

# Common Player Specification

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## Common Player Specification Version 2.2

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## 1 Document Description

### 1.1 Scope

This document defines common elements of a media device, including a Common Player (download and/or streaming) and a Common Streaming Player.

### 1.2 Document Organization

This document is organized as follows:

1. Introduction—Provides background, scope and conventions
2. Describes how a Player interact with other elements of an ecosystem
3. Common Player
4. Common Streaming Player
5. Default File Storage and Locations

### 1.3 Document Notation and Conventions

Except where noted, notations and conventions are as per DECE System Specification [DSystem].

The following terms are used to specify conformance elements of this specification. These are adopted from the ISO/IEC Directives, Part 2, Annex H [ISO-P2H]. For more information, please see that work.

SHALL and SHALL NOT indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

SHOULD and SHOULD NOT indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

MAY and NEED NOT indicate a course of action permissible within the limits of the document.

Terms defined to have a specific meaning within this specification will be capitalized, e.g. “Track”, and should be interpreted with their general meaning if not capitalized. Normative key words are written in all caps, e.g. “SHALL”.

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## 1.4 Normative References

### 1.4.1 DECE References

[DSystem]	System Specification
[DMeta]	Content Metadata Specification
[DMedia]	Common File Format& Media Format Specification
[DDMP]	DECE Media Package (DMP) Specification
[DCManifest]	DECE Common Media Manifest Specification
[DFulfill]	Content Fulfillment Specification

### 1.4.2 Other Normative References

[IANA-LANG]	IANA Language Subtag Registry. <a href="http://www.iana.org/assignments/language-subtag-registry">http://www.iana.org/assignments/language-subtag-registry</a>
[RFC2141]	IETF RFC 2141, URN Syntax, May 1997. <a href="http://tools.ietf.org/html/rfc2141">http://tools.ietf.org/html/rfc2141</a>
[RFC2460]	IETF RFC 2460, Internet Protocol, Version 6 (IPv6) Specification, December 1998. <a href="http://tools.ietf.org/html/rfc2460">http://tools.ietf.org/html/rfc2460</a>
[RFC2616]	IETF RFC 2616, Hypertext Transfer Protocol -- HTTP/1.1, June 1999. <a href="http://tools.ietf.org/html/rfc2616">http://tools.ietf.org/html/rfc2616</a>
[RFC2617]	IETF RFC 2617, HTTP Authentication: Basic and Digest Access Authentication, June 1999. <a href="http://tools.ietf.org/html/rfc2617">http://tools.ietf.org/html/rfc2617</a>
[RFC2782]	IETF RFC 2782, A DNR RR for specifying the location of services (DNS SRV), February 2000. <a href="http://tools.ietf.org/html/rfc2782">http://tools.ietf.org/html/rfc2782</a>
[RFC4346]	IETF RFC 4346, The Transport Layer Security (TLS) Protocol, Version 1.1, April 2006, <a href="http://tools.ietf.org/html/rfc4346">http://tools.ietf.org/html/rfc4346</a>
[RFC4647]	<a href="http://www.ietf.org/rfc/rfc4647.txt">Philips, A., et al, RFC 4647, Matching of Language Tags, September 2006. http://www.ietf.org/rfc/rfc4647.txt</a>
[RFC5646]	<a href="http://www.ietf.org/rfc/rfc5646.txt">Philips, A, et al, RFC 5646, Tags for Identifying Languages, IETF, September, 2009. http://www.ietf.org/rfc/rfc5646.txt</a>

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[MPEG4S]	ISO/IEC 14496-1:2010, "Information technology — Coding of audio-visual objects — Part 1: Systems"
[UNICODE]	UNICODE 6.0.0, "The Unicode Standard Version 6.0", <a href="http://www.unicode.org/versions/Unicode6.0.0/">http://www.unicode.org/versions/Unicode6.0.0/</a>

### 1.4.3 Informative References

[ISO-P2H]	ISO/IEC Directives, Part 2, Annex H: <a href="http://www.iso.org">http://www.iso.org</a>
[SRGB]	IEC 61996-2-1, Multimedia systems and equipment - Colour measurement and management - Part 2-1: Colour management - Default RGB colour space - sRGB
[ITU-BT.1886]	ITU-R Recommendation, "BT.1886 : Reference electro-optical transfer function for flat panel displays used in HDTV studio production", International Telecommunications Union.
[UPNPCDS3]	<i>ContentDirectory:3 Service Template Version 1.01</i> , September 30, 2008, <a href="http://www.upnp.org/specs/av/UPnP-av-ContentDirectory-v3-Service.pdf">www.upnp.org/specs/av/UPnP-av-ContentDirectory-v3-Service.pdf</a>

## 1.5 Terminology and Requirements Scope

Terminology is defined in [DSystem].

