OIPF

Release 2 Specification

Volume 2 – Media Formats

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Open IPTV Forum

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This specification provides multiple options for some features. The Open IPTV Forum Profiles specification complements the Release 2 specifications by defining the Open IPTV Forum implementation and deployment profiles. Any implementation based on Open IPTV Forum specifications that does not follow the Profiles specification cannot claim Open IPTV Forum compliance.

Copyright Notification

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Foreword

This Technical Specification (TS) has been produced by the Open IPTV Forum.

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Introduction

The Open IPTV Forum Release 2 Specification consists of nine volumes:

- Volume 1 – Overview [OIPF_OVIEW2],
- Volume 2 – Media Formats (the present volume),
- Volume 2a – HTTP Adaptive Streaming,
- Volume 3 – Content Metadata [OIPF_META2],
- Volume 4 – Protocols [OIPF_PROT2],
- Volume 4a – Examples of Protocol Sequences,
- Volume 5 – Declarative Application Environment [OIPF_DAE2],
- Volume 6 – Procedural Application Environment [OIPF_PAE2], and
- Volume 7 – Authentication, Content Protection and Service Protection [OIPF_CSP2].

The present volume defines the set of media formats and their usage, available for the implementation of Release 2 Open IPTV Forum compliant services and devices.

The set of media formats comprises:

- Audio-video media formats (section 3), being combinations of the individual formats below.
- Systems layer formats (section 4),
- Video codecs and their usage (section 5),
- Subtitle formats and their usage (section 6),
- Teletext formats and their usage (section 7),
- Audio codecs and their usage (section 8), and
- Graphics and still image codecs and formats (section 9).

For each of these it is described how they apply to the IPTV solution and to the various Release 2 services (described in [OIPF_OVIEW2]), and the implications for interoperability are discussed.

Figure 1 summarises the set of media formats specified by the present document in the form of a media formats stack. Media formats are specified at the content (audio, video, etc.) layers and for the systems layer. Transport protocols below the systems layer are specified in Volume 4 [OIPF_PROT2].

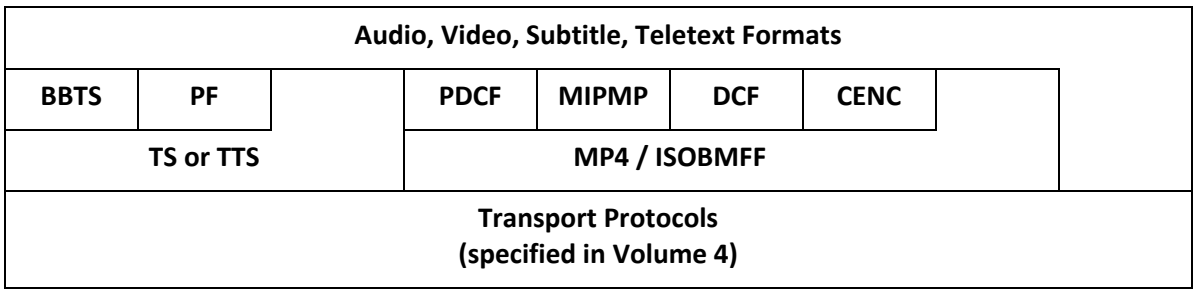

Figure 1: Media formats stack

This volume specifies formats for the A/V content provided by IPTV services using fixed line access networks or mobile access networks and voice and video telephony services. It does not apply to the broadcast channel input of hybrid devices except where explicitly specified.

This specification defines formats for the delivery of 3D video. At the present time, delivery to fixed terminals is targeted. No special provision is made for mobile or portable devices.

This specification defines the media formats utilised on the UNI Reference Point UNIT-17 of the Open IPTV Forum Functional Architecture [OIPF_ARCH2].

