HomeKit Secure Video Open Source Compatibility Guide

Developer Preview

Developer

Contents

1. Introduction

1.1. Feature Overview

This document specifies the HomeKit Accessory Protocol (HAP) services, characteristics and communication protocol for IP camera accessories that support streaming and Camera Event Recording Management.

This specification complements version R17 or later of the official HomeKit Accessory Protocol Specification.

1.2. Requirements, Recommendations, and Permissions

The use of the words must, must not, required, shall, shall not, should, should not, recommended, not recommended, may, optional, and deprecated in a statement have the following meanings:

- must, shall, or required means the statement is an absolute requirement.
- must not, shall not, or prohibited means the statement is an absolute prohibition.
- should or recommended means the full implications must be understood before choosing a different course.
- should not or not recommended means the full implications must be understood before choosing this course.
- may or optional means the statement is truly optional, and its presence or absence cannot be assumed.
- deprecated means the statement is provided for historical purposes only and is equivalent to 'must not'.

1.3. Terminology

- HomeKit Accessory Protocol (HAP) - Protocol used by the accessory to communicate with Apple devices

1.3.1. Accessory, Device, and Product

Throughout this specification:

- The term device or controller is used to refer to an Apple iPod, iPhone, iPad, or Apple Watch (typically running iOS, iPadOS or watchOS, Apple's mobile operating systems).
- The term accessory is used to refer to any product intended to interface with a device via the means described in this specification.
- The term product is used to refer generically to either a Mac (Apple computers that run macOS) or an aforementioned device.

2. Minimum Requirements

The accessory must support at least three concurrent video encodings on each sensor. For 16:9 sensors, the resolutions are:

	4K Camera	2K Camera	1080p Camera
High quality stream	4K at 24 or 30fps	2K at 24 or 30fps	1080p at 30fps
Medium quality stream	1080p at 30fps	1080p at 30fps	720p at 30fps
Low quality stream	360p at 15fps or 240p at 30fps	360p at 15fps or 240p at 30fps	360p at 15fps or 240p at 30fps

A fourth encoding (“Highest”) is supported for 4K sensors that are capable of also providing a 2K stream simultaneously (see “Video Quality” enumeration).

The following table lists a comprehensive list of resolutions for sensors with various aspect ratios.

Aspect Ratio	4K Camera	2K Camera	1080p Camera
16:9	3840x2160 1920x1080 640x360	2560x1440 1920x1080 640x360	1920x1080 1280x720 640x360
9:16	2160x3840 1080x1920 360x640	1440x2560 1080x1920 360x640	1080x1920 720x1280 360x640
4:3	2880x2160 1600x1200 640x480	2048x1536 1600x1200 640x480	1600x1200 1440x1080 640x480
3:4	2400x3200 1200x1600 480x640	1536x2048 1200x1600 480x640	1200x1600 960x1280 480x640
1:1	2880x2880 1440x1440 480x480	1920x1920 1440x1440 480x480	1440x1440 1080x1080 480x480

The accessory must provide maximum and average bitrate information for each video encoding corresponding to encoded video at acceptable quality for the particular encoder being used.

The gap between maximum bitrate and average bitrate is recommended to be 10% or less of the peak bitrate.

The following tables indicate the target bitrates for sensors. Note that Aspect Ratio is not a factor in bitrate targets. Lower average bitrates are acceptable if the vendor's quality targets are met, but maximum bitrates should not be exceeded.

Resolution	FPS	Average Kbps	Maximum Kbps
4K	24 or 30	4500	5000
2K	24 or 30	2800	3000
1080p	30	1700	1800
720p	30	768	800
360p or 240p	15 or 30	180	190

The accessory must support High Efficiency Video Coding (HEVC).

The accessory must support Opus audio encoding.

- 16 kHz capture sampling rate is mandatory.
- 24 kHz capture sampling rate is recommended.

NOTE: With Opus, transmission sample rate is always 48 KHz, which is what should be reported by the characteristic. The capture sampling rate should be 16 or 24 kHz.

3. Services

IP camera accessories that support streaming and recording must implement the services specified in *Section 12 of the HomeKit Accessory Protocol Specification* with the following modifications.

3.1. Camera Capabilities

The Camera Capabilities Service is specific to this project and is intended as the primary mechanism by which an accessory will advertise its capabilities over HAP.

Property	Value
UUID	00008010-0000-1000-8000-0026BB765291
Type	public.hap.service.camera-capabilities
Required Characteristics	Version (“11.31 Version” as defined in R17) Camera Capabilities
Optional Characteristics	Manually Disabled

Note that the version characteristic for Camera Capabilities has a characteristic type of “string”, and will contain the value “17.99”. This version may be updated prior to release.