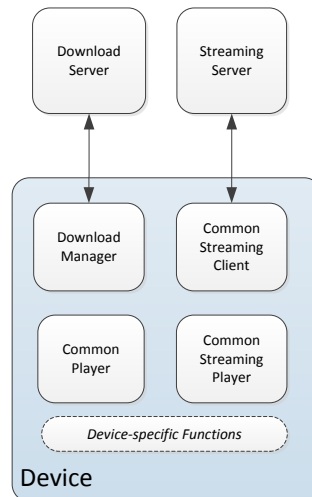
## 1.6 XML Change Management

DECE Devices SHALL comply with XML Change Management defined in [DSystem], Section 1.6.

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## 2 DECE Devices and DECE Ecosystem

This specification defines a set of functionality common functionality for devices that play and/or manage Common File Format as defined in [DMedia] and Common Media Package as defined in [DCMP]]. The following illustrates the model used to describe device functionality:



This document is intended to be referenced by those specifying devices functionality in a given ecosystems. It ensures behavior is consistent across ecosystems. Related specifications that serve that purpose are *Content Fulfillment Specification* [DFulfill] that defines Content Fulfillment (Fulfillment Client and Server, and Common Download Client and Server); and *Common Streaming Protocol* [DStream] that defines Common Streaming.



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## 3 Common Player

This section defines a set of requirements collectively referred to as a “Common Player”.

The intent is for other sections of this document or documents to reference this Section and supplement these requirements as appropriate.

### 3.1 Conditions for Playback

Common Players SHALL be able to decode and present all DCCs under the following conditions:

- The DCC’s Media Profile (e.g., SD or HD) is supported by the Common Player
- The DCC’s Delivery Target is supported by the Common Player
- Content protection rules are met
- CFF Compatibility rules are met, as defined in Section 3.1.1
- The DCC is valid as per all relevant ecosystem specifications

Note that since DCC are ISO File Format compliant, additional boxes not specified in [DMedia] can be present in the DCC.

Client Implementers should note that encoding rates and allowable numbers of tracks can result in DCC sizes larger than  $2^{32}$  bytes (~4 GB), so therefore Device file systems will need to support files of that size.

#### 3.1.1 CFF Compatibility

The DCC is considered CFF Compatible if contains a File Type Box (‘ftyp’) in accordance with [DMedia], Section 2.3.1 and a Content Information Box (‘cinf’) in accordance with [DMedia], Section 2.2.2.

### 3.2 Content Decryption

Common Players SHALL be able to decrypt content using AES CTR Mode as defined in [DMedia], Section 3.

### 3.3 Audio, Video and Subtitle Elementary Stream Requirements

Full details of the audio and video codecs and how the corresponding elementary streams are placed in the DCC can be found in [DMedia].

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Common Players that play Content of a given Media Profile and Delivery Target SHALL play Content specified in [DMedia] Annex C, corresponding with that Delivery Target, with constraints imposed on that Media Profile.

Common Players NEED NOT support 25 Hz or 50 Hz Content as defined in [DMedia] Tables C-4 and C-6.

### 3.3.1 Audio Requirements

Common Players SHALL decode and present audio as defined in the [DMedia], Section 5.

Common Players SHALL decode and present the Selected Audio Track in accordance with Section 0.

#### 3.3.1.1 AAC LC Stereo Support

Common Players SHALL be able to decode AAC LC stereo audio as defined in the [DMedia], Section 5.3.2.

Common Players SHALL be capable of decoding MPEG-4 AAC LC stereo content at bit rates 320 kbps or less, and that were encoded at a sample rate of 44.1 kHz.

Note that this requirement is intended to assist backward compatibility of devices with future DECE versions that include music-only media files.

When decoding AAC LC stereo audio, Common Players NEED NOT interpret the following MPEG-4 AAC elementary stream elements:

- fill\_element (FIL)
- data\_stream\_element (DSE)

#### 3.3.1.2 Other Audio Codecs

The DCC also supports other optional audio codecs.

Common Players MAY implement any Audio CODEC from the [DMedia], Section 5 as long as it is consistent with the Media Profiles and Delivery Targets supported by that Common Player.