1 References

1.1 Normative References

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[AAC]	ISO/IEC 14496-3:2009, “Information Technology - Coding of audio-visual objects – Part 3: Audio”.
[AC3]	ETSI, TS 102 366 V1.2.1 (2008-08), “Digital Audio Compression (AC-3, Enhanced AC-3) Standard”.
[CEACC]	Consumer Electronics Association, CEA-708-C (2006), “Digital Television (DTV) Closed Captioning”.
[CENC]	ISO/IEC FDIS 23001-7:2011 – Information technology - MPEG systems technologies – Part 7: Common encryption in ISO base media file format files
[DLNAMEDIA]	IEC, 62481-2, Digital living network alliance (DLNA) home networked device interoperability guidelines – Part 2: Media Formats, ed1.0 (2007-08).
[DTS]	ETSI, TS 102 114 V1.4.1 (2012-09), “DTS Coherent Acoustics; Core and Extensions”.
[DVB3D]	ETSI, TS 101 547 V1.1.1 (2012-01), “Digital Video Broadcasting (DVB); Frame Compatible Plano-stereoscopic 3DTV”
[DVBSUBT]	ETSI, EN 300 743 V1.4.1 (2011-10), “Digital Video Broadcasting (DVB); Subtitling systems”.
[DVBTTXT]	ETSI, EN 300 472 V1.3.1 (2003-05), “Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams”.
[EN300468]	ETSI, EN 300 468 V1.13.1 (2012-08), “Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems”.
[GEM]	DVB, BlueBook A108r1: “Globally Executable MHP (GEM) Version 1.2.1”, available at http://www.mhp.org
[GIF]	Graphics Interchange Format version 89a, © 1987, 1988, 1989, 1990, CompuServe Incorporated, Columbus, Ohio.
[H262]	ITU-T, Recommendation H.262 / ISO/IEC 13818-2: “Information Technology - Generic Coding of moving pictures and associated audio information: Video”.
[H263]	ITU-T, Recommendation H.263 (2005), “Video coding for low bitrate communication”.
[H264]	ITU-T, Recommendation H.264 / ISO/IEC 14496-10:2005: “Information technology - Coding of audio-visual objects - Part 10: Advanced Video Coding”.
[ISOFF]	ISO/IEC 14496-12:2012, “Information Technology - Coding of Audio-Visual Objects - Part 12: ISO Base Media file format”, International Standards Organization.
[ITUTG711]	ITU-T, Recommendation G.711, “Pulse code modulation (PCM) of voice frequencies”.
[ITUTG729]	ITU-T, Recommendation G.729, “Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)”.
[ITUTG722]	ITU-T, Recommendation G.722, “7 kHz Audio Coding within 64 Kbit/s”.
[ITUTG729-1]	ITU-T, Recommendation G.729.1, “G.729 based Embedded Variable bit-rate coder: An 8-32 Kbit/s scalable wideband coder bitstream interoperable with G.729”.
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[JFIF]	JPEG File Interchange Format, Version 1.02, Eric Hamilton, C-Cube Microsystems, September 1, 1992.
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[MP4V]	ISO/IEC 14496-2:2004, “Information technology - Coding of audio-visual objects - Part 2: Visual”.
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[TS102034]	ETSI, TS 102 034 V1.4.1 (2007-10), “Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Networks”.
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[TS181005]	ETSI, TS 181 005 V3.3.1 (2009-12), “TISPAN Service and Capability Requirements”.
[3GPPAMR]	3GPP, TS 26.071, “Mandatory speech CODEC speech processing functions; AMR speech Codec; General description”. 3GPP, TS 26.090, “Mandatory Speech Codec speech processing functions; Adaptive Multi-Rate (AMR) speech codec; Transcoding functions”.
[3GPPAMRWB]	3GPP, TS 26.171: "Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; General description". 3GPP, TS 26.190, “Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; Transcoding functions”.
[3GPPAMRWB+]	3GPP, TS 26.290, “Audio codec processing functions; Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec; Transcoding functions”.
[3GPPEAAC+]	3GPP, TS 26.401, “General audio codec audio processing functions; Enhanced aacPlus general audio codec; General description”.
[3GPPTS26234]	3GPP, TS 26.234, “Transparent end-to-end Packet-switched; Streaming Service (PSS); Protocols and codecs (Release 9)”.
[3GPPTS26245]	3GPP, TS 26.245, “Transparent end-to-end Packet switched Streaming Service (PSS); Timed text format”.

1.2 Open IPTV Forum References

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[OIPF_OVIEW2]	Open IPTV Forum, “Release 2 Specification, Volume 1 - Overview”, V2.2, April 2013.
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[OIPF_PROT2]	Open IPTV Forum, “Release 2 Specification, Volume 4 - Protocols”, V2.2, April 2013.
[OIPF_DAE2]	Open IPTV Forum, “Release 2 Specification, Volume 5 - Declarative Application Environment”, V2.2, April 2013.
[OIPF_PAE2]	Open IPTV Forum, “Release 2 Specification, Volume 6 - Procedural Application Environment”, V2.2, April 2013.
[OIPF_CSP2]	Open IPTV Forum, “Release 2 Specification, Volume 7 - Authentication, Content Protection and Service Protection”, V2.2, April 2013.

1.3 Informative References

The present document makes no informative references.

2 Conventions and Terminology

2.1 Conventions

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

All sections and appendixes, except “Introduction”, are normative, unless they are explicitly indicated to be informative.

2.2 Terminology

2.2.1 Definitions

In addition to the Definitions provided in Volume 1, the following abbreviations are used in this Volume.

Term	Definition
Mobile A/V Service	An IPTV service delivered using mobile access networks and protocols.

2.2.2 Abbreviations

In addition to the Abbreviations provided in Volume 1, the following abbreviations are used in this Volume.

