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**Content**

[1 Document Overview 4](#_Toc90462442)

[1.1 Purpose & Scope 4](#_Toc90462443)

[1.2 Requirement Types 4](#_Toc90462444)

[1.3 Document Conventions 4](#_Toc90462445)

[1.4 Related Documents 5](#_Toc90462446)

[2 Revision History 6](#_Toc90462447)

[3 Service Overview 9](#_Toc90462448)

[3.1 Stakeholders 9](#_Toc90462449)

[3.2 Potential Use Cases 10](#_Toc90462450)

[3.3 Abbreviations and Definitions 10](#_Toc90462451)

[4 Architecture/Context Diagrams 12](#_Toc90462452)

[4.1 Mobile Device Viewer Example 13](#_Toc90462453)

[4.2 Integrated Security Camera Example 14](#_Toc90462454)

[4.3 Multicasting 15](#_Toc90462455)

[4.4 Architecture Concepts 15](#_Toc90462456)

[4.5 Constraints and Assumptions 16](#_Toc90462457)

[4.5.1 For Controlling ECUs that are AUTOSAR Classic Compliant 16](#_Toc90462458)

[4.5.2 For Controlling ECUs that are Non-AUTOSAR (QNX, or Linux) 17](#_Toc90462459)

[5 Requirements 18](#_Toc90462460)

[5.1 Functional Requirements 18](#_Toc90462461)

[5.1.1 FUR-REQ-403607/C-Publish Camera View Statuses 18](#_Toc90462462)

[5.1.2 FUR-REQ-403608/C-Disable Publish of Camera View Statuses 18](#_Toc90462463)

[5.1.3 FUR-REQ-418779/A-Publish Stream Statuses 18](#_Toc90462464)

[5.1.4 F-REQ-418780/A-Disable Publishing of Stream Statuses 19](#_Toc90462465)

[5.1.5 FUR-REQ-403729/C-Start Stream 19](#_Toc90462466)

[5.1.6 FUR-REQ-409914/B-Change Config While Streaming 19](#_Toc90462467)

[5.1.7 FUR-REQ-403735/C-Stop Stream 20](#_Toc90462468)

[5.1.8 FUR-REQ-409424/C-Live and Buffered Video 20](#_Toc90462469)

[5.1.9 F-REQ-425837/A-Use Default config, if requested is not supported 20](#_Toc90462470)

[5.1.10 F-REQ-470541/A-Communicate Ignition States Supported 20](#_Toc90462471)

[5.2 Non-Functional Requirements 21](#_Toc90462472)

[5.2.1 NFN-REQ-410415/A-Common Interfaces across ECUs 21](#_Toc90462473)

[5.2.2 NFN-REQ-410180/B-Transport Protocol 21](#_Toc90462474)

[5.2.3 NFN-REQ-410181/A-Codec - Video Compression Technology 21](#_Toc90462475)

[5.2.4 NFN-REQ-411358/B-Video Container / Format 22](#_Toc90462476)

[5.2.5 NFN-REQ-415990/A-Video Stream Frames & Embedded Parameter Sets 22](#_Toc90462477)

[5.2.6 NFP-REQ-409283/A-Response Time - Network Ready 22](#_Toc90462478)

[5.2.7 NFN-REQ-409284/A-Availability - LifeCycle 22](#_Toc90462479)

[5.2.8 NFN-REQ-409324/B-Availability - Ignition State 22](#_Toc90462480)

[5.2.9 NFN-REQ-409286/A-Availability - Wakeup 23](#_Toc90462481)

[5.2.10 NFN-REQ-409328/B-Availability - Low Power Mode 23](#_Toc90462482)

[5.2.11 NFN-REQ-409285/A-Software Updates 23](#_Toc90462483)

[5.2.12 NFN-REQ-409287/A-Security 23](#_Toc90462484)

[5.2.13 NFN-REQ-409288/B-Service Version Control 24](#_Toc90462485)

[5.2.14 NFN-REQ-411411/A-Backward Compatibility & Tolerant Reader 24](#_Toc90462486)

[5.2.15 NFN-REQ-413501/A-Errors During Streaming 25](#_Toc90462487)

[5.2.16 NFN-REQ-413588/A-Stream to One of Several Possible Multicast Ports 25](#_Toc90462488)

[5.2.17 NFN-REQ-470543/A-Optional Direct Stream to Cloud 26](#_Toc90462489)

[5.2.18 REQ-416918/A-Do Not Persist Streaming Status 26](#_Toc90462490)

[5.2.19 NFN-REQ-470539/A-Use Of On Demand Broadcast for Requests 26](#_Toc90462491)

[5.3 Future Requirements 27](#_Toc90462492)

[5.3.1 Registration of Camera Service (host & views) 27](#_Toc90462493)

[5.3.2 Support Multiplexing & MPEG2-TS 27](#_Toc90462494)

[5.3.3 Secured Transport protocol 28](#_Toc90462495)

[5.3.4 QOS Management (RTCP?) 28](#_Toc90462496)

[5.3.5 Provide Camera Controller Capability Info 28](#_Toc90462497)

[6 Interface Contracts 29](#_Toc90462498)

[6.1 Service Data Enumerations 29](#_Toc90462499)

[6.1.1 IR-REQ-422102/B-CamSrv\_<host>CameraView 29](#_Toc90462500)

[6.1.1.1 IR-REQ-403738/G-CamSrv\_AdasCameraView 29](#_Toc90462501)

[6.1.1.2 IR-REQ-422105/A-CamSrv\_ArCameraView 32](#_Toc90462502)

[6.1.1.3 IR-REQ-464357/A-CamSrv\_DxpCameraView 33](#_Toc90462503)

[6.1.1.4 IR-REQ-470269/A-CamSrv\_PdcCameraView 33](#_Toc90462504)

[6.1.2 IR-REQ-403743/D-CamSrv\_CameraViewStatus 34](#_Toc90462505)

[6.1.3 IR-REQ-418781/B-CamSrv\_StreamStatus 34](#_Toc90462506)

[6.1.4 IR-REQ-403739/F-CamSrv\_Resolution 34](#_Toc90462507)

[6.1.5 IR-REQ-403740/C-CamSrv\_FrameRate 35](#_Toc90462508)

[6.1.6 IR-REQ-403741/C-CamSrv\_BitRate 35](#_Toc90462509)

[6.1.7 IR-REQ-403742/D-CamSrv\_BroadcastRequest 35](#_Toc90462510)

[6.1.8 IR-REQ-403744/D-CamSrv\_RequestStatus 36](#_Toc90462511)

[6.1.9 IR-REQ-411344/F-CamSrv\_StartProcessStatus 36](#_Toc90462512)

[6.1.10 IR-REQ-435178/B-CamSrv\_StopProcessStatus 37](#_Toc90462513)

[6.1.11 IR-REQ-435179/B-CamSrv\_ChangeProcessStatus 37](#_Toc90462514)

[6.1.12 IR-REQ-409332/B-CamSrv\_PowerMode 38](#_Toc90462515)

[6.1.13 IR-REQ-411345/B-CamSrv\_PowerStatus 38](#_Toc90462516)

[6.1.14 IR-REQ-470542/A-CamSrv\_IgnitionStates 38](#_Toc90462517)

[6.2 Provided Interface Contracts 39](#_Toc90462518)

[6.2.1 IR-REQ-411859/D-CamSrv<host>CameraViewStatus 39](#_Toc90462519)

[6.2.1.1 IR-REQ-410732/E-CamSrvAdasCameraViewStatus 40](#_Toc90462520)

[6.2.1.2 IR-REQ-417486/C-CamSrvArCameraViewStatus 44](#_Toc90462521)

[6.2.1.3 IR-REQ-464377/A-CamSrvDxpCameraViewStatus 46](#_Toc90462522)

[6.2.1.4 IR-REQ-470270/A-CamSrvPdcCameraViewStatus 47](#_Toc90462523)

[6.2.2 IR-REQ-409234/F-CamSrvHostStartVideoStream 48](#_Toc90462524)

[6.2.3 IR-REQ-409235/E-CamSrvHostStopVideoStream 50](#_Toc90462525)

[6.2.4 IR-REQ-409916/E-CamSrvHostChangeViewConfig 51](#_Toc90462526)

[6.2.5 IR-REQ-418782/B-CamSrvHostVideoStreamStatuses 52](#_Toc90462527)

[6.2.6 IR-REQ-409331/D-CamSrvHostLowPowerMode 53](#_Toc90462528)

[6.2.6.1 IR-REQ-419702/C-CamSrvAdasLowPowerMode 54](#_Toc90462529)

[7 Service Behavioral Diagrams 56](#_Toc90462530)

[7.1 Mobile Device Viewer Sequence Diagram 56](#_Toc90462531)

[7.2 Integrated Security Cameras Sequence Diagram 56](#_Toc90462532)

[8 GPB Files (GitHub Links) 58](#_Toc90462533)

**List of Figures**

No table of figures entries found.

**List of Tables**

No table of figures entries found.

# Document Overview

## Purpose & Scope

Platform Vehicle Control Services are software modules designed according Service Oriented Architecture (SOA) design principles. They provide consumer focused features with highly re-usable interfaces which allow the feature to interact with common vehicle resources such as doors, windows, lights, or cameras.

These interfaces abstract the feature from underlying technological implementations and changes over time, allowing the feature to work across vehicle programs and model years.

The purpose of this document is to define a specific Platform Vehicle Control Service, including its intent, context, high level architecture, and requirements, such that the document can be provided to a software development team who will then design and code the software service.

## Requirement Types

Several types of requirements are defined within this document, as described below.

|  |  |
| --- | --- |
| Requirement Type | Description |
| Functional Requirements | Requirements that directly impact consumer expectations of successful delivery. They provide the functionality that is expected by various consumers. |
| Non-Functional Requirements | Requirements that indirectly impact consumer expectations of successful delivery. They are items like performance, availability, and security that are not directly requested by the consumer yet will contribute to their perceived satisfaction with the product. |
| Interface Requirements | Requirements that help define interfaces between software modules and ECUs, including definitions for the constructs below. |
| Data Enumerations | Lists of values for interface parameters that are limited to a predetermined set of values, or enumerated list. |
| Data Structures | Definitions of data structures that are used within interfaces. |
| Provided Contracts | Interfaces that the Service will provide to consuming feature software. |
| Required Contracts | Interfaces that the Service will need, or use, in order to deliver desired functionality. |

## Document Conventions

This document is generated out of the Vehicle Software and Electrical Management System (VSEM).

The document sub-sections which define requirements will have a heading that contains the following information;

* + VSEM Object Type
  + Unique Object ID
  + Revision Level of the object

This heading will look something like;

FUR-REQ-403606/A

Which breaks down in the following Manner:

* ***FUR-REQ:*** Is the VSEM Object Type and identifies it as a Requirement (REQ) and may further describe the requirement sub-type where FUR is a Functional Requirement Object, and NFN is a non-functional requirement.
* ***404053:***is the Unique Object ID
* ***/A:***is the Revision Level of the object*.*

## Related Documents

Below is a list of documents that should be consulted in addition to this functional specification.

**Sources**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item Name** | **Number** | **Document Location** | **Owner** |
| Integrated Security Cameras (ISC) | F005770 | VSEM | Gupta, Ishan (igupta1) |
| CameraManagerService | 754753 | VSEM | Morris, Melissa (mmorr183) |
| Mobile Device Viewer for Vehicle Cameras (MDVVC) | F002812 | VSEM | Moreno Bautista, Ariana (amorenob) |
| Police Data Track Recorder (PTDR) | F004510 | VSEM | Ayala gonzalez, Hugo (hayalago) |
| Enhanced Dash Camera (EDC) | F003751 | VSEM | Eteer, Malik (meteer) |
| Sentinel | F003417 | VSEM | Gupta, Ishan (igupta1) |

**Other References**

|  |  |  |  |
| --- | --- | --- | --- |
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# Revision History

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Object** | **Rev** | **Rev Description** | **Release Status** | **Date Modified** | **Modified By** |
| ENG-754814/A-CameraService+ | A |  | Frozen | 27-Apr-2020 09:54 | Karkare, Medha (mkarkare) |
| ENG-754814/B-CameraService+ | B | Revisions for AUTOSAR SOA CDD Compliance, and API Versioning | Released | 18-Nov-2020 11:19 | Morris, Melissa (mmorr183) |
| ENG-754814/C-CameraService+ | C | Rev C Updates for Resolutions and availble views, per Venkat Karramreddy. | Released | 07-Dec-2020 17:15 | Morris, Melissa (mmorr183) |
| ENG-754814/D-CameraService+ | D | ADAS Signal Alignment  - Rename Update int. is for active stream  - Remove config from status broadcasts, combine into one  - Divide AccessVideoStream into Start, Change, & Stop  - Add Low Power Interface  - Update Diagrams  - Requirement updts | Released | 29-Mar-2021 11:29 | Morris, Melissa (mmorr183) |
| ENG-754814/E-CameraService+ | E | - Multicasting  - Add Stream Status API  - Errors & Retries  - Low Power Mode clarify  - Camera View Statuses clarified  - Remove buffering param & clarify  - Disable is the default  - Change from API to Software Versions  - ISC & AR Module Views | Released | 21-May-2021 13:42 | Morris, Melissa (mmorr183) |
| ENG-754814/F-CameraService+ | F | - Move Invalid\_Command from Request Response to Processing Status  - View Status is On Change  - Correct Topic names  - New View list from ADAS  - Prefixes for uniqueness in AUTOSAR  - Camera Views by Module, <host> prefix  - Add VPSM to Diagrams | Released | 15-Jun-2021 14:59 | Morris, Melissa (mmorr183) |
| ENG-754814/G-CameraService+ | G | - Add Requirement to stream at default config, if requested resolution, framerate, bitrate not supported  - Add FUTURE Requirement regarding need for a registration interface.  - update behavorial diagram, remove duplicate power vote. | Released | 28-Jun-2021 16:22 | Morris, Melissa (mmorr183) |
| ENG-754814/H-CameraService+ | H | - Remove Stream\_ID from Start, Stop, and Change request messages.  - Enum Values for CamSrvBroadcast Request updated to align to ADAV values and GPB  - Enum for Processing Status is updated to align to ADAS Values and GPB | Released | 26-Jul-2021 14:13 | Morris, Melissa (mmorr183) |
| ENG-754814/I-CameraService+ | I | - Update Resolution Enum to protect existing ADAS Values not used by Camera Solution  - ADAS View "OFF" to "NONE"  - Separate ProcessingStatus enum into lists for each request. ADAS is not using a common list, Values do not align. | Released | 12-Aug-2021 14:23 | Morris, Melissa (mmorr183) |
| ENG-754814/J-CameraService+ | J | - Update enum values to ensure uniqueness across the whole CameraService Package. Last update for ADAS, created violations when building as group.  - Remove all underscores from message names in GPBs. Causes error in Davinci Config. | Released | 31-Aug-2021 14:34 | Morris, Melissa (mmorr183) |
| ENG-754814/K-CameraService | K | - Add new views for ADAS DAT222 release, DXP/SDM, and SYNC/Phoenix  - Clarifications on OnDemand interfaces  - Sentinel video buffering timing  - add parameter for Ignition States supported by hosts  - add direct to cloud streaming option | Released | 10-Dec-2021 17:04 | Morris, Melissa (mmorr183) |

# Service Overview

The Camera Service is a portion of an overall in vehicle camera solution that enables many user experience Features to access in vehicle cameras and stream video over Ethernet for a variety of purposes.