3.2. Camera Global Operating Mode

This service allows configuring operation of the accessory as a whole.

Property	Value
UUID	00008032-0000-1000-8000-0026BB765291
Type	public.hap.service.camera-global-operating-mode
Required Characteristics	HomeKit Camera Active Streaming Enabled Camera Operating Mode Indicator
Optional Characteristics	Manually Disabled Night Vision Third Party Camera Active

3.3. Motion Sensor

This service has been enhanced to support multi-sensor capabilities.

Property	Value
UUID	00000085-0000-1000-8000-0026BB765291
Type	public.hap.service.sensor.motion
Required Characteristics	Motion Detected (“11.17 Motion Detected” as defined in R17)
Optional Characteristics	Name (“11.18 Name” as defined in R17) Status Active (“11.48 Status Active” as defined in R17) Status Fault (“11.50 Status Fault” as defined in R17) Status Tampered (“11.53 Status Tampered” as defined in R17) Status Low Battery (“11.52 Status Low Battery” as defined in R17) Contributing Sensors Motion Enabled

The new Contributing Sensors optional characteristic should be used when identifying the sensors which contributed to motion detection.

3.4. Camera Motion Zones

Motion zones will allow the user to specify regions of interest for motion analysis, whereby only motion events within those regions of interest are reported or used for analysis. These zones are supplied to the accessory via the Camera Motion Zones service and associated characteristics. Note that these are sometimes referred to as “Activity Zones” and the two terms can be used interchangeably.

Note that the version characteristic for Camera Motion Zones has a characteristic type of “string”, and will contain the value “17.99”. This version may be updated prior to release.

Property	Value
UUID	00008021-0000-1000-8000-0026BB765291
Type	public.hap.service.camera-motion-zones
Required Characteristics	Version (“11.31 Version” as defined in R17) Active (“11.89 Active” as defined in R17) Camera Zones
Optional Characteristics	None

3.5. Camera Buffer Management

This service allows the accessory to manage its buffers to facilitate recording, uploads, and video processing.

Property	Value
UUID	00008000-0000-1000-8000-0026BB765291
Type	public.hap.service.camera-buffer-management
Required Characteristics	Buffer Upload Command Buffer Activity Command Buffer Event Command Buffer Event Sequence Number Camera Recording Publishing Point
Optional Characteristics	None

3.6. Camera Multi-Tier RTP Stream Management

This service enables the accessory to advertise the codecs and streaming tiers it supports, and to configure and control RTP sessions to stream the audio/video to devices. This service allows multiple clients to stream concurrently per each video encoding. There is no concept of a one-to-one mapping between a video encoder and an RTP streaming session.

Starting or stopping any individual stream may cause a reconfiguration of the requested video encoder configuration.

Property	Value
UUID	00008031-0000-1000-8000-0026BB765291
Type	public.hap.service.camera-multi-tier-rtp-stream-management

Property	Value
Required Characteristics	Streaming Enabled Status Active Supported Video Stream Tiers Supported Audio Stream Tiers Supported RTP Configuration Setup Endpoints RTP Streaming Control Sensor UUID
Optional Characteristics	None

The accessory must support at least five (5) simultaneous RTP sessions.

The accessory must reject any request to start a stream if “Status Active” is set to false.

Status Active must be set to false if any of the following conditions hold:

- Streaming Enabled on this service is false.
- HomeKit Camera Active is false on the Camera Global Operating Mode service.
- Streaming Enabled is false on the Camera Global Operating Mode service.
- The Manually Disabled characteristic exists on the Camera Global Operating Mode service, and its value is true.

Supported RTP Configuration must be set to AES_CM_128_HMAC_SHA1_80.

3.7. Camera WebRTC Stream Management

This service allows the accessory to offer streams over WebRTC.

Property	Value
UUID	00008033-0000-1000-8000-0026BB765291
Type	public.hap.service.camera-webrtc-stream-management

Required Characteristics	WebRTC Solicit Offer WebRTC Provide Answer WebRTC Streaming Control WebRTC Number of Active Sessions WebRTC Reoffer WebRTC Update Session WebRTC Supported Video Stream Tiers WebRTC Supported Audio Stream Tiers Streaming Enabled Sensor UUID
Optional Characteristics	None

The accessory must support at least six (6) simultaneous WebRTC sessions.

3.8. Camera Recording Management

This service enables the accessory to advertise parameters to configure and control camera event recording sessions.