Acronym	Definition
AAC	Advanced Audio Coding
AAC LC	AAC Low Complexity
ADPCM	Adaptive Differential Pulse-Code Modulation
AIT	Application Information Table
AMR	Adaptive Multi-Rate
AMR-WB	Adaptive Multi-Rate Wideband
ATSC	Advanced Television Systems Committee
DSM-CC	Digital Storage Media - Command and Control
DVB	Digital Video Broadcasting
DVB-SI	DVB Service Information
EBU	European Broadcasting Union
EIT	Event Information Table
ETSI	European Telecommunications Standards Institute
fps	Frames per Second
GIF	Graphics Interchange Format
GOP	Group Of Pictures
HE-AAC	High Efficiency-AAC
JPEG	Joint Photographic Experts Group
MPEG	Moving Pictures Expert Group
MPS	MPEG Surround
PCM	Pulse-Code Modulation
PID	Packed Identifier
PMT	Program Map Table
PNG	Portable Network Graphics
PS	Parametric Stereo
PSI	Programme Specific Information
SBR	Spectral Band Replication
SI	Service Information
S/PDIF	Sony/Philips Digital Interconnect Format
UDP	User Datagram Protocol

3 A/V Media Formats

A set of A/V media formats is defined, being combinations of audio, video and systems layer formats defined in the following sections.

The TS and TTS systems layer formats are specified in section 4.1. The protection layers BBTS and PF are specified in Volume 7 of the present specification.

MP4 systems layer format is specified in section 4.2. The protection layers PDCF, MIPMP, CENC and DCF are specified in Volume 7 of the present specification.

Video Formats are defined in section 5.1 and Audio Formats in section 8.1.

Volume 3 [OIPF_META2] describes how the media format of content is signalled in the metadata.

For A/V content in 25Hz systems the following A/V media format combinations are defined:

Table 1: A/V Media Formats for 25Hz video system

System Format	Video Format	Audio Format	Mime Type
TS	AVC_HD_25 AVC_SD_25 AVC_SP_25 AVC_3D_25	HEAAC HEAAC2 HEAAC_MPS MPEG1_L2 MPEG1_L2_MPS AC3 E-AC3 DTS	video/mpeg or video/mp2t
TTS	AVC_HD_25 AVC_SD_25 AVC_SP_25 AVC_3D_25	HEAAC HEAAC2 HEAAC_MPS MPEG1_L2 MPEG1_L2_MPS AC3 E-AC3 DTS	video/vnd.dlna.mpeg-tts
MP4	AVC_HD_25 AVC_SD_25 AVC_SP_25 AVC_3D_25	HEAAC HEAAC2 HEAAC_MPS MPEG1_L2 MPEG1_L2_MPS AC3 E-AC3 DTS	video/mp4
TS	MPEG2_SD_25 MPEG2_SP_25	MPEG1_L2 MPEG1_L2_MPS AC3 E-AC3	video/mpeg or video/mp2t
TTS	MPEG2_SD_25 MPEG2_SP_25	MPEG1_L2 MPEG1_L2_MPS AC3 E-AC3	video/vnd.dlna.mpeg-tts

For A/V content in 30Hz systems the following A/V media format combinations are defined:

Table 2: A/V Media Formats for 30Hz video system

System Format	Video Format	Audio Format	Mime Type
TS	AVC_HD_30 AVC_SD_30 AVC_SP_30 AVC_3D_30	HEAAC HEAAC2 HEAAC_MPS AC3 E-AC3 DTS	video/mpeg or video/mp2t
TTS	AVC_HD_30 AVC_SD_30 AVC_SP_30 AVC_3D_30	HEAAC HEAAC2 HEAAC_MPS AC3 E-AC3 DTS	video/vnd.dlna.mpeg-tts
MP4	AVC_HD_30 AVC_SD_30 AVC_SP_30 AVC_3D_30	HEAAC HEAAC2 HEAAC_MPS AC3 E-AC3 DTS	video/mp4

For protected A/V contents, the following protected A/V media format combinations are defined:

Table 3: Protected A/V media formats

System Format	Protection Format	Video format	Audio format	Mime Type
TS	BBTS PF	(a combination of video format and audio format used for TS system, as defined by Table 1 and Table 2)		video/mpeg or video/mp2t
TTS	BBTS PF	(a combination of video format and audio format used for TTS system, as defined by Table 1 and Table 2)		video/vnd.dlna.mpeg-tts
MP4	PDCF MIPMP CENC	(a combination of video format and audio format used for MP4 system, as defined by Table 1 and Table 2)		video/mp4
	DCF	(a combination of video format and audio format used for MP4 system, as defined by Table 1 and Table 2)		application/vnd.oma.drm.dcf

The following audio media formats are defined that are independent of the video system:

Table 4: Pure audio media formats

Audio Format	Mime Type
MPEG1_L3	audio/mpeg
HEAAC	audio/mp4 or audio/3gpp
WAV	audio/x-wav
DTS	audio/vnd.dts.hd
AMR	audio/amr
AMR-WB	audio/amr-wb
AMR-WB+	audio/amr-wb+
HEAAC2	audio/mp4 or audio/3gpp
AC3	audio/ac3
E-AC3	audio/eac3

NOTE: The HEAAC and HEAAC2 pure audio media formats imply carriage of the respective audio content inside the MP4 system format container.

