/R and/or AB Time range (2min to Xmins)

LS_OTAM_HMI_OTAUSB_Clear	Values{
	01 - Pending
	02 - ConfigtimeExpire
	03 - ClearHMIs
	}
		OTA	USB update is paused and OTA Manager shall clear cache after 7days

LS_OTAM_SW_Installation_State	Values{
	01 - IN_PROGRESS
	02 - PENDING,
	03 - FAILED,
	04 - PAUSED,
	05 - SUCCESSFUL
	}
		OTA	Software installation in progress

LS_OTAM_SW_Download_State	Values{
	01 - IN_PROGRESS,
	02 - PENDING,
	03 - PAUSED,
	04 - FAILED,
	05 - SUCCESSFUL
	}
		OTA	Software download in progress

LS_OTAM_SW_Update_State	Values{
	00 - Clear_HMI
	01 - IN_PROGRESS
	02 - Pending,
	03 - FAILED,
	04 - SUCCESSFUL;
	05 - UP_TO_DATE;
	}
		OTA	OTA Software update Status

LS_OTAM_No_ProgSession_Preconditions_Supported	$D04F (Ref GMRDB for DID bit mapping)	OTA	If software activation is postponed then set a flag for HMI and next action

LS_OTAM_HMI_Master_Reset	Values{
	01 - Cancel
	02 - Pending,
	03 - Pause,
	}
			1. ASU = OFF Cancel the pre-download for only one-time
			2. ASU = ON Pending for consent, with additional consent
			3. ASU = ON Pause during master reset and resume after it's complete without additional consent

LS_OTAM_Activation_Status	Values{
	01 - Expired
	02 - Pending,
	03 - Pause,
	}
		OTA	Software Activation status

LS_OTAM_APP_Update_DOWN	Value{ 01 – App_Name}	OTA	APP name, such as Navigation
LS_OTAM_APP_UPDATE_Timer	Value{	OTA	APP shut down time

fLogical Signal Name	Value	OUTPUT	Description
	Minutes}		
LS_ASUHMI_APP_DOWN	Value { 00- False 01-True}	HMI	APP Shut down Consent
LS_SVS_OTAM_Active	Value{ 00 - True 01 - False}	OTA	Stolen vehicle service
LS_OTAM_ConenctionType_WiFi	Value{ 00 - True 01 - False}	OTA	

8.1.2 Vehicle Connectivity Settings Data Reference

CCS Entity MMOTA – Entity ID 33, Type 1
CCS Entity VehicleConnectivity – Entity ID 1, Type 0
CCS Entity LocationSharing – Entity ID 4, Type 0
CCS Entity EmbeddedWifiConnectivity – Entity ID 23, Type 0
CCS Entity CellularConnectivity – Entity ID 24, Type 0