Property	Value
UUID	00000204-0000-1000-8000-0026BB765291
Type	public.hap.service.camera-recording-management
Required Characteristics	Active Recording Audio Active
Optional Characteristics	None

3.9. Camera Key Management

This service allows the accessory to manage keys as a part of the CMAF Ingest provisioning process.

Property	Value
UUID	00008050-0000-1000-8000-0026BB765291

Type	public.hap.service.camera-key-management
Required Characteristics	Camera Key Camera Key ID
Optional Characteristics	None

3.10.Camera Client Certificate Management

This service allows the accessory to manage client certificates as a part of the CMAF Ingest provisioning process.

Property	Value
UUID	00008080-0000-1000-8000-0026BB765291
Type	public.hap.service.camera-client-certificate-management
Required Characteristics	Camera Client CSR Camera Client Certificate Camera Client Certificate Status
Optional Characteristics	None

4. Characteristics

This chapter specifies new and updated characteristics that an accessory supporting this feature shall implement in addition to the IP Cameras characteristics specified in Section 12 IP Cameras of the HomeKit Accessory Protocol Specification.

4.1. Sensor UUID

This characteristic identifies which sensor a service instance represents.

Property	Value
UUID	0000805B-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.sensor-uuid
Permissions	Paired Read
Format	data

4.2. Motion Enabled

This characteristic identifies whether or not motion detection is enabled for the accessory's motion detector.

Property	Value
UUID	00008087-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.motion-enabled
Permissions	PairedRead, PairedWrite, Notify, TimedWrite, AdminOnly
Format	boolean

4.3. Supported Video Stream Tiers

This characteristic allows an IP Camera accessory to describe the parameters supported for streaming video over an RTP session.

Property	Value
UUID	00008043-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.supported-video-stream-tiers
Permissions	Paired Read, Notify

Property	Value
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Codec	enum	The video codec, indicated using the Video Codec Type enumeration (defined below).
2	Payload Type	uint8	Payload type as defined in RFC 3551.
3	Tiers	tlv8	Repeated. A list of Video Stream Tier TLV8s, as defined below. Each TLV8 is a tier supported for video streaming. There is one TLV of this type per supported tier.

The Video Codec enumeration is defined as follows:

Value	Name	Description
1	H.264	Advanced Video Coding (AVC)
2	H.265	High Efficiency Video Coding (HEVC)

The Video Stream Tier TLV8 is defined as follows:

Type	Name	Format	Description
1	Identifier	uint32	Identifier for this tier.
2	Quality	enum	The quality of the tier, indicated using the Camera Video Quality enumeration (defined below).
3	Target Average Bitrate	uint32	Target average bitrate in kbps.
4	Width	uint16	Width of video frames, in pixels.
5	Height	uint16	Height of video frames, in pixels.
6	Frame Rate	uint8	Frame rate, in frames per second.

The Camera Video Quality enumeration is defined as follows:

Name	Value	Description
Highest	1	(Optional) The 4K stream for a camera that simultaneously offers a 2K stream as High
High	2	The high quality video stream (4K, 2K, or 1080p depending on hardware capabilities)
Medium	3	The medium quality video stream (1080p if the High stream is 2K or 4K, otherwise 720p)

Name	Value	Description
Low	4	The lowest quality video stream (360p 15fps, or 240p at 30fps)

Cameras that do not offer both a 4K and 2K stream simultaneously should not use the “Highest” value. In this case, only the High, Medium, and Low values would be used.

The following table lists common resolutions that may be advertised by your camera. This list is not exhaustive of the resolutions that can be used. Your camera may provide other resolutions that are approximate to these values. The only required resolutions are those that are indicated in Section 2. Minimum Requirements, which should be used as the primary guideline.

Aspect Ratio	Resolution
4:3	4056x3040
16:9	3840x2160 (4K)
4:3	3200x2400 (4K / QUXGA)
16:9	2560x1440 (2K)
4:3	2048x1536 (QXGA)
16:9	1920x1080 (1080p)
4:3	1600x1200 (UXGA)
16:9	1280x720 (720p)
4:3	1024x768 (XGA)
16:9	640x360 (360p / nHD)
4:3	480x360 (360p)
16:9	427x240 (240p)
4:3	320x240 (240p / QVGA)

4.4. Supported Audio Stream Tiers

This characteristic allows an IP Camera accessory to describe the parameters supported for streaming audio over an RTP session.

Property	Value
UUID	00008044-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.supported-audio-stream-tiers
Permissions	Paired Read, Notify
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Codec	enum	Type of audio codec: 3 - Opus 0-2, 4-255 - Reserved for use by Apple
2	Payload Type	uint8	Payload type as defined in RFC 3551.
3	Tiers	tlv8	Repeated. A list of Audio Stream Tier TLV8s, as defined below. Each TLV8 is a tier supported for audio streaming. There is one TLV of this type per supported tier. Exactly one tier is allowed to be supported as of this revision of the specification.