The following graphics formats are defined for usage as specified in section 9:

Table 5: Graphics media formats

Image Format	Mime Type
JPEG	image/jpeg
GIF	image/gif
PNG	image/png

The following video media formats are defined for video telephony services:

Table 6: A/V Media Formats for video telephony

Video Format	Mime Type
H263	video/H263 video/H263-1998 video/H263-2000
MP4V	video/MP4V-ES
AVC_VDC	video/H264

The following audio media formats are defined for Narrow-Band voice and video telephony services:

Table 7: Audio Formats for voice and video telephony (Narrow-Band)

Audio Format	Mime Type
G711	audio/PCMA audio/PCMU
AMR	audio/AMR
G729A	audio/G729

The following audio media formats are defined for Wide-Band voice and video telephony services:

Table 8: Audio Formats for voice and video telephony (Wide-Band)

Audio Format	Mime Type
G722	audio/G722
AMRWB	audio/AMR-WB
G7291	audio/G7291

The following audio media formats are defined for Super-Wideband voice and video telephony services:

Table 9: Audio Formats for voice and video telephony (Super-Wideband)

Audio Format	Mime Type
AACLD	audio/mpeg4-generic
AACELD	audio/mpeg4-generic
G719	audio/G719

The following text format is defined for subtitles provided for Mobile A/V Services:

Table 10: Subtitle Format for Mobile A/V Services

Subtitle Format	Mime Type
3GPP-TT	video/3gpp-tt

4 Systems Layer

At the systems layer, two formats for the carriage of A/V content are defined, namely MPEG-2 Transport Stream and MP4 File Format.

A/V content protection is performed at the systems layer, as defined in [OIPF_CSP2]. The present volume of the specification describes the protected formats in relation to the total set of media format definitions.

4.1 MPEG-2 Transport Stream

The carriage of A/V content and related information (e.g. subtitles) in an MPEG-2 transport stream SHALL be in compliance with [TS101154] clause 4, with the following additional constraints:

- Only a single program SHALL be contained in the transport stream. The transport stream SHALL contain only one Program Map Table (PMT).
- The "TS Optional-SI" profile of PSI/SI carriage, as defined in [TS102034] SHALL be applied, i.e. the Program Association Table (PAT) and Program Map Table (PMT) are REQUIRED, and DVB-SI [EN300468] is OPTIONAL. However, the carriage of EIT for the associated content is RECOMMENDED, as specified in section 4.1.3 of Volume 3 [OIPF_META2].
- The transport stream MAY contain EIT as specified in section 4.1.3 of Volume 3 [OIPF_META2].
- The transport stream MAY contain MPEG-2 encoded AIT as defined in section 5.3 of [TS102809]. This SHALL be supported as defined in [OIPF_DAE2] and below:
    - The application type used for DAE applications in section 5.2.2 of [TS102809] SHALL be 0x0011 (to signal "OIPF DAE").
    - If the optional `data_broadcast_id_descriptor` is used for carousels carrying DAE applications then the value to be used for the `data_broadcast_id` field of SHALL be 0x0150 (to signal "OIPF Object Carousel").
    - A maximum of one sub-table (i.e. using only one PID) signalling DAE applications shall be transmitted per service.
    - All sections of the AIT sub-table for DAE applications shall be transmitted at least once every second.
- The transport stream MAY contain DAE applications transmitted using the DSM-CC object carrousel as defined in section 7.1 of [TS102809].
- The transport stream MAY contain "do-it-now" DSM-CC stream events as defined by section 8.1 of [TS102809].
- The maximum streaming bitrate for a transport stream carrying SD content SHALL NOT exceed 8.0 Mbit/s.
- The maximum streaming bitrate for a transport stream carrying HD content SHALL NOT exceed 24.0 Mbit/s.
- Transport streams MAY contain media zone information (zone map), possibly including navigation constraints, using the signalling mechanisms specified in [MRL DMZ]. Rules about the handling of Marlin media zone information by the OITF, for both unprotected and protected content, are contained in section 6 of [OIPF_CSP2]. Note: this means an MPEG-2 transport stream may contain a DMZ descriptor in PMT and one or more private_sections in the stream, with PID as signalled in DMZ descriptor, and containing zone map information (i.e., navigation constraints), all according to [MRL DMZ] section 7.2.
- Transport streams containing 3D content SHALL comply with the following requirements:
    - The PMT SHALL include the AVC_video_descriptor according to [DVB3D] section 6.1.
    - If SDT and/or EIT are present, it SHALL meet the requirements of [DVB3D] section 6.2.