Each ECU that is in direct control of vehicle cameras will implement their own version of a Camera Service to expose views from its cameras for streaming over Ethernet.

Each Camera Service will provide common interfaces and associated logic that will allow in-vehicle software to;

* Determine the cameras and views available from the various ECUs within a specific vehicle.
* Determine the current status of those views
* Start a video stream over ethernet from the camera to various feature software modules on other ECUs.
* Change the current configuration for a specific camera view while streaming
* Stop the video stream

The various Camera Services are all managed by the parent Camera Manager Service, which acts as a camera view catalog and abstraction layer to all the software features that will require video streams. Please see the architecture section of this document for more information on the overall camera solution.

## Stakeholders

Below is a list of individuals who are either impacted by or have influence over the content within this specification.

|  |  |  |
| --- | --- | --- |
| **Name** | **CDS ID** | **Role / Responsibility** |
| Dhawan, Pradeep (P.K.) | pdhawan | ADAS D&R Engineer (SOA interfaces) |
| Indrakanti, Ram (R.) | rindraka | ADAS – Sentinel Feature |
| Midde, Vijaya Kumar (V.) | [vmidde](mailto:vmidde@ford.com) | ADAS - Mobile Device Viewer Feature  ADAS - Modeling and Signal Mapping |
| Benhamouche, Fatima (F.) | fbenhamo | ADAS - Mobile Device Viewer Feature |
| Vootkuri, ChandraSekhar (C.R.) | cvootkur | AR Module – Core Software Lead |
| Nachtegall, Debbie (D.E.) | dnachte1 | AR Module - Hardware |
| Dogiparthi, Sivaram sudhak (S.) | [sdogipar](mailto:sdogipar@ford.com) | Product Manager-MDVC |
| Kamboj, Nitin (N.) | nkamboj | ADAS - Software Architect for MDVVC & Sentinel |
| Karramreddy, Venkat Sai R (V.) | [vkarramr](mailto:vkarramr@ford.com) | ADAS - Mobile Device Viewer Feature  ADAS - Modeling and Signal Mapping |
| Khan, Kamal (A.) | [kkhan30](mailto:kkhan30@ford.com) | ECG Design Team – Camera Manager |
| Gocmen, Aysegul (A.) | agocmen | ECG Development Team – Camera Manager |
| Chapekis, Steven (S.A.) | [schapeki](mailto:schapeki@ford.com) | CVP&P - Connected Streaming Services |
| Iftikhar, Omar (O.) | oiftikha | CVP&P - Connected Streaming Services |
| Veluppillai, Mahi (M.) | mveluppi | DXP Module |
| Rodriguez, Dearles (D.) | drodr196 | PDC Module – Camera Hardware |
| Mathers, Daniel (D.) | dmather6 | PDC Module – Camera Platform |
| Mueller, Holger (H.) | hmuell62 | PDC Module & Video Recording |

## Potential Use Cases

Below is a list of planned and potential use cases for the Camera Service.

|  |  |
| --- | --- |
| Use Case # | Description |
| UC\_FN\_ CameraServ \_00001 | The Integrated Security Camera Feature will use the Camera Service, as part of the video streaming and recording solution in order to record video from around and inside the vehicle, after a perimeter alarm is triggered. |
| UC\_FN\_ CameraServ \_00002 | A Customer, having been alerted that a perimeter alarm was triggered for their vehicle, uses their phone and the Mobile Device Viewer Feature to watch a video stream from a selected vehicle camera view (provided vehicle is not moving and ignition is off). |
| UC\_FN\_ CameraServ \_00003 | A consumer would like to view a list of all the cameras available on the vehicle and select one for streaming. |
| UC\_FN\_ CameraServ \_00004 | Augmented reality feature would like to consume the exterior rear-view camera stream from ADAS. |
| UC\_FN\_ CameraServ \_00005 | Enhanced Dash Cam will like to select a camera and view from those on board and record the stream while vehicle is moving. |
| UC\_FN\_ CameraServ \_00006 | Camera video stream needs to be recorded for AV in cabin vehicle sensing feature. |
| UC\_FN\_ CameraServ \_00006 | Analytics team would like to capture, Auto Hitch connection video for improvements (Unstructured Data Feature). |

## Abbreviations and Definitions

The list below provides definitions for the abbreviations and terminology used within this document.

|  |  |
| --- | --- |
| **Abbreviation** | **Description** |
| ADAS | Advanced Driver Assistance System |
| AR | Augmented Reality Module |
| BCM | Body Control Module |
| Camera Controller | The ECU connected to one or more camera devices which hosts an instance of the Camera Service.. |
| CDD | Complex Device Driver  A Software Component used to model a function outside of the normal **AUTOSAR** Basic Software stack |
| ECU | Electronic Control Unit |
| ECG | Enhanced Central Gateway  A Compute center within the vehicle that manages in vehicle networking. It also hosts several platform software components. |
| Host | For purposes of this document, host refers to the ECU where an instance of the Camera Service is implemented. Also known as the camera controller. |
| H.264 | A well-known video compression standard for high-definition digital video |
| ISC | Integrated Security Camera  Formerly known as Sentinel, this feature allows for the recording of video form around and in the vehicle immediately following a perimeter alarm event. |
| MDVVC | Mobile Device Viewer of Vehicle Cameras  A feature that allows the vehicle owner to request video feeds from vehicle cameras to their phone using Ford Pass. |
| MQTT | A lightweight messaging protocol for small sensors and mobile devices |
| RTP | Real-time Transport protocol  a network protocol for delivering audio and video over IP networks. |
| RTCP | Real-time Transport Control Protocol  Works with RTP to monitor delivery statistics like number of bytes sent, packets sent, lost packets and round-trip delay between endpoints, so that compensating measures can be taken |
| SOA | Service Oriented Architecture |
| SOA\_CDD | An AUTOSAR Classic Complex Device Driver created by Ford to facilitate SOA communications with AUTOSAR Classic Modules. |

# Architecture/Context Diagrams

This section provides high-level context and architecture diagrams for the Camera Service and its interactions with other software components.

The Camera Service is a portion of an overall video streaming and recording solution within the vehicle. It is envisioned as lower layer microservice, that directly interacts with the physical device, the Camera. The Camera Service will be deployed on any ECU to which a Camera is connected, that is also connected to the in-vehicle Ethernet network.

Since the available cameras, views, and controlling ECUs are likely to change between vehicle programs and over time, a Camera Manager will be deployed in the vehicle which will act as a single point of contact for the list of cameras and views available in that specific vehicle.

All the Camera Services will provide the Camera Manager with their list of camera views and statuses, when requested.

In turn the Camera Manager will provide a consolidated list to various feature software modules, isolating them from changes in the underlying camera architecture.

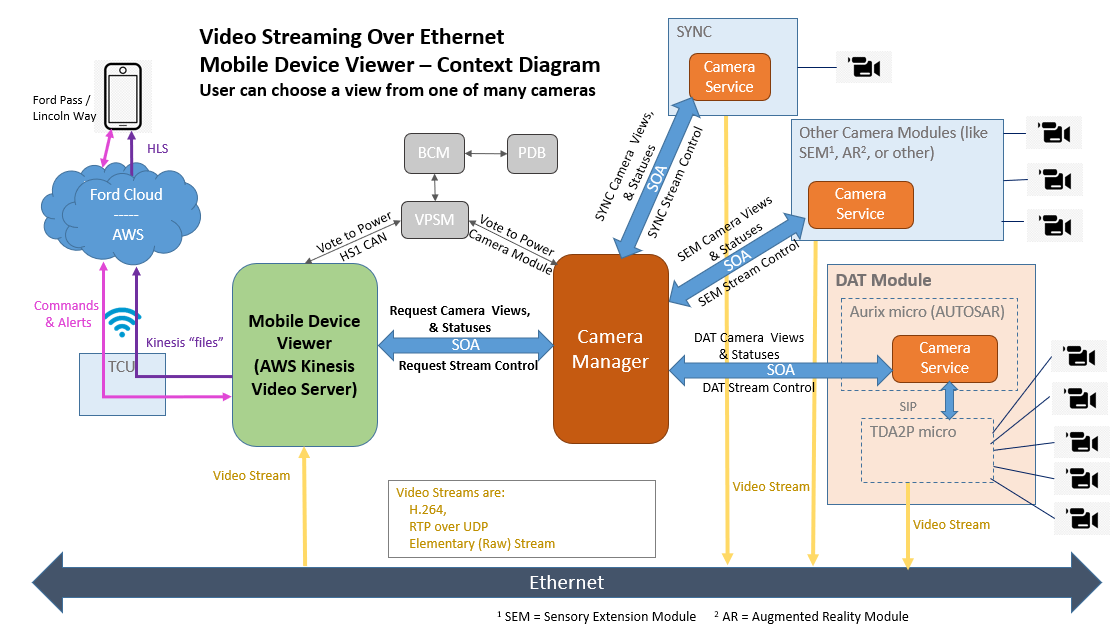
Camera Manager will also provide a multicast port address to both the video source and the in-vehicle software recipients, allowing the feature software to be agnostic of the ECU that is controlling the view in a specific vehicle.

In addition to the Camera Services and Camera Manager, there will be a service to record and playback video, as well as a Video Server that will facilitate streaming video up to the Cloud.

## Mobile Device Viewer Example

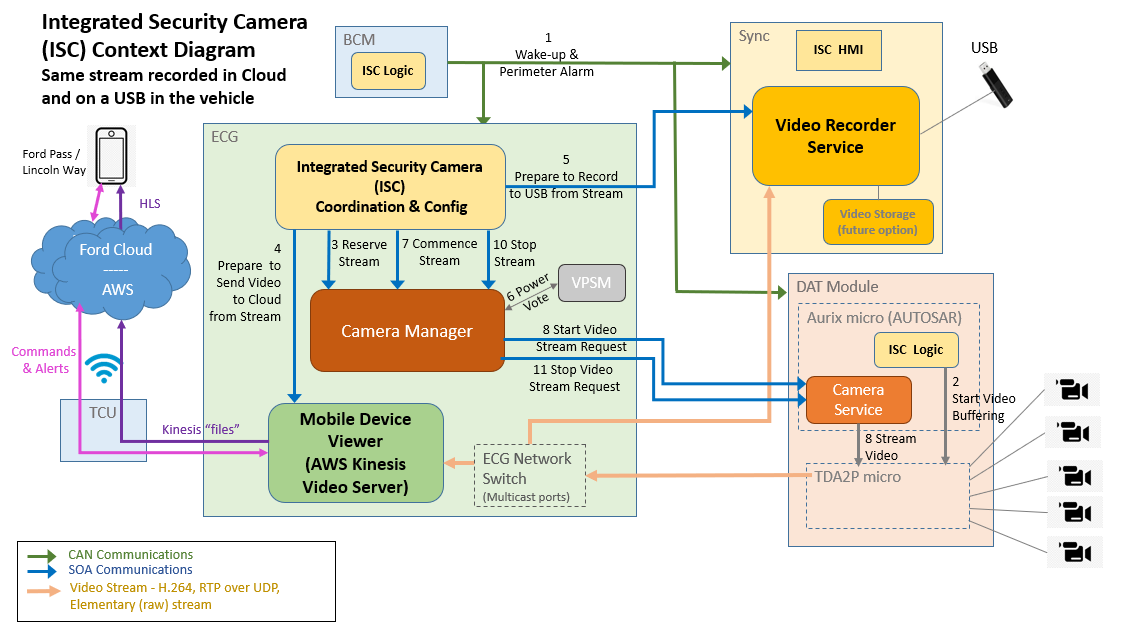
Below is a context diagram showing the Camera Service’s role in the Mobile Device Viewer use case. In this use case, the end consumer can utilize their cell phone to request a video stream from various cameras within their vehicle.

The Camera Manager will make views from multiple in-vehicle Camera Services available to the Mobile Device Viewer feature, streaming the video over in vehicle Ethernet. Camera Manager abstracts the feature away from the underlying vehicle technology, like which ECU provides which view.



## Integrated Security Camera Example

Below is a context diagram showing the Camera Service’s role in the Integrated Security Camera use case. In this use case, when a perimeter alarm is activated in the vehicle, several pre-configured views are recorded to both the cloud and to a USB device within the vehicle.