#### 3.3.1.3 Audio Downmixing

If decoding a multi-channel audio track to an output supporting fewer channels, the Common Player SHALL downmix to the available output channels according to the audio codec recommendations.

For example, when playing a 5.1 channel mix on a 2-channel output, 5.1 channels is downmixed to 2 channels.

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### 3.3.1.4 Output of Encoded Audio

If a Common Player is driving a digital audio output (e.g. SPDIF, HDMI, etc.) that supports the transport of an encoded audio, then the Common Player SHALL be able to pass-through a multi-channel codec other than AAC to the audio output. This includes minor transport conversions necessary to convert from the DCC packaging to the output port packaging.

### 3.3.2 Video Requirements

Common Players SHALL decode and present video as defined in the [DMedia], Section 4.

Common Players SHALL support scaling in a manner that supports subsampling as defined in [DMedia].

#### 3.3.2.1 HDR Metadata

HDR Metadata is data defined in Metadata [DCMeta] as Video/Picture/MaxColorVolume, Video/Picture/ColorEncoding, Video/Picture/LightLevel, and the Video/Picture/HDRPlayback. HDR Metadata can be found in MetadataMovie (from a DCC or CMP), part of a Media Manifest Inventory, from another source of Common Metadata or within “Mastering display colour volume SEI” in the video track as defined in [DMedia] Section 4.2.2. For the avoidance of doubt, HDR Metadata is the information contained in those elements regardless of the exact encoding or the source.

If a Common Player is driving a digital video output (e.g., HDMI) that supports the transport of HDR Metadata, then the Common Player SHALL pass these metadata, if available. Note also that the Common Player might need to transcode metadata from Common Metadata format into a format suitable to the interface.

If a Common Player uses an API to communicate playback conditions to a playback environment and that API supports the delivery of HDR Metadata, the Common Player SHALL be able to pass these metadata.

#### 3.3.2.2 SDR Downconversion

Downconversion is the process of modifying video for a display on a display that is not fully capable of displaying the Content as authored. This capability is discussed in terms of display characteristics.

A characteristics is considered known if either the display is integrated with the player such that there is direct knowledge of that characteristic is ensured, or if signaling conveys the characteristic (e.g., signaling mechanisms defined in CEA-861.3 [CEA861.3]).

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Common Players SHALL NOT play Content if Video/Picture/HDRPlayback/SDRDownconversion is “Prohibited” or “ProhibitedAlways” and the display’s does not accept SMPTE 2084 EOTF [SMPTE2084] or SMPTE 2084 support is unknown.

Display Characteristics are color gamut, dynamic range, MaxCLL, MaxFALL and frame rate. Display Characteristics are considered ‘supported’ as follows:

- A Display Characteristic is assumed supported in a display if the value of the characteristic in the Content is not outside the range defined for that characteristics in the HD Media Profile definition in [DMedia]. Note that this includes color gamut and dynamic range.
- Frame rate is supported if the display can display the Content at that frame rate.
- MaxCLL and MaxFALL are assumed supported unless they are known not to be supported. If these values are not provided in Content metadata, then they are assumed supported by the display.

Common Players SHALL NOT play Content if Video/Picture/HDRPlayback/SDRDownconversion is “ProhibitedAlways” and if any Display Characteristic is not known to be supported. That is, if the player either knows the player does not support the characteristic or if the player cannot determine if the characteristic is supported, the player does not play the Content.

If a Common Player is prohibited from playing Content as a consequence of Video/Picture/HDRPlayback/SDRDownconversion status, and an alternate encoding of the same Content is available that can play without Downconversion, the Common Player SHOULD play that alternate encoding.

The Common Player SHOULD notify the User if a substitution is provided.

Common Players SHALL NOT modify, including removing, Video/Picture/HDRPlayback/SDRDownconversion.

### 3.3.3 Subtitles

The following sections include requirement for subtitles. Note that this includes what are commonly referred to as ‘captions’.

For this section, for a subtitle track, Subtitle Track Language is defined as the value of MetadataMovie/TrackMetadata/Track/Subtitle/Language (as specified in [DMeta], Section 4) corresponding with the subtitle track.

A match is found between Subtitle Track Language and ‘Language Subtags’ of [DMedia], Section 6.9, Table 6-1 by performing a Lookup ([RFC4647], Section 3.4) of the Subtitle Track Language with all

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Language Subtags in [DMedia], Section 6.9.2.2, Table 6-1 as the language priority list ([RFC4647], Section 2.3). If this operation results in 'default', then no match is found.