The preceding specification of the MPEG-2 transport stream format is referred to as the TS systems layer format.

An additional variant of the TS format is defined, namely the time-stamped MPEG-2 transport stream, as defined in [DLNAMEDIA] section 9.3.4.4, applied to the TS systems layer format.

The time-stamped MPEG-2 transport stream format is referred to as the TTS systems layer format.

The methods to protect (encrypt) MPEG-2 transport streams are specified in Volume 7 [OIPF_CSP2] of the present specification. Volume 7 specifies two approaches for content and service protection, namely the terminal-centric approach and the gateway-centric approach.

For the terminal-centric approach and for the output of the CSP gateway in the gateway-centric approach, the protected MPEG-2 transport stream SHALL comply with protection system signalling as specified in [MPEG2TS] and MAY use the Conditional Access Table (CAT) as defined therein. This protected format is referred to generically as PF.

For the gateway-centric approach, the input stream to the CSP gateway is not specified, except in the case of the CI+ gateway-centric approach, where the input stream SHALL comply with the PF format. PF applies to both the TS and TTS systems layer formats.

The protected MPEG-2 transport stream format for the terminal-centric approach is further defined in [MRL BBTS] and is referred to as BBTS. BBTS applies to both the TS and TTS systems layer formats.

The OITF SHALL support the application signalling and in-band delivery of DAE applications via the IP channel, as defined above. In environments where the broadcast channel is based on DVB network technologies and uses DVB-SI as specified in [EN300468], the OITF SHALL also support the application signalling and in-band delivery of DAE applications via the broadcast channel.

4.2 MP4 File Format

The carriage of A/V content and related information (e.g. subtitles) in file-based formats (systems layer format: MP4) SHALL use the MP4 File Format [MP4FF] and ISO Base Media File Format [ISOFF] standards with the constraints defined in section 9.4.4.3 of [DLNAMEDIA], except for 9.4.4.3.3 and 9.4.4.3.10. This is the preferred format for MP4-based unprotected content.

For services that allow the real-time playback of downloaded content before the download has been completed (e.g. Progressive Download), the following additional constraints apply:

- The *moof* box SHALL be used according to section 9.4.4.3.8 of [DLNAMEDIA].
- The size of the *moov* box SHALL be equal to or less than 2Mbytes.
- Use of the *pdin* box, defined in 8.43 of [ISOFF], is RECOMMENDED.

A service MAY apply the additional constraint on *moov* box size according to section 9.4.4.3.11 of [DLNAMEDIA], in order to provide content compliant to the DLNA specification.

In addition, carriage of H.264/AVC content in the MP4 systems layer SHALL be conformant to the AVC File Format standard [AVCFF].

In addition, carriage of MPEG-4 AAC/HE-AAC content in the MP4 systems layer SHALL be conformant to the MP4 File Format standard [MP4FF].

The storage of AC-3 and Enhanced AC-3 content in the MP4 file format shall be conformant to Annex F of [AC3].

MP4 files MAY contain media zone information (zone map), possibly including navigation constraints, using the signalling mechanisms specified in [MRL DMZ]. Rules about the handling of Marlin media zone information by the OITF, for both unprotected and protected content, are contained in section 6 of [OIPF_CSP2]. Note: this means an MP4 file may contain one or more mDMZ boxes containing zone parameters and zone properties (i.e., navigation constraints) according to [MRL DMZ] section 7.1.

The methods to protect (encrypt) MP4-based file formats are specified in [OIPF_CSP2]. Four protection methods are specified and they are allocated the protection format labels as follows:

- OMA PDCF [OMARLIN] is referred to as PDCF,
- OMA DCF [OMARLIN] is referred to as DCF,
- Marlin IP MP [MRL FF] format is referred to as MIPMP.
- Common encryption in ISO base media file format files [CENC] is referred to as CENC.

MP4 files containing 3D content SHALL comply with section 8.15 of [ISOFF], i.e. the 3D video sample SHALL be signalled as restricted video (‘resv’) with stereoscopic video scheme type (‘stvi’).

4.3 Service Usage

Scheduled Content services SHALL use either the TS or the TTS systems layer format.

Unicast CoD services using the Direct UDP or RTP/UDP transport protocols SHALL use either the TS or the TTS systems layer format.

Unicast CoD services using the HTTP transport protocol SHALL use either the TS, the TTS, or the MP4 systems layer format.

Download CoD services SHALL use either the TS, the TTS, or the MP4 systems layer format.

Voice and video telephony services using the RTP/UDP transport protocol do not require any specific systems layer format.

Mobile A/V services do not require any specific systems layer format.

The systems layer formats used for content services are summarised in the following table.