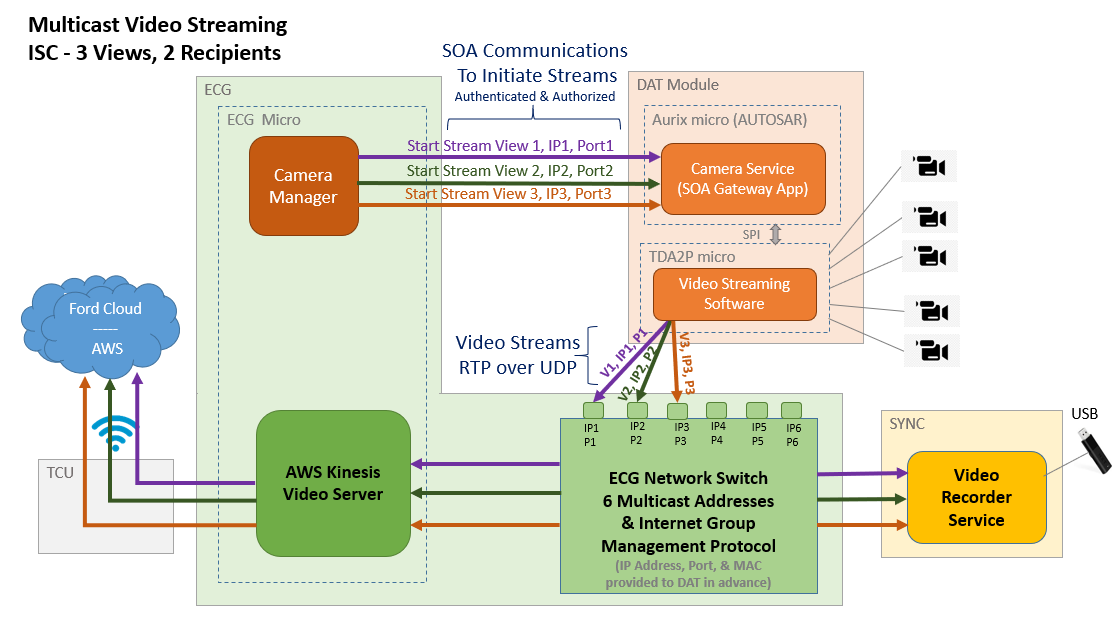
## Multicasting

Given the Integrated Security Camera Feature’s requirement to stream the same camera view to two different recipients, the Camera Solution will adopt a multicasting solution. The multicasting will be implemented on the ECG Network Switch and should have limited impact on the ECUs that are controlling the cameras and acting as the source of the video stream.

The camera stream sources need to be aware of the following:

1. They should be able to stream to any of a predetermined list of multicast ip address and port destinations, see REQ-413588/A-Stream to One of Several Possible Multicast Ports.
2. The multicast ip address and port used for a given video stream will be included in the start stream request coming from the Camera Manager on ECG.

Below is a high-level architecture concept diagram showing the multicast scenario for the Integrated Security Camera use case, where 3 different views are streamed to 2 recipients.



## Architecture Concepts

The Camera Service should be designed and implemented as a separate and cohesive Software Component (SWC) it should be designed around the following concepts:

* Reactive Event/Message Driven Architecture
* Share Nothing/Isolation

**Event driven** architectures prevent concurrency/deadlock issues and the need for mutual exclusion as they are single threaded.

**Share nothing/isolation** will decouple systems.

**Start-Up/Shutdown/Restart Options**:

There are 2 options for the start-up / shutdown or Restart of the Camera Service;

1. Start at boot time or restart of the ECU, shutdown with the ECU
2. Launch dynamically, based on need.

**Option 1**, starting on boot or restart, would be used for any cameras hardwired to the vehicle that should be available at any time.

**Option 2,** starting dynamically or on demand, would be applied to optional cameras that could come and go, for instance an external peripheral camera such as GoPro would have a service start-up when the external device is plugged into the vehicle. The service would then shutdown when the device is disconnected.

For external cameras, the default Camera Service should be instantiated on successful integration with external facing ECU like TCU or SYNC.

## Constraints and Assumptions

Below is a list of constraints and assumptions regarding the design of the Camera Service.

* Camera Manager can communicate with a camera, only through a Camera Service registered with the in-vehicle Service Oriented Architecture (SOA) infrastructure.
* Camera Service needs to be up and running in order for it to communicate with the camera.
* Camera Service needs to run on an ECU that is connected to the Ethernet bus.
* Camera Service assumes that the camera is capable of streaming H.264 on Ethernet using RTP
* The software component associated with Camera needs to implement the Camera Service interfaces described in this document in order to make the camera available to other software within the vehicle via Service Oriented Architecture (SOA) Messaging.
* The Camera Service implementation can perform device and protocol specific actions to support the interface.

### For Controlling ECUs that are AUTOSAR Classic Compliant

* + The ECU is on Ethernet and is able to send and receive SOA messages.
  + To participate in the SOA framework for communication over ethernet, the AUTOSAR node needs to implement the Ford SOA Complex Device Driver (SOA CDD) and MQTT client.
    - Its expectations are documented at: <https://pages.github.ford.com/Central-Software/CS-MQTT-ASR-Requirements/>
    - contacts are Joseph Nnacho (jnnacho@ford.com) and Wajiha Chahine (wchahine@ford.com).

Responsibilities of the SOA CDD and MQTT Client components on the Classic AUTOSAR ECU are;

* + - Establishes connection with the ECG broker
    - Subscribes to request, response, and data topics
    - Serializes/deserializes the GPB payload and routes requests/response to the intended Software Components (SWCs) involved

Note: The SOA CDD implementation processes one request at a time. If a second request arrives before the first is completed, the second one is ignored.

### For Controlling ECUs that are Non-AUTOSAR (QNX, or Linux)

* + The ECU is on Ethernet and is able to send and receive SOA messages.
  + To participate in the SOA framework for communication over ethernet, the ECU needs to implement the appropriate Ford SOA Gateway Client. Information can be found at:
    - [FNV2-SOA Gateway (v0.2)](https://www.eesewiki.ford.com/pages/viewpage.action?pageId=13708047)
    - [FNV2 Programmers Guide (7) : SOA Middleware](https://www.eesewiki.ford.com/display/ecg/FNV2+Programmers+Guide+%287%29+%3A+SOA+Middleware)
    - [SOA Gateway Deployment and User Guide](https://www.eesewiki.ford.com/display/ecg/SOA+Gateway+Deployment+and+User+Guide)
    - Contacts: Dan Krywenky (dkrywenk@ford.com) or Fred Risacher(frisache@ford.com)

# Requirements

This section contains a list of requirements for the Camera Service.

## Functional Requirements

The functional requirements below are those that directly impact consumer expectations of successful delivery. They provide the functionality expected by various consumers.

### FUR-REQ-403607/C-Publish Camera View Statuses

Upon receiving a request from the Camera Manager to enable a periodic broadcast, the Camera Service shall begin broadcasting a list of Camera Views, with their current status.

The broadcast frequency should be on the order of every 200 to 500 milliseconds.

The list of possible statuses shall include;

* Available: The camera view is configured as present in this vehicle
* Not Available: The camera view is not configured as present in this vehicle
* Faulty: A serious hardware or configuration fault has occurred and the camera responsible for providing this view is not functioning.

Note: The status provided by the Camera Service is considered the master source and will be used by Camera Manager on ECG to provide status to consumers, as well as to persist the last known value for key off requests, and potential crash recovery.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | C |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Changed to periodic. Added Streaming Status and note that the Camera Service status is the master used for crash recovery by ECG. |

### FUR-REQ-403608/C-Disable Publish of Camera View Statuses

Upon receiving a request to disable the broadcast from the Camera Manger, the Camera Service shall stop publishing the periodic broadcast of camera view statuses.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | C |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Periodic not on change |

### FUR-REQ-418779/A-Publish Stream Statuses

Upon receiving a request from the Camera Manager to enable a periodic broadcast, the Camera Service shall begin broadcasting video streaming statuses, for up to 3 concurrent video streams.

The broadcast frequency should be on the order of every 500 milliseconds.

The Broadcast should consist of:

1. The name of the view that is streaming, or none
2. The status of the stream including:
   1. No Request: There is no request to occupy this stream.
   2. Streaming: Actively streaming the camera view.
   3. Failed: A failure has occurred while streaming the camera view.

Notes:

1. After a steam has failed, it is expected that Camera Manager will send a Stop Video Stream request for that view, at which point the stream status will return to No Request, and the view name will return to none.
2. The initial value of 3 concurrent streams may be increased as in vehicle camera controllers add capacity to supply more video streams.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | A |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added |

### F-REQ-418780/A-Disable Publishing of Stream Statuses

Upon receiving a request to disable the broadcast from the Camera Manger, the Camera Service shall stop publishing the periodic broadcast of stream statuses.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | A |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added |

### FUR-REQ-403729/C-Start Stream

Upon receiving a Start Stream request from Camera Manager, the Camera Service shall;

1. Acknowledge receipt and validity of the request.
2. Check the configuration parameters from the request and update the camera config as needed.
3. Utilize the IP Address and Port provided in the request for the video stream of the requested view.
4. Begin streaming video for the requested camera view.
5. Send a one-time response to the request indicating whether starting the stream was successful or if one of several possible failures occurred.
6. If the stream is started successfully, then update the stream status with the view name and status of “Streaming” for the next Stream Status broadcast
7. If a non-recoverable error has occurred that will prevent the view from streaming, update the view’s status to “Faulty” for the view status broadcast.

Note: For the Integrated Security Camera (also known as Sentinel) Feature, the interaction will be slightly different. Upon detecting a perimeter alarm event, the Body Domain will wake the DAT module and request it to buffer video for a short time, while the ECG and SYNC modules are powered-up. The details of this interaction will be documented elsewhere as part of the Sentinel / Integrated Security Camera Feature requirements.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | C |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added a one time request processing response, and updating view's status broadcast. |

### FUR-REQ-409914/B-Change Config While Streaming

The Camera Service shall allow the consumer to change the camera view configuration (resolution, framerate, and bitrate) while a stream is active.

Note: Camera Manager will verify that the consumer is the only consumer of that stream prior to allowing the change request and passing it to the Camera Service.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | B |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Clarified only if they are the only consumer of that stream. |

### FUR-REQ-403735/C-Stop Stream

Upon receiving a Stop Stream request from Camera Manager, the Camera Service shall;

1. Acknowledge receipt and validity of the request.
2. Terminate the stream
3. Send a one-time response to the request indicating whether the stop stream was successful or invalid.
4. Change the stream status broadcast information setting the View Name to None and the stream status to “No\_Request”.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | C |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Updated for Ack and one time response message. |

### FUR-REQ-409424/C-Live and Buffered Video

The in-vehicle video streaming supported by the camera solution shall be live video, with only one exception for the ADAS camera host and the Sentinel / Integrated Security Camera use case.

The ADAS camera host will provide for a video buffer in support of the Integrated Security Camera Feature (formerly known as Sentinel). Details of the use case requirements are documented in the Sentinel/ISC Functional Spec and SPSS documents.

In general, the ADAS video source must be available within 2.5 seconds of a perimeter alarm event. The buffer, when initiated, shall facilitate capturing up to 35 seconds of video prior to the start of streaming within the vehicle.

This buffering to local ADAS memory is required in order to capture video as close to the alarm event as possible, and accounts for the power up time difference between the ADAS module versus ECG and SYNC, with power up times of @12 seconds on FNV3.

Note: The Integrated Security Camera Feature will be responsible for providing separate requirements on how to detect a perimeter alarm event, or other trigger event, and what views should be buffered and ready to stream.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | C |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Clarification on special buffering use case and timing |

### F-REQ-425837/A-Use Default config, if requested is not supported

The Camera Service shall stream video using a default resolution, framerate, and bitrate if the requested settings are not valid. It shall send a response message of “VALIDATION\_FAILED” when this occurs (see data enumeration for processing status later in this document).

The default settings should present the view at sufficient quality without overwhelming the vehicle network.

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | A |
| **Revision Date** | 28-Jun-2021 16:22 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added. ADAS has already accounted for this. |

### F-REQ-470541/A-Communicate Ignition States Supported

The Camera Service shall identify the ignition states in which it will support video streaming as part of the Camera View Status Broadcast. Supported ignition states would be one of the following;

* ON
* OFF
* ON\_AND\_OFF

Ideally the Camera Service should also update view statuses (as Available or Not Available) based on the vehicle’s current ignition state.

Note: As of Release 2 (Revision K) of the Camera Service Specification, ignition state support is as follows:

* ADAS = OFF
* AR = ON
* DXP is pending module team verification
* PDC (Phoenix) is pending module team verification

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| **Requirement Information** | |
| **Requirement Type** | F - Functional |
| **Requirement Revision** | A |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | New Requirement, additional camera host modules beyond ADAS are supporting differing ignition states. |

## Non-Functional Requirements

This section provides a list of requirements that only indirectly impact customer expectations and satisfaction, like those around performance and security.

### NFN-REQ-410415/A-Common Interfaces across ECUs

All Camera Service, across all controllers (ECUs) shall adhere to the same interfaces in order to reduce overall complexity.