The Audio Stream Tier TLV8 is defined as follows:

Type	Name	Format	Description
1	Identifier	uint32	Identifier for this tier.
2	Target Average Bitrate	uint32	Target average bitrate in bits per second.
3	Sample Rate	enum	Sample rate of the audio: 1 - 16 kHz 2 - 24 kHz 3 - 32 kHz 4 - 48 kHz 0, 5-255 - Reserved for use by Apple
4	Bit Depth	enum	Bit depth of the audio samples: 1 - 8 2 - 16 3 - 24 0, 4-255 - Reserved for use by Apple
5	Packet Time	uint8	Packet time in ms.The only allowed value as of this revision of the specification is 20.
6	Number of Channels	uint8	Number of audio channels.The only allowed value as of this revision of the specification is 1.

4.5. Camera Capabilities

The Camera Capabilities characteristic is used with the Camera Capabilities service to advertise the capabilities of the camera. Specifically, the presence of this service and characteristic with versions as

specified in this document is required to signify that this camera supports the camera functionality described in this specification.

Property	Value
UUID	00008011-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-capabilities
Permissions	Paired Read
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Version	uint8	The version of Camera Capabilities data contained in this characteristic.
2	Camera Sensors	tlv8	A Camera Sensors TLV8, as defined below.

The Camera Sensors TLV8 is defined as follows:

Type	Name	Format	Description
1	Camera Sensors	tlv8	Repeated. A list of Sensor Configuration TLV8s, as defined below.

The Sensor Configuration TLV8 is defined as follows:

Type	Name	Format	Description
1	Sensor Dimensions	tlv8	A Sensor Dimensions TLV8, as described below.
2	Sensor UUID	data	The UUID of the sensor.
3	Sensor Type	enum	0 - Unknown 1 - Primary 255 - Generic
4	Sensor Intent	enum	0 - Unknown 1 - Main 2 - Package 255 - Generic
5	Video Stream Capabilities	tlv8	Repeated. A list of Camera Video Stream Capabilities TLV8s, as defined below.

The Sensor Dimensions TLV8 is defined as follows:

Type	Name	Format	Description
1	Width	uint16	The width of the sensor in pixels
2	Height	uint16	The height of the sensor in pixels

Note that when interpreting pixel values based upon sensor space, it is assumed that the top-left corner of the sensor is at pixel location (0, 0).

The Camera Video Stream Capabilities TLV8 is defined as follows:

Type	Name	Format	Description
1	Identifier	data	UUID identifying this video configuration.
2	Video Quality	enum	The video quality type for this configuration.
3	Width	uint16	Width in pixels.
4	Height	uint16	Height in pixels.
5	Frames Per Second	uint8	Frames per second.
6	Average Bit Rate	uint32	Average bit rate for this configuration in kbps.
7	Peak Bit Rate	uint32	Peak bit rate for this configuration in kbps.

4.6. Contributing Sensors

When added as an optional characteristic to a service, this characteristic identifies the sensors that are contributing to the currently detected motion.

Property	Value
UUID	00008086-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.contributing-sensors
Permissions	Paired Read, Notify
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Sensor List	tlv8	Repeating. A list of Contributing Sensor TLV8s, as defined below.

The Contributing Sensor TLV8 is defined as follows:

Type	Name	Format	Description
1	Sensor UUID	data	The UUID of the sensor that contributed.

4.7. Camera Key

This characteristic allows the accessory to receive a key.

Property	Value
UUID	00008051-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-key
Permissions	Paired Write, Timed Write
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Key	data	The key data.
2	Key Number	uint64	The key number.

4.8. Camera Key ID

This characteristic allows the accessory to provide the identifier for a key.

Property	Value
UUID	00008052-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-key-id
Permissions	Paired Read, Notify
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Key ID	uint64	The key's identifier.

4.9. Buffer Upload Command

This characteristic allows the accessory to be commanded to upload a recording from its buffer.

Property	Value
UUID	00008013-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-buffer-command
Permissions	Paired Read, Paired Write, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Session ID	uint64	The UUID identifying the session.
2	Command	enum	1 = Start 2 = StartAndStop 3 = Stop
3	Start	uint64	The timestamp at which the uploaded clip should begin.
4	Stop	uint64	The timestamp at which the uploaded clip should stop.
5	Stop Action	enum	1 = Pause 2 = Finalize

Response:

Type	Name	Format	Description
1	Clip ID	uint64	The ID of the clip that was uploaded.