Table 11: Systems layer formats for content services

Service	Transport protocol	Systems layer format
Scheduled content	Direct UDP or RTP/UDP	TS, TTS
Streamed CoD	Direct UDP or RTP/UDP	TS, TTS
Streamed CoD	HTTP	TS, TTS, MP4
Download CoD	HTTP	TS, TTS, MP4

5 Video

The specification of video formats and codec profiles is based upon the DVB A/V codec usage specification for applications based on MPEG-2 transport streams [TS101154]. The present specification further profiles the DVB specification by mandating certain codec choices and video formats.

H.264/AVC [H264] (video format label: AVC) is the preferred video codec for both standard definition and high definition content and is the mandatory video content format. Decoding support for AVC is a mandatory minimum OITF capability with regard to A/V media formats.

MPEG-2 video [H262] (video format label: MPEG2) MAY be used when appropriate, for example when legacy equipment or content in that format has already been deployed, or due to regulatory or contractual considerations.

H.264/AVC [H264] (video format label: AVC_VDC), MPEG-4 Part 2 Visual [MP4V] (video format label: MP4V) and H.263 [H263] (video format label: H263) MAY be used for video telephony services. If video telephony services are supported on the OITF, encoding and decoding of H.264 (video format label AVC_VDC) SHALL be supported and encoding and decoding of H.263 (video format label H263) is RECOMMENDED.

H.264/AVC [H264] (video format label: AVC_VDC), MPEG-4 Part 2 Visual [MP4V] (video format label: MP4V) and H.263 [H263] (video format label: H263) MAY be used for Mobile A/V services.

Plano-stereoscopic 3D TV is supported using H.264/AVC, using side-by-side and top-bottom formats.

5.1 Formats

Five profiles of video content are defined and described in the following sub-sections:

- High Definition (HD),
- Standard Definition (SD),
- 3D,
- Video Telephony,
- Sub-Picture.

Additionally, Video formats for Mobile A/V Services are defined.

5.1.1 High Definition Profile

5.1.1.1 H.264/AVC

H.264/AVC HD video content SHALL comply with [TS101154] clauses 5.5 and 5.7.

This format corresponds to video format label AVC_HD_25 in 25Hz systems and AVC_HD_30 in 30Hz systems.

5.1.1.2 MPEG-2

MPEG-2 HD video content in 25Hz systems SHALL comply with [TS101154] clause 5.2 with the following exceptions:

- The 2.21:1 Aspect Ratio SHALL NOT be used.

This format corresponds to video format label MPEG2_HD_25.

MPEG-2 HD video content in 30Hz systems SHALL comply with [TS101154] clause 5.4 with the following exceptions:

- The 2.21:1 Aspect Ratio SHALL NOT be used.

This format corresponds to video format label MPEG2_HD_30.

5.1.2 Standard Definition Profile

5.1.2.1 H.264/AVC

H.264/AVC SD video content SHALL comply with [TS101154] clauses 5.5 and 5.6.

This format corresponds to video format label AVC_SD_25 in 25Hz systems and AVC_SD_30 in 30Hz systems.

5.1.2.2 MPEG-2

MPEG-2 SD video content in 25Hz systems SHALL comply with [TS101154] clause 5.1 with the following exceptions:

- The 2.21:1 Aspect Ratio SHALL NOT be used.

This format corresponds to video format label MPEG2_SD_25.

MPEG-2 SD video content in 30Hz systems SHALL comply with [TS101154] clause 5.3 with the following exceptions:

- The 2.21:1 Aspect Ratio SHALL NOT be used.

This format corresponds to video format label MPEG2_SD_30.

5.1.3 Video Telephony Profile

5.1.3.1 H.264/AVC

H.264/AVC video content SHALL comply with [TS126114] clause 5.2.2.

This format corresponds to video format label AVC_VDC.

5.1.3.2 MPEG-4 Part-2 Visual

MPEG-4 Part-2 Visual video content SHALL comply with [TS126114] clause 5.2.2.

This format corresponds to video format label MP4V.

5.1.3.3 H.263

H.263 video content SHALL comply with [TS126114] clause 5.2.2.

This format corresponds to video format label H263.

5.1.4 Sub-Picture Profile

The following table list the supported coding parameters for sub-picture video

Table 12: Sub-Picture formats

Horizontal Resolution (pixels)	Vertical Resolution (lines)	Scan Type	Frame Rate (fps)	Aspect Ratio	System
192	192	p	23.976, 24, 59.94	16:9	30Hz
192	144	p	23.976, 24, 59.94	16:9	30Hz
128	96	p	23.976, 24, 59.94	16:9	30Hz
192	192	p	29.97	16:9, 4:3	30Hz
192	144	p	29.97	16:9, 4:3	30Hz
128	96	p	29.97	16:9, 4:3	30Hz
192	192	p	25	16:9, 4:3	25Hz
192	144	p	25	16:9, 4:3	25Hz
128	96	p	25	16:9, 4:3	25Hz
192	192	p	50	16:9	25Hz
192	144	p	50	16:9	25Hz
128	96	p	50	16:9	25Hz

5.1.4.1 H.264/AVC

The IPTV solution SHALL utilize the following encoded video media profile for content used in Sub-Picture streams.