This means the message names, and structures will remain consistent across ECUs. Camera Manager will differentiate between controllers by utilizing host as part of the SOA Topic, for instance the SOA Topic for a Start Stream request will generally be identified as

SERVICES/REQUEST/<host>/CAMERA\_SERVICE/STREAM

When making a start stream request to an ADAS Camera View the topic used will become;

SERVICES/REQUEST/ADAS/CAMERA\_SERVICE/STREAM

Any deviation from the common interfaces must be reviewed with the Camera Manager team and captured in both the Camera Service and Camera Manager Specifications.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 29-Mar-2021 11:29 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added requirement, to ensure reduced complexity as new camera controllers are added. |

### NFN-REQ-410180/B-Transport Protocol

The Camera Service shall stream video using the Real-time Transport Protocol (RTP) at the application layer, over the User Datagram Protocol (UDP) transport layer.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | B |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added UDP clarification. |

### NFN-REQ-410181/A-Codec - Video Compression Technology

The Camera Service video stream shall adhere to the H.264 video compression standard.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 29-Mar-2021 11:29 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** |  |

### NFN-REQ-411358/B-Video Container / Format

The video streams provided by the Camera Services via Camera Manager shall be raw or elementary RTP Streams.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | B |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Clarified initially will be raw / elementary stream, see future requirement section regarding MPEG2-TS for multiplexing in the future. |

### NFN-REQ-415990/A-Video Stream Frames & Embedded Parameter Sets

The video streams provided by the Camera Services via Camera Manager shall consist of the following:

1. An I-frame or Instantaneous Decoder Refresh (IDR) frame shall be provided at a configurable interval within the video stream. As these contribute to bandwidth utilization, the recommended default is every 1 second, but it should be possible to tune this value during testing.
2. Every I-frame must be preceded with an embedded;
   1. Sequence Parameter Set (SPS)
   2. Picture Parameter set (PPS)

The above is critical in order to ensure that recipients can properly interpret and use the video stream, even if they join after the stream has started.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added Requirement |

### NFP-REQ-409283/A-Response Time - Network Ready

It is expected that the Camera Service shall be built to perform as efficiently as possible, with response times (from receipt of a request to the action being completed) on the order of hundreds of milliseconds.

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| **Requirement Information** | |
| **Requirement Type** | NFP - Non-Functional-Performance |
| **Requirement Revision** | A |
| **Revision Date** | 29-Mar-2021 11:29 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Changed from paragraph to requirement object. Updated properties. |

### NFN-REQ-409284/A-Availability - LifeCycle

The Camera Service shall be available in the normal vehicle life cycle mode, it may be available, but is not required, in other modes like factory or transport.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 29-Mar-2021 11:29 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Clarified Service should be available in normal life cycle mode. Changed from paragraph to requirement object. Updated properties. |

### NFN-REQ-409324/B-Availability - Ignition State

The Camera Service shall be available in all ignition states, including off, provided available battery charge is not low.

When ignition is off, it must be possible for the Camera Manager Service to request the ECU controlling the cameras to wake-up and make cameras available for video streaming.

Note: For the ADAS Module, **DAT211** release train, video streaming over Ethernet will **only be available in the ignition OFF state**. It is expected this will change in future module releases.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | B |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added Requirement to clarify Service available in ignition off. |

### NFN-REQ-409286/A-Availability - Wakeup

The Camera Service shall be part of the ECU wakeup strategy. It should be available anytime the module controlling the cameras is up and operational, to make any cameras permanently attached to the vehicle (either by Ford or as an aftermarket option, like the rear auxiliary camera) available to stream video over Ethernet.

When ignition is off, it must be possible for the Camera Manager Service to request the ECU controlling the cameras to power-up and make cameras available for video streaming.

For cameras that are not permanently attached to the vehicle (like an external GoPro brought in by the end consumer and temporarily connected via USB, Wi-Fi or other mechanism) the Camera Service should make those cameras available when the camera device is connected.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 29-Mar-2021 11:29 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Clarified Camera Service should be part of ECU wake-up strategy. Changed from paragraph to requirement object. Updated properties. |

### NFN-REQ-409328/B-Availability - Low Power Mode

The Camera Service should be available in a Low Power Mode, to enable video streaming in an ignition off state, while preserving battery power.

The Camera Manager, in addition to waking up the camera controller, should also be able to request that it operate in Low Power Mode, ensuring that cameras are powered and able to stream, while other functions or processors that are not in use can be powered down.

If the camera controller transitions between low power mode and a full powered mode, any active video streams should not be disrupted. One case where this could occur is if the ignition is turned on while streaming video that started in an ignition off state.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | B |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added statement that transition should not impact active video stream. |

### NFN-REQ-409285/A-Software Updates

The Camera Service shall be capable of being updated via Over The Air (OTA) Software Updates.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 29-Mar-2021 11:29 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Changed from paragraph to requirement object. Updated properties. |

### NFN-REQ-409287/A-Security

It is currently assumed that the Camera Service will require no additional authentication, or authorization beyond that provided via the SOA Middleware, the Access Control List (ACL), and Ethernet using TLS.

Only Camera Manager will be authorized to use any Camera Service request. All other consumers (like Mobile Device Viewer, or Video Recorder) should utilize Camera Manager Interfaces in order to access camera views from multiple controllers as installed in the specific vehicle.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 29-Mar-2021 11:29 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Changed from paragraph to requirement object. Updated properties. |

### NFN-REQ-409288/B-Service Version Control

The Camera Service shall facilitate identification of Software Version mismatches across ECUs by maintaining a three-tiered software version number like xxx.yyy.zzz. Note: ADAS (DAT221) is exempt from this requirement (see note below).

The tiers will be interpreted as;

* xxx - major change: not-backward compatible change
* yyy - minor change: backward compatible change
* zzz - file update: used to track file updates that do not alter service interfaces or functionality, for example bug fixes, comments, or documentation tags

With the advent of Over The Air software updates, it is possible for the software versions on different ECUs to become out of synch, potentially breaking the interfaces between them. There is a desire to identify when the Camera Service and the Camera Manager software versions are no longer compatible in order to provide an indication of the version mismatch in a log, or through status updates to Camera Solution Consumers.

The Camera Service shall store, or otherwise associate a version number to the Camera Service software installed in the vehicle and provide it real time to the Camera Manager as part of the View Status broadcast.

This will allow the Camera Manager to check the installed Camera Service version against its expected version number for that Camera Controller and identify a potential mismatch.

When a mismatch occurs, Camera Manager will place the error into a log, and update the View Statuses it sends to Consumers to reflect the version incompatibility.

**ADAS Exception / Requirement:** The timing of the DAT221 release train prevents this functionality from being implemented in that release. The ADAS module will align to software versioning in a later release version.

**The previously communicated version numbers by interface shall be removed from the ADAS interfaces. ADAS will NOT be required to do any Version Checking of incoming interfaces**.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | B |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Changed from API level to Software/Service level. ADAS has exception for now. |

### NFN-REQ-411411/A-Backward Compatibility & Tolerant Reader

As part of a Service Oriented Architecture (SOA) Camera Service Software is expected to adhere to industry standard SOA design principles, particularly as they relate to interfaces. Attempts must be made to keep interfaces backward compatible, adding rather than removing or changing parameters and values.

It is also expected that the service will exercise industry standards for being a “tolerant reader” of messages, meaning that newly added parameters are ignored, rather than generating errors, whenever practical.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 29-Mar-2021 11:29 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** |  |

### NFN-REQ-413501/A-Errors During Streaming

If a ***recoverable error*** occurs while streaming video, the Camera Service shall retry the action for a configurable amount of time (default = 1 second), then:

* 1. If the action succeeds before the retry time out occurs, then no status update is required, continue streaming.
  2. If the action continues to fail until the retry time out is reached, then:
     1. Terminate the stream
     2. Update the Stream status to “Failed” for the next broadcast.
     3. After a Stop Video Stream request is received for the failed view then, update the Stream Status by changing the View Name to None, and the status from Failed to No Request.

List of errors that should be retried:

* ERROR\_CPU\_LOAD
* ERROR\_BANDWIDTH\_LOAD
* CONFIG\_ERROR

If a ***non-recoverable error*** occurs while streaming video, the Camera Service shall:

1. Terminate the stream
2. Update the Stream status to “Failed” for the next broadcast.
3. After a Stop Video Stream request is received for the failed view then, update the Stream Status by changing the View Name to None, and the status from Failed to No Request.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Added per discussions with suppliers and ADAS team. Updated for retries without broadcast, until verified continues to fail. |

### NFN-REQ-413588/A-Stream to One of Several Possible Multicast Ports

The Camera Service shall be able to send video streams to one of several possible multicast destinations. The IP address and port to use for a specific stream will be provided in the start video stream request coming from Camera Manager.

The list of possible multicast ports are as follows:

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| --- | --- | --- |
| **IP Address** | **Port** | **MAC Address** |
| 235.10.1.1 | 5000 | 01-00-5e-0a-01-01 |
| 235.10.1.2 | 5000 | 01-00-5e-0a-01-02 |
| 235.10.1.3 | 5000 | 01-00-5e-0a-01-03 |
| 235.10.1.4 | 5000 | 01-00-5e-0a-01-04 |
| 235.10.1.5 | 5000 | 01-00-5e-0a-01-05 |
| 235.10.1.6 | 5000 | 01-00-5e-0a-01-06 |
| 235.10.1.7 | 5000 | 01-00-5e-0a-01-07 |
| 235.10.1.8 | 5000 | 01-00-5e-0a-01-08 |
| 235.10.1.9 | 5000 | 01-00-5e-0a-01-09 |
| 235.10.1.10 | 5000 | 01-00-5e-0a-01-0a |

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** |  |

### NFN-REQ-470543/A-Optional Direct Stream to Cloud

The RIViS feature and DXP module will not be able to utilize the same stream to cloud mechanism as Mobile Device Viewer or Sentinel (due to latency concerns with the AWS Kinesis solution). Therefore, the camera solution will support passing a cloud destination IP address and port which the camera host module can use to make a connection through the Wireless Interface Router (WIR) System to stream the video to the cloud via this alternate mechanism.

When using this alternate mechanism to stream to the cloud, the Camera View will not be sent through a multicast port and will NOT be available to any other consumer or feature.

It is expected that the DXP camera host module shall still support in vehicle video streaming to a multicast address, when requested.

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| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | New Requirement - Planned for use by DXP host module and RIViS Feature only |

### REQ-416918/A-Do Not Persist Streaming Status

The Camera Service shall NOT persist the streaming states of any view if powered off, nor automatically re-activate any terminated streams when powering back up.

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| **Requirement Information** | |
| **Requirement Type** |  |
| **Requirement Revision** | A |
| **Revision Date** | 21-May-2021 13:42 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** |  |

### NFN-REQ-470539/A-Use Of On Demand Broadcast for Requests

The Camera Service shall utilize the On Demand, On Change Broadcast messaging pattern in order to deliver an immediate acknowledgment of request receipt followed by a later “broadcast” of the true request processing status for the following types of requests;

* Start video stream
* Change video stream
* Stop video stream
* Low power mode

Since the execution time of a number of the above requests can take a significant amount of time, there was a desire to provide an immediate acknowledgment of request receipt, allowing camera manager to make a retry determination without waiting for full execution if necessary. A message pattern of a request followed by two responses is not possible, therefore the on-demand broadcast pattern is used.

The initial request both activates the SOA broadcast mechanism (SOA\_Command in the header = “Consumer Request”) and supplies the actual request in the payload.

The **Camera Service shall** immediately respond with an acknowledgement that the request was received and pass the payload (actual request) on to the camera or low power mode functions.

When processing is completed, the **Camera Service shall** detect the changed/updated status from the camera or low power mode functions, and it shall trigger a subsequent broadcast containing the actual processing result (success or failure with any error code).

The Camera Manager will send a subsequent request with the SOA Command in the header set to “Consumer Cancel”. This will allow the SOA Middleware to decrement the subscriber count for the broadcast. The **Camera Service may** also use this to decrement a subscriber count if it chooses to keep such a count.

The **Camera Service shall** NOT pass on the payload of a request when the SOA\_Command is set to “Consumer Cancel”.

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | NFN - Non-Functional-N/A |
| **Requirement Revision** | A |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | New Requirement - based on integration issue found during DAT 221 implementation. |

## Future Requirements

Below is a list of anticipated future requirements or enhancements. These are provided as information only, but they should be taken into consideration while making near term design and implementation decisions.

### Registration of Camera Service (host & views)

In the future, the Camera Manager is likely to provide a registration interface that will allow camera services to register new views, or new camera controllers (hosts) real time. This would eliminate the need for manual configuration and software updates to Camera Manager, in order to make those new views available for video streaming over Ethernet to other ECUs and offboard applications.

This would be dependent on having camera controllers (particularly those on AUTOSAR Classic and the SOA CDD) able to act as a consumer of that interface, and to implement support for the string data type, and nested messages or arrays.

It may be possible for modules that are not on AUTOSAR Classic, and not using the SOA CDD to adopt the use of this interface sooner.

### Support Multiplexing & MPEG2-TS

As we add more features and have multiple features utilizing video streams at the same time, the in-vehicle camera solution will need to provide more video streams simultaneously. One feature in progress desires 5 simultaneous exterior views from the ADAS camera views.

This may require implementing multiplexing and MPEG2-TS Containers.

The Camera Services may need to facilitate the multiplexing of several views into one complex communication stream, whenever both the video recipient and the Camera Controller providing the video support multiplexing.

Note:

It is likely that within a given vehicle we will have a mix of sources and recipients at different capability levels, as not all will be able to add support for multiplexing at the same time.

Therefore, support for multiplexing may be achieved by adding a new interface named StartMuxedStream. This new interface would allow the consumer to request multiple views within a single request message (thus indicating a desire and capacity to process a multiplexed stream).

Upon receiving such a request, Camera Manager would need to determine what, if any, of the views are from the same camera controller, and if that controller supports multiplexing.

A mechanism would be needed to inform Camera Manager as to what camera controllers support multiplexing and MPEG2-TS containers, perhaps this could be achieved by adding a parameter to the View Status broadcast.

### Secured Transport protocol

The cyber security team has requested that we move from Real Time Transport (RTP) to Secure Real-Time Transport Protocol (SRTP). When implemented it is envisioned that Camera Manager will provide session-based keys to the video source and all authorized recipients.

### QOS Management (RTCP?)

As more video streaming features are added to vehicles, some mechanism of Quality of Service (QOS) management, like Real-time Transport Control Protocol (RTCP), may be required. This would include automatically adjusting video quality settings (like framerate, bitrate, and resolution) in order to ensure effective network transmission and limit bandwidth utilized.