4.10.Buffer Activity Command

This characteristic allows the accessory to be commanded to perform an activity on its buffer.

Property	Value
UUID	00008017-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-activity-command
Permissions	Paired Write
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Start	uint64	NTP Timestamp.
2	Duration	uint64	The duration in milliseconds.
3	Activity	enum	1 = Should Record 2 = Should Not Record

4.11.Buffer Event Command

This characteristic allows controllers to fetch and acknowledge events from the Camera Event Queue.

Property	Value
UUID	00008014-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-buffer-event-command
Permissions	Paired Read, Paired Write, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Command	enum	1 = Query 2 = Acknowledge
2	Sequence Number	uint64	The event sequence number.
3	Limit	uint64	The limit.

Response:

Type	Name	Format	Description
1	Events	tlv8	Repeated. A list of Camera Buffer Event TLV8s, as defined below.

The Camera Buffer Event TLV8 is defined as follows:

Type	Name	Format	Description
1	Sequence Number	uint64	The sequence number of the event.
2	Type	enum	1 = CMAF Session Start 2 = CMAF Session Stop 3 = Motion 4 = CMAF Error
3	CMAF Session Start	tlv8	A Camera Buffer Event CMAF Session Start TLV8, as defined below.
4	CMAF Session Stop	tlv8	A Camera Buffer Event CMAF Session Stop TLV8, as defined below.
5	Motion	tlv8	A Camera Buffer Event Motion TLV8, as defined below.
6	CMAF Error	tlv8	A Camera Buffer Event CMAF Error, as defined below.

The Camera Buffer Event CMAF Session Start TLV8 is defined as follows:

Type	Name	Format	Description
1	CMAF Session ID	uint64	Indicates the session ID.

The Camera Buffer Event CMAF Session Stop TLV8 is defined as follows:

Type	Name	Format	Description
1	CMAF Session ID	uint64	Indicates the session ID.

The Camera Buffer Event Motion TLV8 is defined as follows:

Type	Name	Format	Description
1	Active	boolean	Indicates whether or not motion was active.

The Camera Buffer Event CMAF Error TLV8 is defined as follows:

Type	Name	Format	Description
1	CMAF Session ID	uint64	Indicates the session ID.

2	CMAF Error	enum	0 = None 1 = Unknown 2 = Cannot Find Host 3 = Cert Connection Failure 4 = Cannot Certify 5 = Invalid State 6 = Requires Retry 7 = No Response 8 = Max Session Time Exceeded 9 = Canceled 10 = MP4 Error 11 = Connection Failed 12 = Timeout 13 = Out of Resources 14 = Invalid Data 15 = HTTP Bad Request 16 = HTTP Invalid Token 17 = HTTP Camera Zone Disabled 18 = HTTP Mismatched Token 19 = HTTP Not Found 20 = HTTP Init Missing 21 = HTTP Unsupported Media Type 22 = HTTP Blocked 23 = HTTP Certificate Expired 24 = HTTP Internal Server Error 25 = HTTP Service Unavailable 26 = HTTP Camera Zone Does Not Exist

4.12.Buffer Event Sequence Number

This characteristic keeps track of the sequence number in the Camera Event Queue. Once notified, controllers can use the "Buffer Event Command" service to fetch events.

Property	Value
UUID	00008015-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-buffer-event-sequence-number
Permissions	Paired Read, Notify
Format	uint32

4.13.Camera Recording Publishing Point

This characteristic identifies the URL and server certificates needed to publish recorded clips.

Property	Value
UUID	00008016-0000-1000-8000-0026BB765291

Property	Value
Type	public.hap.characteristic.camera-recording-publishing-point
Permissions	Paired Read, Paired Write
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	URL	string	The CMAF `publishing_point_url`. Must end in a trailing slash.
2	Server CA Certificates	tlv8	Repeating. A list of Certificate TLV8s, defined as follows.

The Certificate TLV8 is defined as:

Type	Name	Format	Description
1	Certificate	data	A Certificate in DER format.

4.14.Camera Zones

Camera Zones represent the concept of user supplied zones that correspond to regions of the image, or video. Examples of this might be motion zones (also known as activity zones), where the user supplies regions of the image where motion can trigger motion events, but not when the motion occurs outside the region.

Property	Value
UUID	00008022-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-zones
Permissions	Paired Read, Paired Write
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Zone Data Version	uint8	The version of Zones Data contained in this characteristic. Implementations compliant with this version of the specification should write the value 2 into the Zone Data Version field.