Common Players SHALL decode and present both text profile and image profile subtitles as per [DMedia] v1.0.7, and all versions adopted up to the DMedia specification defined by [DMedia] Annex A {DMEDIA\_VERSION\_POINTS}. If the schema location field of SubtitleSampleEntry in the CFF-TT subtitle track Sample Description Box ('std') does not conform to [DMedia] v1.0.7 or any version adopted up to the DMedia specification defined by [DMedia] Annex A {DMEDIA\_VERSION\_POINTS}, Common Players SHALL ignore the value of the schema location field of SubtitleSampleEntry.

Note: see also [DSystem] Section 1.6 for requirements related to XML Change Management.

### 3.3.3.1 Subtitling Track Selection

Common Players SHALL determine Primary Subtitling Presentation Track, as defined in [DMeta] in accordance with Section 0.

Common Players SHALL determine Alternate Subtitling Presentation Track, as defined in [DMeta] in accordance with Section 0.

For purpose of track selection, a text track SHALL NOT be considered playable if both of the following are true:

- the Subtitle Track Language matches a 'Language Subtags' of [DMedia], Section 6.9.2, Table 6-1
- the Common Player does not support rendering of all glyphs that correspond to the Unicode Code Points defined for matching Language Subtag in [DMedia], Section 6.9.2, Table 6-1

A Common Player SHALL NOT select tracks that are not playable.

### 3.3.3.2 Subtitling Mode

A Common Player SHALL be in either Primary Subtitling Presentation Mode or Alternate Subtitling Presentation Mode.

As an initial condition, unless otherwise specified, a Common Player SHALL be in Alternate Subtitling Presentation Mode.

If a Primary Subtitling Presentation Track is selected through the Subtitling Track Selection process (Section 3.3.3.1), the Common Player SHALL be in the Primary Subtitling Presentation Mode, unless the User has opted to turn subtitles off. That is, when a Primary Subtitling Presentation Track is selected, the Device is in Primary Subtitle Presentation Mode unless the User selects otherwise.

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When a Primary Subtitling Presentation Track is selected through the Subtitling Track Selection process (Section 3.3.3.1), Common Players SHOULD provide the means for a User to turn subtitles off (Alternate Subtitling Presentation Mode) and on (Primary Subtitling Presentation Mode).

### 3.3.3.3 Subtitle Playback

During playback, when in Primary Subtitling Playback Mode, the Common Player SHALL decode and present the Primary Subtitling Mode Track.

During playback, when in Alternate Subtitling Playback Mode and an Alternate Subtitle Presentation Track has been selected through the Subtitling Track Selection process (Section 3.3.3.1), Common Players SHALL decode and present forced elements as per [DMedia] Section 6 from the Alternate Subtitle Presentation Track. In the case of a Forced Subtitle Track, this is all elements.

Common Players SHALL NOT decode and present more than one subtitle track simultaneously.

Common Players SHALL decode and present subtitles as per [DMedia], Section 6.

Note that Devices process both text profile and image profile subtitles.

Common Players SHALL render Graphic and Format Unicode Code Points encountered in textual content within CFF-TT subtitles. The Glyph rendered for Graphics and Format Unicode Code Points SHALL correspond with the character represented by the Unicode Code Point as per [UNICODE] or, in the case where the Unicode Code Point is not supported by the Common Player, the Glyph rendered SHALL correspond with Unicode Code Point U+25A1 ("WHITE SQUARE") or Unicode Code Point U+005F ("LOW LINE").

Common Players SHALL ignore Control Codes Unicode Code Points (U+0000..U+001F and U+007F..U+009F) encountered in textual content within CFF-TT subtitles. An ignored Control Code does not affect presentation. No glyph is rendered for a Control Code.

Common Players SHALL support rendering of all glyphs that correspond to the Unicode Code Points defined for the "x-ALL" Language Subtag sequence in [DMedia], Section 6.9.2, Table 6-1. Note that this includes support for 'en' (English).

Common Players SHALL satisfy the observed presentation behavior of subtitle rendering model defined in [DMedia], Section 6, including the behavior seen with the minimum performance requirements defined in [DMedia] Annex B. Common Players are allowed to use any implementation that satisfies the observed behavior defined by the model and are allowed to have higher decoding, drawing or text rendering rates.