### Provide Camera Controller Capability Info

Each Camera Service controller may need to provide Camera Manager with information regarding the controller’s capabilities like:

* Support of Multiplexing
* Support of SRTP versus RTP
* Maximum number of streams supported

Ideally the camera controllers will be the master source for this information and provide it as a data broadcast, or registration with Camera Manager.

This will also allow Camera Manager to adjust its behavior based on what each different controller is capable of, as well as adapting to possible over the air software updates of the controller that enhance its functionality.

# Interface Contracts

The sections below contain interface requirements used to form a Service “Contract” between the service provider and the service consumer. This includes enumeration data type definitions and message definitions.

## Service Data Enumerations

The sub-sections below provide definitions for all the enumeration data types used in the Camera Service interfaces. Enumerations are predetermined lists of values for a given parameter. In CAN terminology these may be referred to as Network Encoding Types.

### IR-REQ-422102/B-CamSrv\_<host>CameraView

Each Camera Service will need to maintain an enumeration that provides the list of Camera Views that are provide by the Camera Controller.

It was decided to allow each Camera Service (or Camera Controller) to maintain its own separate list of values, so that the modules can develop and deploy independently.

The Camera View enumeration must adhere to the following naming pattern

CamSrv\_<host>CameraView

where <host> is replaced with the common abbreviation for the Camera Controller ECU (Like ADAS, or AR).

Each Camera Service MUST provide its list of views in advance to the Camera Manager development team for incorporation into the superset list of all the possible views. The view name MUST be unique across all camera services and controllers in all possible vehicles.

The camera views identified for each Camera Service to date, are defined below.

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | B |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - ADD DXP and Pheonix(SYNC) views |

#### IR-REQ-403738/G-CamSrv\_AdasCameraView

**Description:** The enumeration below provides the list of camera views supported by the ADAS Module.

As more Cameras and views are added, this list must be updated.

For sample views please see; <https://wiki.ford.com/display/CS/Cameras%2C+Views%2C+and+Configurations+Available>

|  |  |  |
| --- | --- | --- |
| **Value** | **ADAS Signal Value** | **Description** |
| NONE | 0 | This will not be used in SOA messaging. A Value of zero is used in ADAS Signals to indicate no request.  While ADAS named this value “OFF”, we need to use NONE because OFF was used for PowerMode. GBP will not compile unless names are unique. |
| FRONTNORMAL | 1 | Shows the area to the exterior FRONT of the vehicle. |
| REARNORMAL | 2 | Shows the area to the exterior REAR of the vehicle, from a camera at the license plate. |
| FRONT360 | 3 | This view includes both a video feed showing the area to the front of the vehicle, plus a representation of the vehicle (360 degrees around it) with gray zones depicting possible camera views. |
| REAR360 | 4 | This view includes both a video feed showing the area to the rear of the vehicle, plus a representation of the vehicle (360 degrees around it) with gray zones depicting possible camera views. |
| FRONTSPLIT | 12 |  |
| REARSPLIT | 13 |  |
| REARZOOM | 14 |  |
| CHMSL | 15 | View from near the Center High Mounted Stop Lamp (CHMSL), for a pick-up truck it looks back on to the bed of the truck. |
| CHMSLZOOM | 16 | Same as CHMSL above but zoomed in. |
| AUX | 17 | After Market Camera installed to the rear of vehicle for use with trailers. |
| TBA2\_STRAIGHT\_BACK | 20 |  |
| TADZOOM | 21 |  |
| V5050 | 22 |  |
| LEFT | 24 | Shows the area to the exterior LEFT side of the vehicle. Left is from the reference of a driver looking out the windshield. |
| RIGHT | 26 | Shows the area to the exterior RIGHT side of the vehicle. Right is from the reference of a driver looking out the windshield. |
| TBA2\_REARSPLIT | 27 |  |
| TBA2\_REAR360 | 28 |  |
| TBA2\_CHMSL | 29 |  |
| TBA2\_AUX | 30 |  |
| TBA2\_REARNORMAL | 31 |  |
| REAR\_FWD\_OFFSET | 33 |  |
| REAR\_RWD\_OFFSET | 34 |  |
| FRONT\_FWD\_OFFSET | 35 |  |
| FRONT\_RWD\_OFFSET | 36 |  |
| REAR\_FL\_CORNER | 37 |  |
| REAR\_FR\_CORNER | 38 |  |
| REAR\_RL\_CORNER | 39 |  |
| REAR\_RR\_CORNER | 40 |  |
| FRONT\_FL\_CORNER | 41 |  |
| FRONT\_FR\_CORNER | 42 |  |
| FRONT\_RL\_CORNER | 43 |  |
| FRONT\_RR\_CORNER | 44 |  |
| FRONT\_ROCK\_CRAWL | 45 | Close up view of front tires, split to show both the left and right tires in one view. |
| REAR\_ROCK\_CRAWL | 46 | Close up view of rear tires, split to show both the left and right tires in one view. |
| HITCH | 47 |  |
| AH\_REARNORMAL | 48 |  |
| TRAILER360 | 59 |  |
| TRAILERREARNORMAL | 60 |  |
| TRAILERINTERIOR\_VIEW1 | 61 |  |
| TRAILERINTERIOR\_VIEW2 | 62 |  |
| TRAILERLEFT | 63 |  |
| TRAILERRIGHT | 64 |  |
| TBA2\_TRAILER360 | 65 |  |
| TBA2\_TRAILERREARNORMAL | 66 |  |
| TBA2\_TRAILERINTERIOR\_VIEW1 | 67 |  |
| TBA2\_TRAILERINTERIOR\_VIEW2 | 68 |  |
| TBA2\_TRAILERLEFT | 69 |  |
| TBA2\_TRAILERRIGHT | 70 |  |
| IVV | 74 |  |
| AH\_REARZOOM | 81 |  |
| INTCAM1 | 82 | Interior view. In the Transit vehicle program this replaces the CHMSL view and displays the interior cargo area of the vehicle. |
| INTCAM2 | 83 | Interior view. In the Transit vehicle program this replaces the AUX view and displays the interior cabin area of the vehicle. |
| NORMAL\_360 | 84 | This view is 4 camera feeds stitched together to show exterior front, rear, left, and right areas around the vehicle within one video stream. |
| AUX\_CAM | 85 | Raw fisheye view from the AUX\_1 camera. |
| CHMSL\_CAM | 86 | Raw fisheye view from the CHMSL camera. |
| FRONT\_CAM | 87 | Raw fisheye view from the Front camera. |
| REAR\_CAM | 88 | Raw fisheye view from the Rear camera. |
| SIDE\_L\_CAM | 89 | Raw fisheye view from the left side camera. |
| SIDE\_R\_CAM | 90 | Raw fisheye view from the righty side camera. |
| FRONT\_LEFT\_OFFSET | 91 |  |
| FRONT\_RIGHT\_OFFSET | 92 |  |
| REAR\_LEFT\_OFFSET | 93 |  |
| REAR\_RIGHT\_OFFSET | 94 |  |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | G |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add new views for DAT 222 release |

#### IR-REQ-422105/A-CamSrv\_ArCameraView

**Description:** The enumeration below provides the camera views supported by the Augmented Reality (AR) Module.

As more Cameras and views are added, this list must be updated.

For sample views please see; <https://wiki.ford.com/display/CS/Cameras%2C+Views%2C+and+Configurations+Available>

|  |  |
| --- | --- |
| Value | Description |
| EXT\_FRONT\_AR\_RGB | Augmented Reality, Red, Green, Blue (RGB) Camera View. Shows the area to the front of the vehicle from a front windshield perspective.  Available only at the following resolutions:  1080p (1920x1080)  720p (1280x720)  Contacts for more information = ulangkam; cvootkur; dnachte1 |
| EXT\_FRONT\_AR\_FIR | Augmented Reality, Far InfraRed (FIR) Camera View.  Shows the area to the front of the vehicle from a front windshield perspective.  Available only at a resolution of:  640 x 480  Contacts for more information = ulangkam; cvootkur; dnachte1 |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | A |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - added for separate enum for the Augmented Raelity (AR) Module camera view values.  - Add CamSrv Prefix required to ensure uniqueness in AUTOSAR environment |

#### IR-REQ-464357/A-CamSrv\_DxpCameraView

**Description:** The enumeration below provides the camera views supported by the DXP Module from the Seat Display Module (SDM) cameras.

As more Cameras and views are added, this list must be updated.

For sample views please see; <https://wiki.ford.com/display/CS/Cameras%2C+Views%2C+and+Configurations+Available>

|  |  |
| --- | --- |
| **Value** | **Description** |
| FRONT\_LEFT\_SEAT | This is an Interior view of the Front Left Seat of the vehicle. |
| FRONT\_RIGHT\_SEAT | This is an Interior view of the Front Right Seat of the vehicle. |
| REAR\_LEFT\_SEAT | This is an Interior view of the Rear Left Seat of the vehicle. |
| REAR\_RIGHT\_SEAT | This is an Interior view of the Rear Right Seat of the vehicle. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | A |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** |  |

#### IR-REQ-470269/A-CamSrv\_PdcCameraView

**Description:** The enumeration below provides the camera views supported by the PDC Module.

As more Cameras and views are added, this list must be updated.

For sample views please see; <https://wiki.ford.com/display/CS/Cameras%2C+Views%2C+and+Configurations+Available>

|  |  |
| --- | --- |
| **Value** | **Description** |
| FRONT\_ROW\_SEAT | This is an Interior view of the Front Row Seat from overhead. |
| SECOND\_ROW\_SEAT | This is an Interior view of the Second Row Seat from overhead. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | A |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** |  |

### IR-REQ-403743/D-CamSrv\_CameraViewStatus

**Description:** This enumeration describes the possible camera view statuses.

|  |  |
| --- | --- |
| Value | Description |
| NOT\_AVAILABLE | The camera view is not configured as present within the specific vehicle. |
| AVAILABLE | The camera view is configured as present within the specific vehicle. |
| FAULTY | A serious hardware or configuration fault has occurred that prevents the camera responsible for this view from operating. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | D |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add CamSrv Prefix required to ensure uniqueness in AUTOSAR environment |

### IR-REQ-418781/B-CamSrv\_StreamStatus

**Description:** This enumeration describes the possible video stream statuses.

|  |  |
| --- | --- |
| Value | Description |
| NO\_REQUEST | There is no request to occupy this stream. |
| STREAMING | Actively streaming a camera view. |
| STREAMING \_FAILED | A failure has occurred while streaming the view.  Note: It is expected that the Camera Manager will send a Stop Video Stream command following the failure, in order to return the stream status to No\_Request. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | B |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add CamSrv Prefix required to ensure uniqueness in AUTOSAR environment |

### IR-REQ-403739/F-CamSrv\_Resolution

**Description:** This enumeration provides the list of available resolutions used to change a cameras configuration when starting or changing the video stream.

Please note: For the ADAS controller the orientation of all views (Portrait or landscape) will be based on the orientation of the SYNC Monitor installed in the specific vehicle.

|  |  |  |
| --- | --- | --- |
| **Value** | **ADAS Signal Value** | **Description** |
| RES\_1280\_BY\_800 | 0 | This is a high-resolution view. |
| RES\_640\_BY\_480 | 1 | This is a medium-resolution view. |
| RES\_480\_BY\_360 | 2 | This is a low-resolution view. |
| RESERVED\_ADAS1 | 3 | Needed to protect existing ADAS signal values not used by Camera Solution |
| RESERVED\_ADAS2 | 4 | Needed to protect existing ADAS signal values not used by Camera Solution |
| RESERVED\_ADAS3 | 5 | Needed to protect existing ADAS signal values not used by Camera Solution |
| RES\_1920\_BY\_1080 | n/a | 1080p – Not supported by ADAS |
| RES\_1280\_BY\_720 | n/a | 720p – Supported by the AR Module Views |
| RES\_ 2048\_BY\_1280 | n/a | 16:10 aspect ratio – supported by PDC |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | F |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add new Res supported by PDC |

### IR-REQ-403740/C-CamSrv\_FrameRate

**Description:** This enumeration provides the list of supported Frame rates for camera configurations, that can be used when starting or changing a video stream.

|  |  |
| --- | --- |
| **Value** | **Description** |
| FPS\_30 | 30 frames per second |
| FPS\_15 | 15 frames per second |
| FPS\_10 | 10 frames per second. |
| FPS\_60 | 60 frames per second, only supported by AR Views |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | C |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add CamSrv Prefix required to ensure uniqueness in AUTOSAR environment |

### IR-REQ-403741/C-CamSrv\_BitRate

**Description:** This enumeration provides the list of supported Bit Rates for camera configurations, that can be used when starting or changing a stream.

|  |  |
| --- | --- |
| **Value** | **Description** |
| KBPS\_10000 | 10,000 Kilobits per second |
| KBPS\_5000 | 5,000 kilobits per second |
| KBPS\_1000 | 1,000 kilobits per second. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | C |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add CamSrv Prefix required to ensure uniqueness in AUTOSAR environment |

### IR-REQ-403742/D-CamSrv\_BroadcastRequest

**Description:** This enumeration describes what action is requested for broadcast of data.

|  |  |
| --- | --- |
| **Value** | **Description** |
| ENABLE\_BROADCAST | A request to enable or start broadcasting |
| DISABLE\_BROADCAST | A request to disable or stop broadcasting. This will be the default value for the ADAS model. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | D |
| **Revision Date** | 26-Jul-2021 14:13 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Updated to align to ADAV values and GPB;  - from Enable to Enable\_Broadcast  - from Disable to Disable\_Broadcast |

### IR-REQ-403744/D-CamSrv\_RequestStatus

**Description:** This enumeration describes the immediate responses that will be given by the Camera Service. This includes only quick validation and acknowledgement of receipt. Actual status of processing the request will be provided in a broadcast update later.