2	Zone Data	data	A list of Zone Data TLV8s, to be interpreted according to the Zone Data Version value.

For version 2 of Zone Data, the Zone Data TLV8 is defined as follows:

Type	Name	Format	Description
1	Method	enum	The status of the command, indicated using the Zone Application Method enumeration (defined below).
3	Polygons	tlv8	Repeated. A list of Polygon TLV8s, as defined below.

The Zone Application Method enum is defined as follows:

Value	Name	
1	Normal	Specifies that the union of the interiors of each of the zones forms the region of interest.
2	Inverted	Specifies that the intersection of the exteriors of each of the zones forms the region of interest.

The Polygon TLV8 is defined as follows:

Type	Name	Format	Description
1	Identifier	data	A UUID used to identify this zone.
3	Vertices	data	A list of pairs of UINT16 (X,Y) coordinates in little endian format that form the vertices of a non-self intersecting polygon. Polygon edges are implied between consecutive vertices in the list, and an edge is implied between the final vertex and the first.

Note that the Polygon TLV8s should be interpreted as a series of non-self intersecting polygons, each specified as an array of vertices, with each vertex specified by a pair of UINT16 (X, Y) coordinates, in the two-dimensional cartesian plane bounded by the dimension of the sensor, with sensor coordinate (0, 0) being located in the upper left corner of the sensor.

4.15.Streaming Enabled

This characteristic allows configuring whether streaming is enabled.

Property	Value
UUID	00008041-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.streaming-enabled
Permissions	Paired Read, Paired Write, Notify, Timed Write, AdminOnly

Format	boolean

4.16.RTP Streaming Control

This characteristic allows control over RTP streams.

Property	Value
UUID	00008045-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.rtp-streaming-control
Permissions	Paired Read, Paired Write, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.This must match the UUID written to Setup Endpoints.
2	Command	enum	The streaming command being issued: 1 - End 2 - Start 0, 3-255 - Reserved for use by Apple
3	Video Tier	uint32	The identifier of a video tier.This must match the Identifier field of some entry in Supported Video Stream Tiers. Only present when Command is Start.
4	Video SSRC	uint32	SSRC for video RTP stream. Only present when Command is Start.
5	Audio Tier	uint32	The identifier of an audio tier.This must match the Identifier field of some entry in Supported Audio Stream Tiers. Only present when Command is Start.
6	Audio SSRC	uint32	SSRC for audio RTP stream. Only present when Command is Start.

After a write is issued to this characteristic by the controller, the next read of this characteristic indicates the status of the write command. The read value is defined as follows:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.This must match the UUID written as part of the write value
2	Status	enum	The status of the command: 0 - Success 1 - Unknown Session Identifier 2 - No Such Stream 3 - Busy 4 - Error 5-255 - Reserved for use by Apple No Such Stream indicates that an End command was attempted for a stream that is not currently started.

4.17.WebRTC Solicit Offer

This characteristic allows clients to solicit streaming offers.

Property	Value
UUID	00008053-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.webrtc-solicit-offer
Permissions	Paired Read, Paired Write, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Options	tlv8	The WebRTC Offer Options TLV8 indicating the options.

The WebRTC Offer Options TLV8 is defined as follows:

Type	Name	Format	Description
1	SFrame Enabled	boolean	Indicates if the controller is requesting end-to-end media encryption for this session.

Response:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.

Type	Name	Format	Description
2	SDP Offer	string	The RFC 8866-compliant SDP Offer.
3	Additional Candidates	tlv8	Repeated. A list of WebRTC ICE Candidate TLV8s, as defined below.
4	Status	enum	The status of the command: 0 - Success 1 - Privacy Mode Active 2 - Error
5	SFrame Configuration	tlv8	An SFrame Key Data TLV8, as defined below.

The WebRTC ICE Candidate TLV8 is defined as follows:

Type	Name	Format	Description
1	Candidate	string	An RFC 8825-compliant ICE Candidate.
2	SDP Mid	string	The Candidate's media stream identification tag which uniquely identifies the media stream within the component with which the candidate is associated, or null if no such association exists.
3	SDP MLine Index	uint16	The zero-based index number of the media description (as defined in RFC-8866) in the SDP with which the Candidate is associated or null if no such association exists.

The SFrame Key Data TLV8 is defined as follows:

Type	Name	Format	Description
1	Key	data	The raw key data.
2	KID	uint64	The SFrame Key ID.

4.18.WebRTC Provide Answer

This characteristic allows the accessory to respond to client solicitations.

Property	Value
UUID	00008054-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.webrtc-provide-answer
Permissions	Paired Read, Paired Write, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.
2	SDP Answer	string	The RFC 8866-compliant SDP Answer.
3	Additional Candidates	tlv8	Repeated. A list of WebRTC ICE Candidates.