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Common Players are allowed to render/paint and scale to different resolutions than the SMPTE TT root container in order to optimize for presentation to the display connected to (or integrated as part of) the Common Player, provided that they maintain relative position between subtitles and video. Common Players SHALL maintain subtitle and video relative position (regardless of differences in resolution between the display and SMPTE TT root container).

Common Players SHALL composite subtitles on to a minimum of 16-bit full color Subtitle Plane as per [DMedia] Section 6.

Common Players SHALL match the Subtitle Plane and Video Plane color space for subtitle overlay.

For random access or subtitle track switching, Common Players SHOULD search for the subtitle fragment that includes the composition time for the random access video sample, and prepare subtitles for presentation from the random access point into the video presentation.

Note that Media Clients will need to acquire the 'mfra' Box at the end of the file to properly random access subtitle fragments.

### 3.3.3.4 Subtitle Color and EOTF Conversion

CFF-TT uses the sRGB [SRGB] color space and Gamma 2.4 [ITU-BT-1886] Electro-optical Transfer Function (EOTF). Conversions are necessary to composite CFF-TT subtitles with video of a Media Profile with High Dynamic Range (HDR) (i.e., those with dynamic range beyond the HD Media Profile).

When subtitles are composited with video using a Media Profile with High Dynamic Range, the Common Player SHOULD convert subtitles to the color space of the video's Media Profile.

When subtitles are composited with video using a Media Profile with High Dynamic Range, the Common Player SHOULD convert subtitles to the EOTF of the video's Media Profile.

### 3.3.4 Audio and Subtitle Track Selection

The purpose of this section is to define behavior for Devices with respect to audio and subtitle track selection. This allows Devices to select default tracks consistent with the intent of the Content Providers.

Information is provided to assist Devices in selecting the appropriate audio and subtitle information. Information is contained in MetadataMovie/TrackMetadata and MetadataMovie/TrackSelections, both defined in [DMeta].

Track selection is made based on Device defaults (e.g., region and language), User preferences (e.g., language, accessibility), available tracks, TrackMetadata information and, if available, TrackSelections

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information. Generally, Users may override Device track selection. However, there are no overrides for Alternate Subtitle Presentation Track.

Additional terminology used in this section is defined in [DMeta], Section 5.

### 3.3.4.1 Default Track Selection

Container Metadata provides information that can be used to select default tracks in accordance with the Content Provider's intent. These data are defined in [DMeta], Section 4.1.5, and the assumed algorithm in [DMeta] Section 5.

System Language and other language preferences SHALL be at least one language that can be represented as Language Tags as per [RFC5646] from the IANA Language Subtag Registry [IANA-LANG].

Common Players SHALL set the System Language.

Common Players SHOULD set the default System Language to match the user Interface language or Operating System language.

Common Players SHOULD provide the means for Users to set the System Language.

Common Players SHOULD provide System Language settings to include dialects. For example, "Latin Spanish" (IANA tag 'es-419') should be distinguished from "Castilian Spanish" (IANA tag 'es').

Common Players SHOULD provide the means for User to select an audio preference for Type compatible with MetadataMovie/TrackMetadata/Track/Audio/Type. For example, the User can select a Type of 'dialogcentric'.

Common Players SHALL provide the means for User to select a subtitle preference for Type compatible with MetadataMovie/TrackMetadata/Track/Subtitle/Type. For example, the User can select a Type of 'SDH'.

Common Players SHALL provide the means for User to select a language preference for audio.

Common Players SHALL provide the means for User to select a language preference for subtitles.

Common Players SHOULD provide the means for User to select a preference dubbed audio or original audio.

Prior to playback, Common Players SHALL use track selection methods described in [DMeta], Section 5 to select default audio and subtitle tracks.



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### 3.3.4.2 User Track Selection

Common Players SHALL provide the ability for a User to select the Selected Audio Track.

Common Players SHALL provide the ability for a User to select the Primary Subtitling Presentation Track.

Common Players SHALL NOT allow a User to select a Forced Subtitle as the Primary Subtitling Presentation Track.

Common Players SHALL NOT allow the User to select the Alternate Subtitling Presentation Track.

Common Players MAY persistently store User track selections for later use. In the future, these can be used in lieu of default track selection for this DCC.

### 3.3.5 Synchronization

Common Players SHALL synchronize audio and video presentation within 15-millisecond accuracy. Note that players should take care to maximize accuracy (minimize offset). Note also that this tolerance is in addition to audio-video presentation synchronization offset permitted in the Seamless Playback model as referenced in Section 3.6.3.