|  |  |
| --- | --- |
| Value | Description |
| ACKNOWLEDGED | The request was received and has been passed on to other layers for processing. |
| ~~INVALID\_COMMAND~~ | ~~Incoming Request ID (start, change, or stop) matches~~ *~~the~~* ~~previous request ID.~~ |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | D |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Moving Invalid Command to Processing Status. Per ADAS team IPMB Ford Model will do Validation, so won't be part of immediate validation/ack.  - Add CamSrv Prefix required to ensure uniqueness in AUTOSAR environment |

### IR-REQ-411344/F-CamSrv\_StartProcessStatus

**Description:** This enumeration describes the final result of a request to start a video stream (success or failure type) which will be given by the Camera Service once processing has completed.

|  |  |  |
| --- | --- | --- |
| **Value** | **ADAS Signal Value** | **Description** |
| START\_SUCCESS | 0 | The request was processed successfully. |
| START\_FAILED | 1 | An error occurred while encoding the video, or an unknown error occurred. |
| INVALID\_START\_REQUEST | 2 | Requested camera view is not valid, unable to start a stream. |
| VALIDATION\_FAILED | 3 | Requested settings (resolution, framerate, bitrate) are not valid. **But** the video will stream using the cameras default settings. |
| ACCESS\_DENIED | 4 | The camera used for the requested view is part of an ongoing stream for a different view, so it cannot be accessed now. |
| ERROR\_CPU\_LOAD | 5 | Request is rejected because the CPU load is more than the threshold (90%) |
| ERROR\_BANDWIDTH\_LOAD | 6 | Request is rejected because bandwidth limit will be exceeded. Bandwidth threshold is 80% (48Mbps) |
| BUFFERING\_VIDEO\_ ERROR | 7 | An error occurred when establishing a buffer for this view. Note: This occurs for the Integrated Security Camera feature prior to the stream request being sent, but the buffering error will be communicated upon requesting the view to be streamed. Video will NOT be streamed. |
| CONFIG\_ERROR | 8 | An error was detected in the client configuration. |
| INVALID\_START\_COMMAND | 9 | Incoming Start Request ID matches *the* previous Request ID. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | F |
| **Revision Date** | 31-Aug-2021 14:34 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add "START" to interpretation values for Success, Failed, etc. in order to ensure uniqueness across proto files. |

### IR-REQ-435178/B-CamSrv\_StopProcessStatus

**Description:** This enumeration describes the final result of a request to stop a video stream (success or failure type) which will be given by the Camera Service once processing has completed.

|  |  |  |
| --- | --- | --- |
| **Value** | **ADAS Signal Value** | **Description** |
| STOP\_SUCCESS | 0 | The request was processed successfully. |
| STOP\_FAILED | 1 | An un-anticipated error occurred. |
| INVALID\_STOP\_REQUEST | 2 | Requested camera view is not currently streaming, so there is nothing to stop. |
| INVALID\_STOP\_COMMAND | 3 | Incoming Stop Request ID matches *the* previous request ID. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | B |
| **Revision Date** | 31-Aug-2021 14:34 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add "STOP" to interpretation values for Success, Failed, etc. in order to ensure uniqueness across proto files. |

### IR-REQ-435179/B-CamSrv\_ChangeProcessStatus

**Description:** This enumeration describes the final result of a request to change a video stream configuration (success or failure type) which will be given by the Camera Service once processing has completed.

|  |  |  |
| --- | --- | --- |
| **Value** | **ADAS Signal Value** | **Description** |
| CHANGE\_SUCCESS | 0 | The request was processed successfully. |
| CHANGE\_FAILED | 1 | An un-anticipated error occurred. |
| INVALID\_CHANGE\_REQUEST | 2 | Requested camera view is not currently streaming, so there is nothing to change. |
| INVALID\_CHANGE\_COMMAND | 3 | Incoming Change Request ID matches *the* previous request ID. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | B |
| **Revision Date** | 31-Aug-2021 14:34 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add "CHANGE" to interpretation values for Success, Failed, etc. in order to ensure uniqueness across proto files. |

### IR-REQ-409332/B-CamSrv\_PowerMode

**Description:** This enumeration describes the power mode options available based on desired camera views for the ADAS Module.

|  |  |
| --- | --- |
| **Value** | **Description** |
| OFF | No Low Power Mode is being requests |
| VIEWABLE\_CAMERAS | Request to Power on Cameras and any additional processor required to support video streaming. |
| FRONT\_WINDSHIELD\_CAMERA | Placeholder only for ADAS. May be used to power only a separate windshield camera/microprocessor, which is not currently available to stream. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | B |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add CamSrv Prefix required to ensure uniqueness in AUTOSAR environment |

### IR-REQ-411345/B-CamSrv\_PowerStatus

**Description:** This enumeration provides the status of the Camera Low Power Mode.

|  |  |
| --- | --- |
| **Value** | **Description** |
| ENABLED | Low Power Mode is enabled, and cameras are powered and ready for stream request. |
| DISABLED | Low Power Mode is not enabled. If ignition state is off, Cameras may not have power nor be ready to stream.  This is the default value. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | B |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add CamSrv Prefix required to ensure uniqueness in AUTOSAR environment  - Aligned to name in GPB and ADAS |

### IR-REQ-470542/A-CamSrv\_IgnitionStates

**Description:** This enumeration provides the list of possible ignition states in which the camera host module may support video streaming.

|  |  |
| --- | --- |
| **Value** | **Description** |
| ON | Video streaming is only supported when ignition state is on. |
| OFF | Video streaming is only supported when ignition state is off. |
| ON\_AND\_OFF | Video streaming is supported when ignition state is either on or off. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | A |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | New Requirement, added to allow modules to identify in which ignition states they will support video streaming. |

## Provided Interface Contracts

The sections below describe the common set of interfaces that shall be implemented as Camera Services across all Camera Controllers in the vehicle. These interfaces will be utilized by the Camera Manager to control video streams on behalf of various features.

In order to allow Camera Manager to easily interact with the various Camera Services a common naming schema has been created. Camera Manager will direct requests to the correct camera controller by using a generic SOA Topic and Message Name, and replacing the phrase, “host”, with the appropriate ECU acronym, like ADAS or AR.

When Implementing these interfaces, the ECU team MUST replace all occurrences of “Host” with the appropriate ECU acronym.

### IR-REQ-411859/D-CamSrv<host>CameraViewStatus

Each Camera Service shall implement an on-demand, on-change broadcast interface that will provide Camera Manager with the status of all camera views it hosts, as well as the installed version number of the Camera Service Software.

Note: ADAS module is exempt from versioning for their DAT 221 release.

For efficient implementation across camera controllers a common pattern of message and topic naming has been created, containing a “host” identifier. During implementation the ECU module team must replace all occurrences of the phrase “host” with the common ECU acronym of the camera controller (like ADAS or AR).

Message names shall follow the pattern of:

CamSrv<host>CameraViewStatus.<msg\_type>

Where CamSrv is a prefix required to ensure uniqueness in the AUTOSAR environment.

Where <host> is replaced by the common acronym of the ECU that acts as a camera controller. controller.

And <msg\_type> is replaced by the appropriate suffix for that type of message:

* Request
* Response
* Data

Topic names will follow the pattern below, where <host> is replaced by the common acronym of the controller.

* ***Request Topic:*** SERVICES/REQUEST/<host>/CAMERA\_SERVICE/STATUS
* ***Response Topic:*** <Consumer Provided>
* ***Data Topic:*** SERVICES/DATA/<host>/CAMERA\_STATUS

The Camera View Status interfaces in the sections below provide the detailed messaging for each Camera Controller.

**Please note:**

1. The interfaces below were structured taking into account the limitations of the SOA CDD implementation for FNV3, which cannot support strings, nested messages, nor repeated fields.
2. Current view configuration information (resolution, framerate, and bitrate) were removed since these cannot be provided by the ADAS camera processor.

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | D |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | Add view statuses for new DXP and Pheonix views. |

#### IR-REQ-410732/E-CamSrvAdasCameraViewStatus

***Purpose:*** This API will allow the Camera Manager to receive a list of views provided by the ADAS module along with the view statuses

This data broadcast shall be enabled by request. The values will be broadcast after receiving the request, and then re-broadcast anytime a view status is changed. The broadcast will end when a request to disable the broadcast is received, or the Camera Service is shutdown to conserve battery.

***Message Pattern:*** On Demand Broadcast, rebroadcast when data changes

***Request Topic:*** SERVICES/REQUEST/ADAS/CAMERA\_SERVICE/STATUS

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/ADAS/CAMERA\_STATUS

Notes:

Since the SOA CDD cannot support nested messages in order to create arrays, and AUTOSAR modules cannot support dynamic arrays, the values for each view are specifically created and named.

ADAS (DAT221 Release) is exempt from providing Version information in the broadcast.

ADAS DAT221 Release will NOT stream video when Ignition is on. It will continue to report the views as available, but any request to stream when ignition is on, will be denied.

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrvAdasCameraViewStatus.Request | enum | broadcast\_request | Type of broadcast request (enable or disable) see Data Type above named CamSrv\_BroadcastRequest |
| CamSrvAdasCameraViewStatus.Response | enum | command\_status | Acknowledgement that request was received, and broadcast should begin, see data type enum named CamSrv\_RequestStatus |
| CamSrvAdasCameraViewStatus.Data | enum | CamStatData\_FRONTNORMAL | Status of the camera view, see enum data type named CamSrv\_CameraViewStatus |
|  | enum | CamStatData\_REARNORMAL | Status of the camera view. |
|  | enum | CamStatData\_FRONT360 | Status of the camera view. |
|  | enum | CamStatData\_REAR360 | Status of the camera view. |
|  | enum | CamStatData\_FRONTSPLIT | Status of the camera view. |
|  | enum | CamStatData\_REARSPLIT | Status of the camera view. |
|  | enum | CamStatData\_REARZOOM | Status of the camera view. |
|  | enum | CamStatData\_CHMSL | Status of the camera view. |
|  | enum | CamStatData\_CHMSLZOOM | Status of the camera view. |
|  | enum | CamStatData\_AUX | Status of the camera view. |
|  | enum | CamStatData\_TBA2\_STRAIGHT\_BACK | Status of the camera view. |
|  | enum | CamStatData\_TADZOOM | Status of the camera view. |
|  | enum | CamStatData\_V5050 | Status of the camera view. |
|  | enum | CamStatData\_LEFT | Status of the camera view. |
|  | enum | CamStatData\_RIGHT | Status of the camera view. |
|  | enum | CamStatData\_TBA2\_REARSPLIT | Status of the camera view. |
|  | enum | CamStatData\_TBA2\_REAR360 | Status of the camera view. |
|  | enum | CamStatData\_TBA2\_CHMSL | Status of the camera view. |
|  | enum | CamStatData\_TBA2\_AUX | Status of the camera view. |
|  | enum | CamStatData\_TBA2\_REARNORMAL | Status of the camera view. |
|  | enum | CamStatData\_REAR\_FWD\_OFFSET | Status of the camera view. |
|  | enum | CamStatData\_REAR\_RWD\_OFFSET | Status of the camera view. |
|  | enum | CamStatData\_FRONT\_FWD\_OFFSET | Status of the camera view. |
|  | enum | CamStatData\_FRONT\_RWD\_OFFSET | Status of the camera view. |
|  | enum | CamStatData\_REAR\_FL\_CORNER | Status of the camera view. |
|  | enum | CamStatData\_REAR\_FR\_CORNER | Status of the camera view. |
|  | enum | CamStatData\_REAR\_RL\_CORNER | Status of the camera view. |
|  | enum | CamStatData\_REAR\_RR\_CORNER | Status of the camera view. |
|  | enum | CamStatData\_FRONT\_FL\_CORNER | Status of the camera view. |
|  | enum | CamStatData\_FRONT\_FR\_CORNER | Status of the camera view. |
|  | enum | CamStatData\_FRONT\_RL\_CORNER | Status of the camera view. |
|  | enum | CamStatData\_FRONT\_RR\_CORNER |  |
|  | enum | CamStatData\_FRONT\_ROCK\_CRAWL |  |
|  | enum | CamStatData\_REAR\_ROCK\_CRAWL |  |
|  | enum | CamStatData\_HITCH |  |
|  | enum | CamStatData\_AH\_REARNORMAL |  |
|  | enum | CamStatData\_TRAILER360 |  |
|  | enum | CamStatData\_TRAILERREARNORMAL |  |
|  | enum | CamStatData\_TRAILERINTERIOR\_VIEW1 |  |
|  | enum | CamStatData\_TRAILERINTERIOR\_VIEW2 |  |
|  | enum | CamStatData\_TRAILERLEFT |  |
|  | enum | CamStatData\_TRAILERRIGHT |  |
|  | enum | CamStatData\_TBA2\_TRAILER360 |  |
|  | enum | CamStatData\_TBA2\_TRAILERREARNORMAL |  |
|  | enum | CamStatData\_TBA2\_TRAILERINTERIOR\_VIEW1 |  |
|  | enum | CamStatData\_TBA2\_TRAILERINTERIOR\_VIEW2 |  |
|  | enum | CamStatData\_TBA2\_TRAILERLEFT |  |
|  | enum | CamStatData\_TBA2\_TRAILERRIGHT |  |
|  | enum | CamStatData\_IVV |  |
|  | enum | CamStatData\_AH\_REARZOOM |  |
|  | enum | CamStatData\_INTCAM1 |  |
|  | enum | CamStatData\_INTCAM2 |  |
|  | enum | CamStatData\_NORMAL\_360 |  |
|  | enum | CamStatData\_AUX\_CAM |  |
|  | enum | CamStatData\_CHMSL\_CAM |  |
|  | enum | CamStatData\_FRONT\_CAM |  |
|  | enum | CamStatData\_REAR\_CAM |  |
|  | enum | CamStatData\_SIDE\_L\_CAM |  |
|  | enum | CamStatData\_SIDE\_R\_CAM |  |
|  | enum | CamStatData\_FRONT\_LEFT\_OFFSET |  |
|  | enum | CamStatData\_FRONT\_RIGHT\_OFFSET |  |
|  | enum | CamStatData\_REAR\_LEFT\_OFFSET |  |
|  | enum | CamStatData\_REAR\_RIGHT\_OFFSET |  |
|  | enum | ignition\_state\_supported | Ignition State in which video streaming is allowed or supported (ON, OFF, or ON&OFF).  see data type enum named CamSrv\_IgnitionStates |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | E |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add new views for DAT 222 release  - Add parameter for Igntion state supported. |

#### IR-REQ-417486/C-CamSrvArCameraViewStatus

***Purpose:*** This API will allow the Camera Manager to receive a list of views provided by the Augmented Reality (AR) module along with the view statuses

This data broadcast shall be enabled by request. The values will be broadcast after receiving the request, and then re-broadcast anytime a view status is changed. The broadcast will end when a request to disable the broadcast is received, or the Camera Service is shutdown to conserve battery.