Response:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.
2	Status	enum	The status of the command, indicated using the WebRTC Streaming Status enumeration (defined below).

The WebRTC Streaming Status enum is defined as follows:

Value	Name
0	Success
1	Unknown Session Identifier
2	Busy
3	Error

4.19.WebRTC Streaming Control

This characteristic allows for clients to control streaming.

Property	Value
UUID	00008056-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.webrtc-streaming-control
Permissions	Paired Read, Paired Write, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.

Type	Name	Format	Description
2	Command	enum	The streaming control command. 1 - End

Response:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.
2	Status	enum	The status of the command, indicated using the WebRTC Streaming Status enumeration.

4.20.WebRTC Number of Active Sessions

This characteristic allows controllers to determine the number of active sessions.

Property	Value
UUID	00008057-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.webrtc-number-of-active-sessions
Permissions	Paired Read, Notify
Format	uint8
Minimum Value	0
Maximum Value	255

4.21.WebRTC Reoffer

This characteristic allows clients to renegotiate an existing connection.

Property	Value
UUID	00008058-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.webrtc-reoffer
Permissions	Paired Read, Paired Write, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.
2	SDP Offer	string	The RFC 8866-compliant SDP Offer.
3	Options	tlv8	A WebRTC Offer Options TLV8.

Response:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.
2	SDP Answer	string	The RFC 8866-compliant SDP Answer.
3	Status	enum	The status of the command, indicated using the WebRTC Streaming Status enumeration.
4	SFrame Configuration	tlv8	An SFrame Key Data TLV8.

4.22.WebRTC Update Session

This characteristic allows clients to update an existing session.

Property	Value
UUID	0000805C-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.webrtc-update-session
Permissions	Paired Write, Paired Read, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.
2	ReceiveKeysToAdd	tlv8	Repeated. A list of SFrame Key Data TLV8s.
3	ReceiveKIDSToRemove	tlv8	Repeated. A list of SFrame KID TLV8s, as defined below.

The SFrame KID TLV8 is defined as follows:

Type	Name	Format	Description
1	KID	uint64	The SFrame Key ID.

Response:

Type	Name	Format	Description
1	Session Identifier	data	The UUID identifying the session.
2	Status	enum	The status of the command, indicated using the WebRTC Streaming Status enumeration.

4.23.WebRTC Supported Video Stream Tiers

This characteristic allows an IP Camera accessory to describe the parameters supported for streaming video over a WebRTC session.

Property	Value
UUID	00008059-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.webrtc-supported-video-stream-tiers
Permissions	Paired Read, Notify
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Codec	enum	The video codec, indicated using the Video Codec Type enumeration (defined below).
2	Payload Type	uint8	Payload type as defined in RFC 3551.
3	Tiers	tlv8	Repeated. A list of Video Stream Tier TLV8s, as defined below. Each TLV8 is a tier supported for video streaming. There is one TLV of this type per supported tier.

4.24.WebRTC Supported Audio Stream Tiers

This characteristic allows an IP Camera accessory to describe the parameters supported for streaming audio over a WebRTC session.

Property	Value
UUID	0000805A-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.webrtc-supported-audio-stream-tiers
Permissions	Paired Read, Notify
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Codec	enum	Type of audio codec: 3 - Opus 0-2, 4-255 - Reserved for use by Apple
2	Payload Type	uint8	Payload type as defined in RFC 3551.
3	Tiers	tlv8	Repeated. A list of Audio Stream Tier TLV8s, as defined below. Each TLV8 is a tier supported for audio streaming. There is one TLV of this type per supported tier. Exactly one tier is allowed to be supported as of this revision of the specification.

4.25.Camera Client CSR

This characteristic describes the camera CSR request and response for CMAF Ingest provisioning.

Property	Value
UUID	00008081-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-client-csr
Permissions	Paired Read, Paired Write, Write Response
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Nonce	data	A random 32-byte string.

Response:

Type	Name	Format	Description
1	CSR	data	The Certificate Signing Request, encoded in DER format.
2	Nonce Signature	data	The elliptic curve signature of the Nonce signed by the same private key as the CSR. A maximum of 128 bytes.

4.26.Camera Client Certificate

This characteristic is used to provide the client certificate needed for CMAF Ingest provisioning.

Property	Value
UUID	00008082-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-client-certificate
Permissions	Paired Read, Paired Write, Timed Write
Format	tlv8

The write value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Client Certificate	data	The issued Client Certificate, in DER format.
2	CA	data	The Certificate Authority for the Client Certificate, in DER format.