Common Players SHALL synchronize subtitle and video presentation with frame accuracy.

Common Players SHALL support an Edit List Box with a Timeline Mapping Edit entry as described in [DMedia] 2.4, and if included, shift the media timeline relative to the presentation timeline so that the specified Media-Time in the media timeline is mapped to the start of the presentation timeline.

Note: If an Edit List Box exists, inter-track synchronization is based on the Device appropriately processing the Edit List Box and mapping the media timeline to the presentation timeline.

### 3.3.6 Chapters

When random accessing a chapter from EntryTimecode (as defined in [DMeta] 4.1.4), Common Players SHOULD start presentation at the video frame at or immediately following that time on the movie presentation timeline. For the avoidance of doubt, if the referenced picture is not a video random accessible sample, decoding may need to begin at a previous random accessible sample and prior pictures not presented.

When Common Players begin playback from a Chapter time, they SHOULD start Audio presentation on the next sync sample on the movie timeline at or after the first video frame presented.

When Common Players begin playback from a Chapter time, they SHOULD start Subtitle presentation with the next Subtitle Event on the movie timeline at or after the first video frame presented.

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For avoidance of doubt, as with all playback, video, subtitle, and audio synchronization to the movie presentation timeline is to be maintained.

Common Players MAY display chapter images as referenced in the Chapter element.

Common Players MAY display text as included in the Chapter/DisplayLabel element.

If multiple instances of DisplayLabel are provided, the Common Player SHOULD determine the best language as if the DisplayLabel element is a Subtitle track (i.e., DisplayLabel/@language is equivalent to Track/Subtitle/Language element). For example, if DisplayLabel and Subtitle have the same languages, DisplayLabel will have the same language as subtitles.

Common Players MAY create and display their own text or images for chapter selection; for example, "Chapter 1".

### 3.4 Trick Play

Common Players MAY be capable of trick play. Examples of trick play are fast forward, rewind and skip.

### 3.5 Common Media Package (CMP) Playback Support

To playback Content from a CMP, Common Players must be able to locate and read tracks from multiple DCCs, typically in CMPs. Within a CMP, as per [DDMP] Media Presentations are defined in a TableOfContents part and Media Presentations are defined in Presentation parts of the CMP. Late Binding requires the ability to playback any combination of video track, audio track and subtitle track from a Media Presentation.

Common Players SHALL meet all requirements from Section 3.1 through 3.4 for playback of tracks from one or more DCCs in a CMP or equivalent as defined in [DDMP] and [DMedia]. A CMP equivalent refers to CMP information stored in a manner other than in a CMP, such as on Devices that do not support Outbound File Transfer.

Common Players MAY play one or more track via progressive download while playing one or more tracks from a CMP.

### 3.6 Experience Media Application Playback

The Experience Media Application is a DMP Media Application that defines the relationship between various media objects, allowing a Device to allow the User to navigate Content.

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Experience Media Application is structurally defined [DDMP], Section 4.3.7.1 and functionally defined in [DCManifest].

Any Experience Media Application functions implemented by a Common Player SHALL be implemented in accordance with [DDMP], Section 4.3.7.1 and [DCManifest]. In case of conflict, precedence is this specification, then [DDMP], then [DCManifest]. That is, this specification supersedes the other specifications.

### 3.6.1 General Requirements

A Common Player SHALL have the ability to parse the Experience Media Application for the purpose of playing all Content referenced by Experience elements.

A Common Player SHALL provide the ability for a User to play any Audiovisual Content referenced within Experiences.

### 3.6.2 Navigation

Common Players SHALL provide the User the ability to navigate Experiences. Note that the starting Experience element is the first instance of Experience in ExperienceMediaApp/Experiences.

Common Players SHALL present metadata associated with each Experience element or Experience/Audiovisual element as it is navigated.

### 3.6.3 Sequential Playback

The Media Manifest has provisions to play a single Presentation, play a sequence of clips (Presentation subsets) and/or images. Devices are required to support all of these playback models.

A Common Player SHALL playback Presentations referenced in Experience/Audiovisual/PresentationID. Note that this is within an Audiovisual element. Note that the order of Audiovisual elements within an Experience has no meaning.