- H.264/AVC Main Profile @ Level 1.3

This format corresponds to video format label AVC_SP_25 in 25Hz systems, and AVC_SP_30 in 30Hz systems.

5.1.4.2 MPEG-2

The MPEG-2 Main Profile @ Low Level as defined in [H262] shall be used for Sub-Picture video streams. The DVB codec toolbox [TS101154] does not provide constraints applicable to Sub-Picture formats.

This format corresponds to video format label MPEG2_SP_25 in 25Hz systems, and MPEG2_SP_30 in 30Hz systems.

5.1.5 Video formats for Mobile A/V Services

5.1.5.1 H.263

H.263 video content SHALL comply with [3GPPTS26234] section 7.4.

5.1.5.2 H.264/AVC

H.264/AVC video content SHALL comply with [3GPPTS26234] section 7.4.

5.1.5.3 MPEG-4 Part-2 Visual

MPEG-4 Part-2 Visual video content SHALL comply with [3GPPTS26234] section 7.4.

5.1.6 H.264/AVC GOP Structure

All AVC format content provided in IPTV services SHALL conform to the following constraints in GOP structure:

- I picture: A picture with *slice_type*=7 or *slice_type*=2 for all the slices composing that picture or IDR picture
- P picture: A picture with *slice_type*=5 or *slice_type*=0 for all the slices composing that picture.
- B picture: A picture with *slice_type*=6 or *slice_type*=1 for all the slices composing that picture.
- Decoding order among I or P pictures SHALL be kept in their display order.
- P picture SHALL NOT refer to B pictures.
- Complementary reference field pair that includes I/P field SHALL NOT include B field.
- Reference B picture SHALL refer to the following.
  - I or P frames or complementary reference field pairs of I or P pictures that immediately precedes/follows in display order.
- Non-reference B picture SHALL refer to the following.
  - I or P frames or complementary reference field pairs of I or P pictures that immediately precedes/follows in display order.
  - A reference B frame or a complementary reference field pair of reference B pictures that immediately precedes/follows in display order and is present between “pic1” and “pic2” in display order. Here, “pic1” is immediately preceding I or P picture and “pic2” is immediately following I or P picture.

5.1.7 3D

5.1.7.1 H.264/AVC

3D content SHALL comply with [DVB3D] section 5.1. The coded video stream SHALL apply the frame packing arrangement supplemental enhancement information (SEI) message according to [DVB3D] section 6.4.

This format corresponds to video format label AVC_3D_25 in 25Hz systems and AVC_3D_30 in 30Hz systems.

The following formats are specified by [DVB3D]:

- 720p @ 50Hz Top-and-Bottom (TaB);
- 720p @ 50Hz Side-by-Side (SbS) (*);
- 1080i @ 25Hz Side-by-Side (SbS);
- 720p @ 59.94 / 60 Hz Top-and-Bottom (TaB);
- 720p @ 59.94 / 60 Hz Side-by-Side SbS (SbS) (*);
- 1080i @ 29.97 / 30 Hz Side-by-Side (SbS);
- 1080p @ 23.98 / 24 Hz Top-and-Bottom (TaB);
- 1080p @ 23.98 / 24 Hz Side-by-Side (SbS) (*).

(*): these formats are optional for compliance with HDMI. Some 3DTV capable display devices might not support these 3DTV video formats.

5.2 Service Usage

The video formats specified in the Standard Definition Profile and in the High Definition Profile are applicable to A/V content provided within any of the Release 2 IPTV services. The video formats for Mobile A/V Services are applicable to any of the Release 2 IPTV services. The video formats specified in the Video Telephony Profile are applicable to content provided within Video Telephony services. The video formats specified in the Sub-Picture Profile are applicable for use with Picture-in-Picture function.

6 Subtitles

This section defines the formats of subtitle streams for the purpose of providing alternative language subtitles and closed captions for A/V services. The decision on the use and format of subtitle streams is made by the service provider or content provider. Subtitle content MAY be provided with any IPTV service.

6.1 Formats

For an IPTV service delivered using the TS or TTS system formats, any of the following subtitle formats SHALL be used:

- Based on DVB subtitles [DVBSUBT] using format label DVB-SUBT. This format includes support for subtitles in 3D video content.
- Based on EBU Teletext [DVBTTXT] using format label EBU-SUBT.
- Based on CEA-708-C [CEACC] using format label CEA-SUBT.

If other subtitle formats are used, e.g. for market specific or regulatory reasons, their usage is outside the scope of the present specification.

For Mobile A/V Services, the Timed Text [3GPPTS26245] format SHALL be used. This format corresponds to video format label 3GPP-TT.