4.27.Camera Client Certificate Status

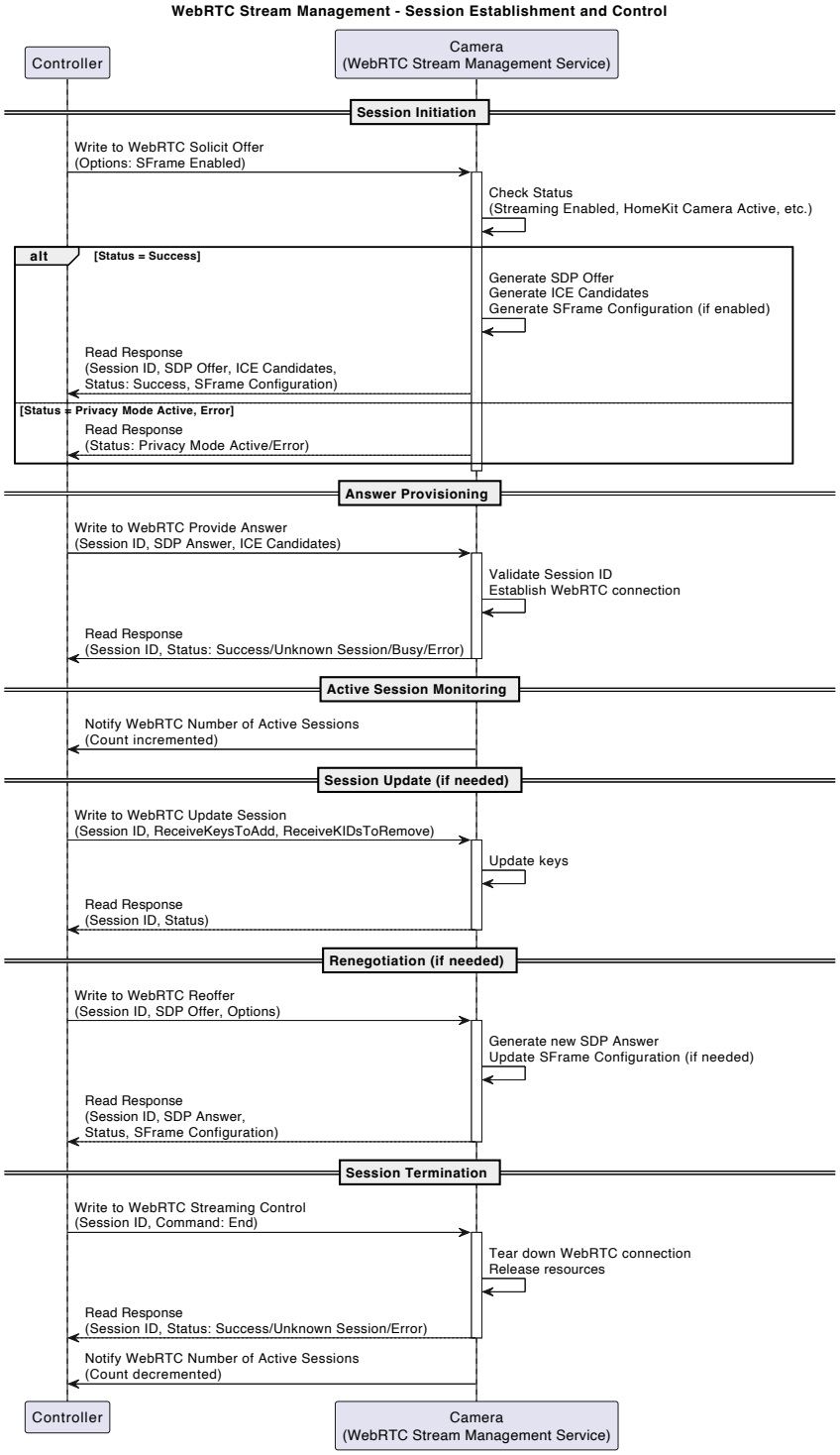
This characteristic describes the camera CSR request and response for CMAF Ingest provisioning.

Property	Value
UUID	00008083-0000-1000-8000-0026BB765291
Type	public.hap.characteristic.camera-client-certificate-status
Permissions	Paired Read, Notify
Format	tlv8

The value of this characteristic is defined as follows:

Type	Name	Format	Description
1	Needs Update	boolean	Indicates that the Client Certificate may be expiring soon or has already expired, and needs to be updated.

5. WebRTC Call Sequence



6. Revision History

Version	Date	Notes
1.0	2026-06-03	Initial version.

Apple Inc.

Apple Inc.
One Apple Park Way
Cupertino, CA 95014
408-996-1010