A Common Player SHALL playback Clips and Image Clips referenced in Experience/Audiovisual/Presentation/PlayableSequence as defined in [DCManifest], Section 5.2.3 with the following conditions

- Common Players SHALL play Clips and Image Clips in accordance with their respective @sequence elements.
- Presentation is referenced in PlayableSequence/Clip/PresentationID

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- Timecodes are relative to the Presentation time, with 0 being the beginning of a Presentation or clip.
- Common Players SHALL support Clip playback in accordance with Clip/EntryPointTimecode starting within 1 frame of the specified time. Note that the absence of Clip/EntryPointTimecode requires the Device to start playback at the beginning of the Clip
- Common Players SHALL support Clip playback in accordance with Clip/ExitPointTimecode ending within 1 frame of the specified time. Note that the absence of Clip/ExitPointTimecode requires the Device to stop playback at the end of the Clip.
- Common Players SHALL play Clips and Image Clips in the order defined by @sequence. If @sequence is absent and more than one Clip exists, the Device SHOULD play Clips in the order in the PlayableSequence element.
- If the @seamless attribute is missing or 'false', Common Players SHALL present no more than 1 second of black and silence between the playback of the referenced content in each Clip or Image Clip.
- If the @seamless attribute is present and 'true', Common Players SHALL playback Clips and Image Clips without delay in accordance with [DMeta], Annex B.

### 3.6.4 Galleries

Galleries are collections of images.

Common Players SHOULD present Galleries.

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## 4 Common Streaming Player

This section defines the requirements for a Common Streaming Player.

### 4.1 Common Streaming Playback

Note that Section 7 defines obtaining a Fulfillment Manifest including FulfillmentManifest/StreamingInfo. Further defined was the method of obtaining BaseLocations that contains information necessary to acquire Licenses.

#### 4.1.1 General Requirements for Streaming

Common Streaming Players as defined in [DSystem] have the capability to playback tracks streamed from a network.

Common Streaming Players SHALL meet all requirements from all of the following, except as noted in this specification:

- Section 3.1 through 3.3 for playback
- [DStream]

#### 4.1.2 Common Streaming Data Sources

Common Streaming Players, when streaming SHALL obtain information for Default Track Selection from StreamingInfo/ExperienceStreamApp/Presentations.

Common Streaming Players, when streaming SHALL obtain the MPD used for Common Streaming Protocol as defined in [DStream] from StreamingInfo//MPDLocation.

#### 4.1.3 Common Streaming Experience

Common Streaming Players, when streaming SHALL support Experience Media Application Playback as defined in Section 3.6 using information in StreamingInfo/ExperienceStreamApp.

#### 4.1.4 Common Streaming Protocol Requirements

Common Streaming Players SHALL support streaming protocol in accordance with [DStream].

#### 4.1.5 Streaming Media Playback Requirements

This section is equivalent to Section 8.2, but for Common Streaming.

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Devices SHALL be able to decode and present all Common Streaming streams under the following conditions:

- A valid DRM license for Content to be streamed is available to the Device, as defined in [DStream], Section 4.5;
- The stream's Media Profile (e.g., SD or HD) is supported by the Device;
- The stream's Delivery Target is supported by the Device;
- The stream conforms to DMedia v1.2 or any versions adopted up to the DMedia specification defined by [DMedia] Annex A {DMEDIA\_VERSION\_POINTS}.
- Content protection rules are met
- The stream is valid as per all relevant DECE specifications.

### 4.1.5.1 Content Encryption

Devices SHALL be able to decrypt content using AES CTR Mode as defined in [DMedia], Section 3.

### 4.1.6 Specific Playback Environments

#### 4.1.6.1 HTML5

One model for DASH is to implement the Player, including download protocol in HTML/ECMAScript. This model is valid for DECE, although the HTML/ECMAScript is not defined by DECE. For the implementation to be considered Common Streaming, it must comply with the requirements for Common Streaming (e.g., [DStream]).

Devices MAY support Common Streaming through an HTML5 browser.

#### 4.1.6.2 Combined Streaming and Playback from DCCs

Common Streaming Players SHALL play tracks entirely via streaming. That is, Players need to be capable of playing Content entirely through the Common Streaming mechanism (i.e., no download).

Common Streaming Players MAY play one or more track via streaming while playing one or more track from a DMP.

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### 4.1.6.3 Adaptive Progressive Download

Adaptive Progressive Download is a hybrid of Progressive Download and Common Streaming. Although it incorporates Common Streaming concepts, it is still a download operation as the end result is downloaded DCC.

When performing Adaptive Progressive Download a Device performs the following functions

- Download an adaptation set whose highest bitrate video track is a CFF single track DCC and lower bitrate tracks are CSF or CFF
- Progressive download can be any segment from the adaptation set
- Following progressive download, any segment that is not highest bitrate is replaced.