***Message Pattern:*** On Demand Broadcast, rebroadcast when data changes

***Request Topic:*** SERVICES/REQUEST/AR/CAMERA\_SERVICE/STATUS

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/AR/CAMERA\_STATUS

Notes:

Since the SOA CDD cannot support nested messages in order to create arrays, and AUTOSAR modules cannot support dynamic arrays, the values for each view are specifically created and named.

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrvArCameraViewStatus.Request | Enum | broadcast\_request | Type of broadcast request (enable or disable) see Data Type above named CamSrv\_BroadcastRequest |
| CamSrvArCameraViewStatus.Response | enum | command\_status | Acknowledgement that request was received, and broadcast should begin, or that versions or incompatible, see data type enum named CamSrv\_RequestStatus |
| CamSrvArCameraViewStatus.Data | uint32 | API\_major\_version | 3-digit number incremented to indicate a major software change that is NOT backward compatible |
|  | uint32 | API\_minor\_version | 3-digit number incremented to indicate a minor software change that IS backward compatible (additions) |
|  | uint32 | API\_file\_updt\_version | 3-digit number incremented to indicate either a pre-production update, or software change that does not impact interfaces or functionality, like bug fixes, comments or tags |
|  | enum | Ignition\_state\_supported | Ignition State in which video streaming is allowed or supported (ON, OFF, or ON&OFF).  see data type enum named CamSrv\_IgnitionStates |
|  | enum | ignition\_state\_supported |  |
|  | enum | CamStatData\_EXT\_FRONT\_AR\_RGB | Status of the camera view, see enum data type named CamSrv\_CameraViewStatus |
|  | enum | CamStatData\_EXT\_FRONT\_AR\_FIR | Status of the camera view. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | C |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - add ignition state supported parameter |

#### IR-REQ-464377/A-CamSrvDxpCameraViewStatus

***Purpose:*** This API will allow the Camera Manager to receive a list of views provided by the DXP module along with the view statuses

This data broadcast shall be enabled by request. The values will be broadcast after receiving the request, and then re-broadcast anytime a view status is changed. The broadcast will end when a request to disable the broadcast is received, or the Camera Service is shutdown to conserve battery.

***Message Pattern:*** On Demand Broadcast, rebroadcast when data changes

***Request Topic:*** SERVICES/REQUEST/DXP/CAMERA\_SERVICE/STATUS

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/DXP/CAMERA\_STATUS

Notes:

Since the SOA CDD cannot support nested messages in order to create arrays, and AUTOSAR modules cannot support dynamic arrays, the values for each view are specifically created and named.

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrvDxpCameraViewStatus. Request | Enum | broadcast\_request | Type of broadcast request (enable or disable) see Data Type above named CamSrv\_BroadcastRequest |
| CamSrvDxpCameraViewStatus. Response | enum | command\_status | Acknowledgement that request was received, and broadcast should begin, or that versions or incompatible, see data type enum named CamSrv\_RequestStatus |
| CamSrvDxpCameraViewStatus.Data | uint32 | API\_major\_version | 3-digit number incremented to indicate a major software change that is NOT backward compatible |
|  | uint32 | API\_minor\_version | 3-digit number incremented to indicate a minor software change that IS backward compatible (additions) |
|  | uint32 | API\_file\_updt\_version | 3-digit number incremented to indicate either a pre-production update, or software change that does not impact interfaces or functionality, like bug fixes, comments or tags |
|  | enum | ignition\_state\_supported | Ignition State in which video streaming is allowed or supported (ON, OFF, or ON&OFF).  see data type enum named CamSrv\_IgnitionStates |
|  | enum | CamStatData\_FRONT\_LEFT\_SEAT | Status of the camera view, see enum data type named CamSrv\_CameraViewStatus |
|  | enum | CamStatData\_FRONT\_RIGHT\_SEAT | Status of the camera view. |
|  | enum | CamStatData\_REAR\_LEFT\_SEAT | Status of the camera view. |
|  | enum | CamStatData\_REAR\_RIGHT\_SEAT | Status of the camera view. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | A |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | new requirement for new camera host module. |

#### IR-REQ-470270/A-CamSrvPdcCameraViewStatus

***Purpose:*** This API will allow the Camera Manager to receive a list of views provided by the PDC module along with the view statuses

This data broadcast shall be enabled by request. The values will be broadcast after receiving the request, and then re-broadcast anytime a view status is changed. The broadcast will end when a request to disable the broadcast is received, or the Camera Service is shutdown to conserve battery.

***Message Pattern:*** On Demand Broadcast, rebroadcast when data changes

***Request Topic:*** SERVICES/REQUEST/DXP/CAMERA\_SERVICE/STATUS

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/DXP/CAMERA\_STATUS

Notes:

Since the SOA CDD cannot support nested messages in order to create arrays, and AUTOSAR modules cannot support dynamic arrays, the values for each view are specifically created and named.

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrvDxpCameraViewStatus. Request | Enum | broadcast\_request | Type of broadcast request (enable or disable) see Data Type above named CamSrv\_BroadcastRequest |
| CamSrvDxpCameraViewStatus. Response | enum | command\_status | Acknowledgement that request was received, and broadcast should begin, or that versions or incompatible, see data type enum named CamSrv\_RequestStatus |
| CamSrvDxpCameraViewStatus.Data | uint32 | API\_major\_version | 3-digit number incremented to indicate a major software change that is NOT backward compatible |
|  | uint32 | API\_minor\_version | 3-digit number incremented to indicate a minor software change that IS backward compatible (additions) |
|  | uint32 | API\_file\_updt\_version | 3-digit number incremented to indicate either a pre-production update, or software change that does not impact interfaces or functionality, like bug fixes, comments or tags |
|  | enum | ignition\_state\_supported | Ignition State in which video streaming is allowed or supported (ON, OFF, or ON&OFF).  see data type enum named CamSrv\_IgnitionStates |
|  | enum | CamStatData\_FRONT\_ROW\_SEAT | Status of the camera view, see enum data type named CamSrv\_CameraViewStatus |
|  | enum | CamStatData\_SECOND\_ROW\_SEAT | Status of the camera view. |

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| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | A |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | new requirement for new camera host module. |

### IR-REQ-409234/F-CamSrvHostStartVideoStream

***Purpose:*** This interface will allow Camera Manager to start a video stream for the specified camera view.

***Message Pattern:*** Request / Response followed by a one-time status broadcast

**Note:** The response is a quick acknowledgement of receipt and initial validation. It is followed later by a one-time broadcast of the final processing status. This was done because the actual processing takes some time and may be done in a separate microprocessor. This prevents blocking other SOA messaging while the request is processed.

***Request Topic:*** SERVICES/REQUEST/<host>/CAMERA\_SERVICE/STREAM

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/<host>/START\_STREAM\_STATUS

Notes:

1. The IP Address of the stream destination has been broken into 4 parts since the FNV2/FNV3 implementation of the SOA Complex Device Driver for AUTOSAR Classic Modules does not support strings.
2. When sending a start stream request to the ADAS module, Camera Manager must wait for ADAS to respond before sending the next start stream request. This will prevent the second start stream request from inadvertently superseding or overwriting the prior request while it is in progress.

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrv<host>StartVideoStream.Request | Enum | camera\_view | Camera View to be streamed.  See enum named CamSrv\_<host>CameraView |
|  | Enum | resolution | Desired resolution for the video. See enum named CamSrv\_Resolution |
|  | Enum | frame\_rate | Desired frame rate for the video. See enum named CamSrv\_FrameRate |
|  | Enum | bit\_rate | Desired bit rate for the video. See enum named Cam\_srv\_Bitrate |
|  | uint32 | request\_id | Unique number of the request assigned by Camera Manager, used to link the final processing result to the originating request. The number will go from 1 to 255, and then start over. |
|  | uint32 | port | Port to be used for the stream. |
|  | uint32 | ip\_address\_part1 | First portion of the IP address for the stream. NOTE: Strings are not supported by the SOA CDD, so breaking into parts. |
|  | uint32 | ip\_address\_part2 | Second portion of the IP address for the stream |
|  | uint32 | ip\_address\_part3 | Third portion of the IP address for the stream |
|  | uint32 | ip\_address\_part4 | Fourth portion of the IP address for the stream |
|  | uint32 | cloud\_dest\_port | Optional – port used to stream direct to cloud through WIR system (intended for RIViS and DXP) |
|  | uint32 | cloud\_dest\_ip\_part1 | Optional – part 1 of IP address to stream direct to cloud through WIR system (intended for RIViS and DXP) |
|  | uint32 | cloud\_dest\_ip\_part2 | Optional – part 2 of IP address to stream direct to cloud through WIR system (intended for RIViS and DXP) |
|  | uint32 | cloud\_dest\_ip\_part3 | Optional – part 3 of IP address to stream direct to cloud through WIR system (intended for RIViS and DXP) |
|  | uint32 | cloud\_dest\_ip\_part4 | Optional – part 4 of IP address to stream direct to cloud through WIR system (intended for RIViS and DXP) |
| CamSrv<host>StartVideoStream.Response | Enum | command\_status | Request receipt acknowledgement, indicating request is in progress. See enum named CamSrv\_RequestStatus |
| CamSrv<host>StartStream.Data | uint32 | Request\_id | Unique ID of the start stream request. |
|  | Enum | strt\_strm\_command\_status | Status of the Start Stream Request. See enum named CamSrv\_StartProcessStatus |

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| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | F |
| **Revision Date** | 10-Dec-2021 17:04 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Add direct to cloud IP address and port fields - for DXP/RIViS special use case. |

### IR-REQ-409235/E-CamSrvHostStopVideoStream

***Purpose:*** This interface will allow Camera Manager to stop a video stream for a specific Camera View.

***Message Pattern:*** Request / Response followed by a one-time status broadcast

***Request Topic:*** SERVICES/REQUEST/<host>/CAMERA\_SERVICE/STOP\_STREAM

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/<host>/STOP\_STREAM\_STATUS

**Note:** When sending a stop stream request to the ADAS module, Camera Manager must wait for ADAS to respond before sending the next stop stream request. This will prevent the second stop stream request from inadvertently superseding or overwriting the prior request while it is in progress.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** | |
| CamSrv<host>StopVideoStream.Request | Enum | camera\_view | Camera View to be stopped.  See enum named CamSrv\_<host>CameraView | |
|  | uint32 | request\_id | Unique number of the request assigned by Camera Manager, used to link the final processing result to the originating request. | |
| CamSrv<host>StopVideoStream.Response | Enum | command\_status | Request receipt acknowledgement, indicating request is in progress. See enum named CamSrv\_RequestStatus. | |
| CamSrv<host>StopVideoStream.Data | uint32 | Request\_id | Unique ID of the stop stream request. |
|  | Enum | stp\_strm\_command\_status | Status of the stop stream request. See enum named CamSrv\_StopProcessStatus. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | E |
| **Revision Date** | 31-Aug-2021 14:34 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Update Processing enum name now that they are separate for Start, change, and stop |

### IR-REQ-409916/E-CamSrvHostChangeViewConfig

***Purpose:*** This interface will allow Camera Manager to change the configuration of an active camera video stream. Please note there will be a delay on the order of one second for the camera to alter the configuration of the active video stream

***Message Pattern:*** Request / Response followed by a one-time status broadcast

***Request Topic:*** SERVICES/REQUEST/<host>/CAMERA\_SERVICE/CHANGE\_STREAM

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/<host>/CHANGE\_STREAM\_STATUS

**Note:** When sending a change stream request to the ADAS module, Camera Manager must wait for ADAS to respond before sending the next change stream request. This will prevent the second change stream request from inadvertently superseding or overwriting the prior request while it is in progress.

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrv<host>ChangeViewConfig.Request | Enum | camera\_view | Camera View to be changed. See enum named CamSrv\_<host>CameraView |
|  | uint32 | request\_id | Unique number of the request assigned by Camera Manager, used to link the final processing result to the originating request. |
|  | Enum | resolution | New desired resolution for the active video stream. See enum named CamSrv\_Resolution |
|  | Enum | framerate | New desired frame rate for the active video stream. See enum named CamSrv\_FrameRate |
|  | Enum | bitrate | New desired frame rate for the active video stream. See enum named CamSrv\_BitRate |
| CamSrv<host>ChangeViewConfig.Response | Enum | command\_status | Request receipt acknowledgement, indicating request is in progress. See enum named CamSrv\_RequestStatus. |
| CamSrv<host>ChangeViewConfig.Data | uint32 | Request\_id | Unique ID of the change stream request. |
|  | Enum | chg\_view\_command\_status | Status of the change stream request. See enum named CamSrv\_ChangeProcessStatus |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | E |
| **Revision Date** | 31-Aug-2021 14:34 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Update Processing enum name now that they are separate for Start, change, and stop |

### IR-REQ-418782/B-CamSrvHostVideoStreamStatuses

***Purpose:*** This API will allow the Camera Manager to receive the statuses of any video streams along with the view being streamed if active.

This data broadcast shall be enabled by request, and then broadcast periodically, on the order of every 500 milliseconds, from that point forward. The broadcast will end when a request to disable the broadcast is received, or the Camera Service is shutdown to conserve battery.