Common Players MAY play using 'Adaptive Progressive Download', when available.

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## 5 Default File Storage and Locations

This section describes how and where media files are stored. This section uses the term ‘Application’ to refer to any application involved in writing media files. Ecosystem files are DCCs, DMPs and any other files involved in playback in the applicable ecosystem.

All requirements in this section assume the feasibility of writing files to the locations indicated. That is, the requirements are irrelevant if it is not feasible for the Application to write to or read from the specified location as applicable.

The term Default File Location is defined in Section 5.2.

### 5.1 Using Default File Locations

#### 5.1.1 Storing Files

Applications storing ecosystem files on a local file system or removable media SHOULD by default store ecosystem files at the applicable Default File Location.

Applications storing ecosystem files on a local file system or removable media SHALL provide Users the ability to select the Default File Location as the default location for storing ecosystem files.

If the Application intends to store an ecosystem file at the Default File Location, but that location does not exist, the Application SHALL create the location associated with the Default File Location, if possible.

#### 5.1.2 Locating Files

Applications searching for ecosystem files on a local file system or removable media SHOULD by default first search for ecosystem files at the applicable Default File Location.

Applications accessing ecosystem files from a local file system or removable media SHALL provide Users the ability to select the Default File Location as the default location for searching for ecosystem files.

#### 5.1.3 Setting Location for Reading and Storing Files

Applications that do not by default store files in the Default File Location SHALL provide a means for the User to change the storage location to the Default File Location, where feasible.

Applications that do not by default search for files in the Default File Location SHALL provide a means for the User to add the Default File Location to the search path, where feasible.



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In multi-user environments, Applications MAY provide an option to store files in the “public” folder to make them discoverable by other users.

### 5.2 Default File Location

Default File Locations identify for a given operating system and/or the storage medium the default location for media files. This section indicates the correct Default File Location for various operating systems and for removable storage.

The symbols <ecosystem> and <ecosystem-short> must be defined for each ecosystem. For example, for DECE, <ecosystem> would be ‘UltraViolet’ and <ecosystem-short> would be ‘UV’.

#### 5.2.1 Microsoft Windows

The Default File Location for Microsoft Windows operating systems is not a fixed location. Rather it is obtained using the following steps:

- Default path for Windows 7 and newer is: %USERPROFILE%\Videos\  - Pass FOLDERID\_VideosLibrary to IKnownFolder to determine default video save location.
- Default File Location for Windows versions older than Windows 7 is: %USERPROFILE%\My Documents\My Videos\- Use FOLDERID\_Videos if available, otherwise use CSIDL\_VIDEOS if available
- If GUIDs not available, use legacy default path below.
- If %USERPROFILE% not available substitute null and use default drive

#### 5.2.2 Apple Mac OS X

The Default File Location for Apple Mac OS X is: /Users/<username>/Movies/<ecosystem> where <username> is the Mac OS username.

#### 5.2.3 Unix, Linux, Posix and other Unix variants

The Default File Location of Unix, Linux, Posix and other Unix variants is: /home/media/<ecosystem>

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### 5.2.4 Android OS

- For API Level 8 or above, Default File Location is determined as follows:  
`getExternalStoragePublicDirectory(DIRECTORY_MOVIES)`, create <ecosystem> subdirectory if not present
- For APIs prior to API Level 8, the Default File Location is `/sdcard/Movies/<ecosystem>`. If not available, for Default File Location use: `/Movies/<ecosystem>`

### 5.2.5 General Media (FAT, NTFS, HFS, etc.; or NAS, etc.)

General Media refers to storage such as other fixed media, removable storage media (such as, USB, SD card, hard disk, optical discs, etc.), and external media such as NAS. File location is independent of operating system. A hierarchical file system (i.e., one with a top level directory and subdirectories) is assumed.

The Default File Location is: `<root>Movies<path separator><ecosystem>`

Where

- `<root>` is the indicator of the root directory; for example `"/` or `"\`. Where practical, root SHOULD be a shared location, rather than a user-specific path. An example of impractical is where multiple users do not have write privileges to a shared location.
- `<path separator>` is the character or characters used to separate directory levels in a path, typically `"/` or `"\`.

The term `<ecosystem-short>` SHALL be substituted for `<ecosystem-short>` in file systems where that substitution would convert an invalid Default File Location into a valid Default File Location.

### 5.2.6 iOS

- iOS does not currently have a default location.

### END ###