***Message Pattern:*** On Demand Broadcast, updated periodically

***Request Topic:*** SERVICES/REQUEST/<host>/CAMERA\_SERVICE/STREAM\_STATUS

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/<host>/STREAM\_STATUS

Notes:

* <host> in the above topic names should be replaced with the common name of the ECU hosting the Camera Service (like ADAS or AR).
* Since the SOA CDD cannot support nested messages in order to create arrays, and AUTOSAR modules cannot support dynamic arrays, the values for each of the possible streams are specifically created and named (stream1, stream2, and stream3).

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrv<Host>VideoStreamStatus.Request | Enum | broadcast\_request | Type of broadcast request (enable or disable). See enum named CamSrv\_BroadcastRequest |
| CamSrv<Host>VideoStreamStatus.Response | enum | command\_status | Acknowledgement that request was received, and broadcast should begin, or that versions or incompatible. See enum named CamSrv\_RequestStatus |
| CamSrv<Host>VideoStreamStatus.Data | enum | stream1\_view\_name | Name of the Camera View being streamed, or None.  See enum named CamSrv\_<host>CameraViews |
|  | enum | stream1\_status | Status of the video stream  See enum named CamSrv\_StreamStatus. |
|  | enum | stream2\_view\_name | Name of the Camera View being streamed, or None.  See enum named CamSrv\_<host>CameraViews |
|  | enum | stream2\_status | Status of the video stream.  See enum named CamSrv\_StreamStatus. |
|  | enum | stream3\_view\_name | Name of the Camera View being streamed, or None.  See enum named CamSrv\_<host>CameraViews |
|  | enum | stream3\_status | Status of the video stream.  See enum named CamSrv\_StreamStatus. |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | B |
| **Revision Date** | 15-Jun-2021 14:59 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Update Response Topic to <Consumer Provided> per ECG requestand Ford SOA Broker Standard.  - Correct Data Topic Stream\_Status not Camera\_Status  - Add CamSrv prefix for uniqueness in AUTOSAR  - Add "host" to name & need cam view by host. |

### IR-REQ-409331/D-CamSrvHostLowPowerMode

***Purpose:*** This interface will be implemented by any camera controller that supports a low power mode. It will allow Camera Manager to request the module power up cameras and additional microprocessors necessary for video streaming, while leaving other functionality un-powered in order to conserve battery life in an ignition off state.

The Camera Service for each Camera Controller that has a low power mode, will replace <host> in the message name and topic with the applicable acronym for the ECU controlling the cameras (like ADAS, AR, SYNC, etc.)

***Message Pattern:*** Request / Response followed by a one-time status broadcast

***Note:*** It can take @ 1 second for the cameras to power up and initialize.

***Request Topic:*** SERVICES/REQUEST/<host>/CAMERA\_SERVICE/POWER\_MODE

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/<host>/POWER\_MODE\_STATUS

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrv<host>LowPowerMode.Request | Enum | powermode | Power Mode to be initiated, based on desired views to stream.  See enum named CamSrv\_PowerMode. |
| CamSrv<host>LowPowerMode.Response | Enum | command\_status | Receipt acknowledged or Incompatible version. See enum named CamSrv\_RequestStatus |
| CamSrv<host>LowPowerMode.Data | Enum | lwr\_pwr\_command\_status | Status of lower power mode (enabled or disabled). When enabled cameras are powered and ready for stream requests. See enum named CamSrv\_CameraLowPowerStatus |

|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | D |
| **Revision Date** | 31-Aug-2021 14:34 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Correct Data Message Name for consistency and SOA CDD format |

#### IR-REQ-419702/C-CamSrvAdasLowPowerMode

***Purpose:*** The ADAS module supports a low power mode, for cameras. This interface will allow Camera Manager to request the ADAS module to power up cameras and additional microprocessors necessary for video streaming, while leaving other functionality un-powered in order to conserve battery life in an ignition off state.

***Message Pattern:*** Request / Response followed by a one-time status broadcast

***Note:*** It can take @ 1 second for the ADAS cameras to power up and initialize.

***Request Topic:*** SERVICES/REQUEST/ADAS/CAMERA\_SERVICE/POWER\_MODE

***Response Topic:*** <Consumer Provided>

***Data Topic:*** SERVICES/DATA/ADAS/POWER\_MODE\_STATUS

|  |  |  |  |
| --- | --- | --- | --- |
| **Message Name** | **Data Type** | **Message Element Name** | **Description** |
| CamSrvAdasLowPowerMode.Request | Enum | powermode | Power Mode to be initiated, based on desired views to stream.  See enum named CamSrv\_PowerMode |
| CamSrvAdasLowPowerMode.Response | Enum | command\_status | Receipt acknowledged or Incompatible version. See enum named CamSrv\_RequestStatus |
| CamSrvAdasLowPowerMode.Data | Enum | lwr\_pwr\_command\_status | Status of lower power mode (enabled or disabled). When enabled cameras are powered and ready for stream requests. See enum named CamSrv\_PowerStatus |

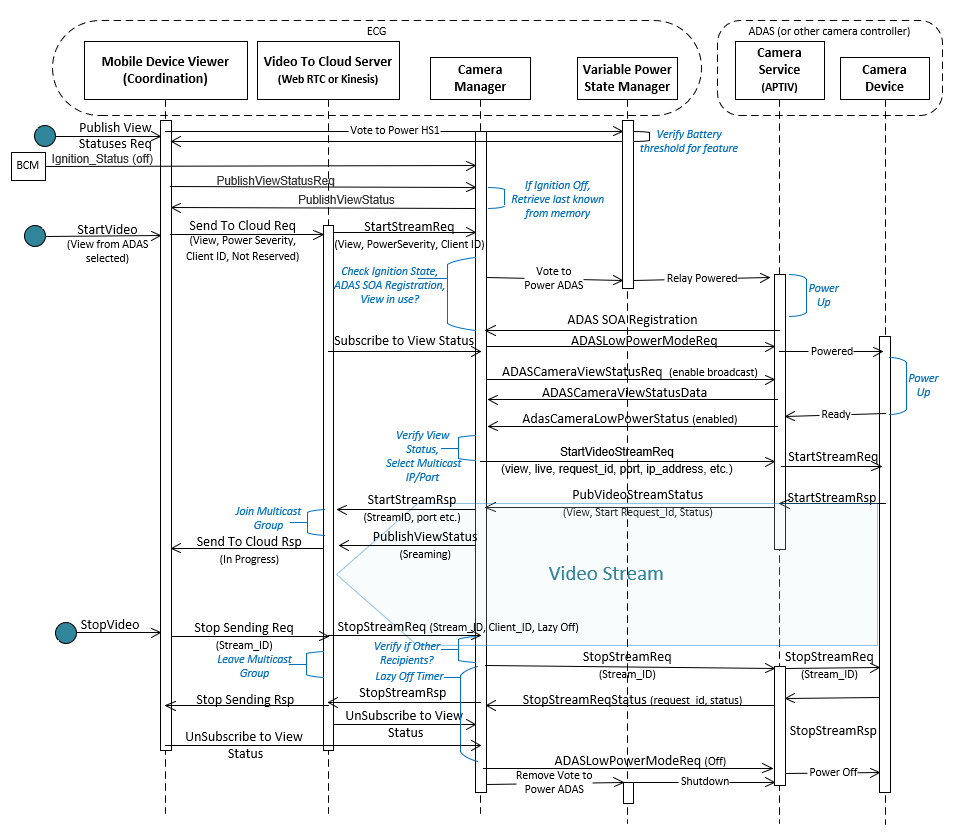
|  |  |
| --- | --- |
| **Requirement Information** | |
| **Requirement Type** | IR - Interface Requirement |
| **Requirement Revision** | C |
| **Revision Date** | 31-Aug-2021 14:34 |
| **Revised By** | Morris, Melissa (mmorr183) |
| **Revision Status** | Released |
| **Revision Comments** | - Not Revised - Data message name was already correct. Only the "host" template message name was incorrect. |

# Service Behavioral Diagrams

The sections below include sample, high-level sequence diagrams for various activities related to the Camera Service.

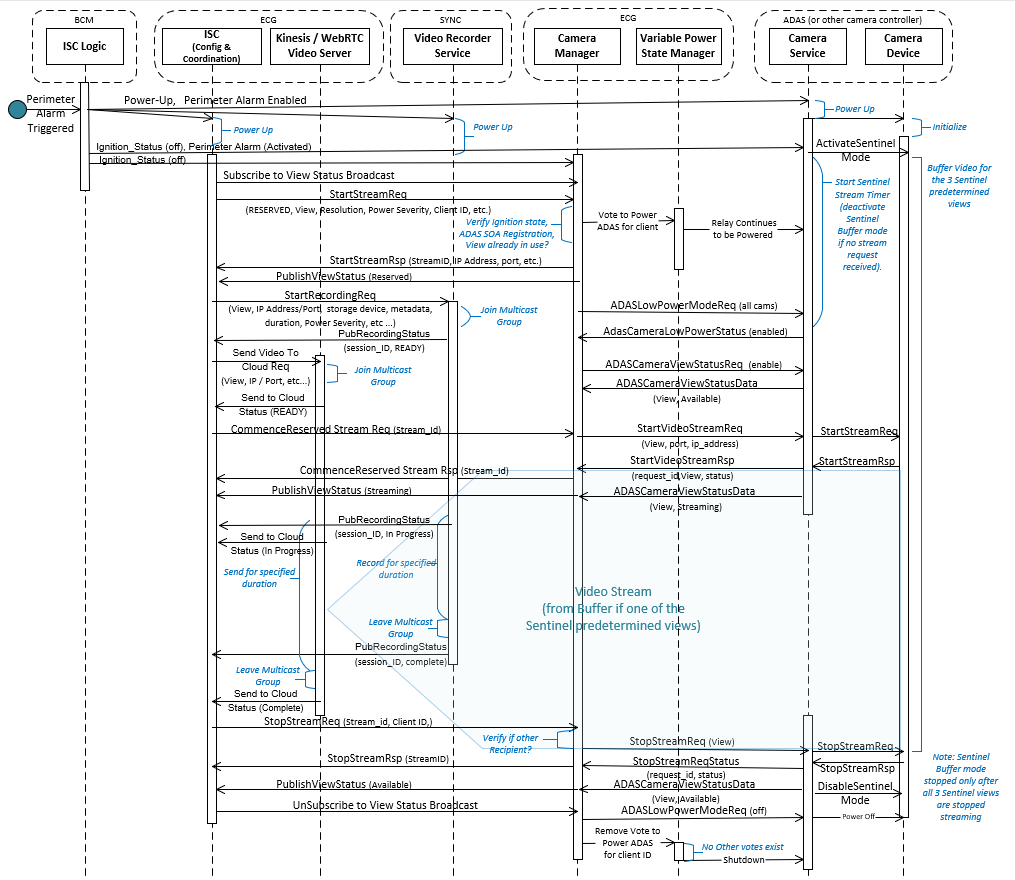
## Mobile Device Viewer Sequence Diagram

Below is a high-level sequence diagram for a start and stop video stream interaction for Mobile Device Viewer.



## Integrated Security Cameras Sequence Diagram

Below is a high-level sequence diagram of the interactions for the Integrated Security Cameras (Sentinel) use case, where the video is recorded within the vehicle as well as sent up to the cloud for potential storage or viewing there. It assumes multicasting is enabled in the vehicle.



# GPB Files (GitHub Links)

The Google Protobuf (GPB) files, used as interface definition language for coding, are available from several sources.

**Released in VSEM under:**

Function Group: Fn009448

Function ID: Fn013102

VSEM Document: VDOC090429

Note: The actual Proto Files are found under “General Data Artifacts” of the Function, using the My Team Center View.

**Github Repos:**

**Draft GBP Files are at:** <https://github.ford.com/sw-architecture/idl/tree/master/Services/CameraService>

**Ford GBP Repository is**: <https://github.ford.com/FNV/idl/tree/master/cameraservice>

Please note that once an ECG in house development team is engaged to work on the Camera Manager, the GPB files will be moved from the Draft location above to the common Ford Master Repository which is also cloned for supplier access.

**Creating ECU Specific GPB Files:**

The ECU team is responsible for taking the Master (or template) GPB files, and altering them for their specific views the ECU.

The master set of GPB files is found at: <https://github.ford.com/sw-architecture/idl/tree/master/Services/CameraService/Master_List>

Instructions for altering the Master GPBs to be ECU specific are in the readme file displayed at the bottom of the above github repo.

Basically, the ECU team MUST replace all occurrences of the word “Host” with the appropriate ECU acronym, both in the file name, and within the GPB file itself. They must also update the view enumeration for their ECU, and the list of views provided in the CameraViewStatus file.

**List of Master GPB file names:**

* HostCameraServiceCommon.proto
* HostCamera**ViewStatus**.proto
* Host**Start**VideoStream.proto
* Host**Change**ViewConfig.proto
* Host**Stop**VideoStream.proto
* Host**StreamStatus**.proto
* Host**LowPowerMode**.proto

Some ECU Specific GPBs have been provided for the convenience of the early adopters.

**ADAS Module:**

<https://github.ford.com/sw-architecture/idl/tree/master/Services/CameraService/ADAS>

* AdasCameraServiceCommon.proto
* AdasCameraViewStatus.proto
* AdasChangeViewConfig.proto
* AdasLowPowerMode.proto
* AdasStartVideoStream.proto
* AdasStopVideoStream.proto
* AdasVideoStreamStatus.proto

**Augmented Reality (AR) Module:**

<https://github.ford.com/sw-architecture/idl/tree/master/Services/CameraService/AR>

* ArCameraServiceCommon.proto
* ArCameraViewStatus.proto
* ArChangeViewConfig.proto
* ArStartVideoStream.proto
* ArStopVideoStream.proto
* ArVideoStreamStatus.proto