6.2 Service Usage

Subtitle streams within an IPTV service MAY be used for the provision of:

- Subtitles for foreign-language content,
- Closed captions for enhanced accessibility,
- Any other purpose where such streams form part of a service offering.

7 Teletext

This section defines the formats of teletext for the purpose of providing an information service together with the A/V stream. Teletext is a legacy sub-service of Scheduled Content Services utilised in some parts of the European market.

Teletext information MAY be supported by the Scheduled Content Service.

It is expected that in the future such information services will be provided by the Declarative Application Environment [OIPF_DAE2].

7.1 Formats

Teletext information SHALL be based on EBU Teletext [DVBTTXT]. This format corresponds to the format label EBU-TTXT.

7.2 Service Usage

The Scheduled Content service MAY include teletext information.

Teletext information SHALL NOT be provided with content delivered by the Content on Demand services.

8 Audio

The specification of audio formats and codec profiles is based upon the DVB A/V codec usage specification for applications based on MPEG-2 transport streams [TS101154]. The present specification further profiles the DVB specification by mandating certain codec choices and audio formats.

MPEG-4 AAC or HE-AAC [AAC] (audio format label: HEAAC) is the preferred audio codec for A/V content and is the mandatory audio content format. Decoding support for HE-AAC is a mandatory minimum OITF capability with regard to A/V media formats.

MPEG 4 HE-AAC v2 [AAC] (audio format label: HEAAC2) MAY be used when appropriate, as designated by systems requirements.

MPEG-1 Audio Layer II [MPEG1] (audio format label: MPEG1_L2) or AC-3 (Dolby Digital) [AC3] (audio format label: AC3) MAY be used when appropriate, for example when legacy equipment or content in that format has already been deployed, or due to regulatory or contractual considerations.

DTS-HD [DTS] (audio format label: DTS) MAY be used when appropriate, as designated by systems requirements.

Enhanced AC-3 (Dolby Digital Plus) [AC3] (audio format label: E-AC3) MAY be used when appropriate, as designated by systems requirements.

MPEG Surround [MPS] (audio format label: MPS) may be used in combination with MPEG-4 AAC or HE-AAC or MPEG-1 Layer II. This combination implements scalability from a stereo (or mono) core bitstream to multichannel and will thus play at least in stereo (or mono) on MPEG-4 AAC-only (respectively MPEG-4 HE AAC or MPEG-1 Layer II) decoding devices.

AMR [3GPPAMR] (audio format label: AMR) and AMR-WB [3GPPAMRWB] (audio format label: AMR-WB) MAY be used for Mobile A/V Services. MPEG-4 AAC or HE-AAC [AAC] (audio format label: HEAAC), enhanced aacPlus [3GPPEAAC+] (audio format label: HEAAC2) and Extended AMR-WB [3GPPAMRWB+] (audio format label: AMR-WB+) MAY be used for Mobile A/V Services.

For audio-only services, the MPEG-1 Audio Layer III (MP3) codec [MPEG1] MAY also be used.

Profiles of audio are also used to provide audible notifications and audio clips within the Declarative [OIPF_DAE2] and Procedural Application Environments [OIPF_PAE2], as specified in section 8.2.1.

For voice and video telephony services the following audio media formats MAY be used:

- G.711 [ITUTG711] (audio format label: G711) MAY be used for narrow-band voice telephony.
- AMR [3GPPAMR] (audio format label: AMR) MAY be used for narrow-band voice telephony.
- G.729.A [ITUTG729] Annex A (audio format label: G729A) MAY be used for narrow-band voice telephony.
- G722 [ITUTG722] (audio format label: G722) MAY be used for wide-band voice telephony.
- AMR-WB/G.722.2 [3GPPAMRWB] (audio format label: AMRWB) MAY be used for wide-band voice telephony.
- G.729.1 [ITUTG729-1] (audio format label: G7291) MAY be used for wide-band voice telephony.
- MPEG-4 AAC LD [AAC] (audio format label: AACLD) MAY be used for super-wideband voice and video telephony.
- MPEG-4 AAC ELD [AAC] (audio format label: AACELD) MAY be used for super-wideband voice and video telephony.
- G.719 [ITUTG719] (audio format label: G719) MAY be used for super-wideband voice and video telephony

If voice or video telephony services are supported on the OITF, encoding and decoding of G.711 and AMR for narrow-band and G.722 and AMR-WB/G722.2 for wide-band SHALL be supported.

8.1 Formats

8.1.1 HE-AAC and AAC

AAC, HE-AAC and HE-AAC v2 audio coding SHALL be in accordance with [AAC], which contains the audio object types AAC LC, SBR and PS. Its use is constrained according to [TS101154] clause 6.4.

AAC and HE-AAC format corresponds to the audio format label HEAAC.

HE_AAC v2 format corresponds to the audio format label HEAAC2.

8.1.1.1 A/V content

HEAAC format audio for A/V content SHALL utilise Level 4 encoding as specified in [AAC].

If used in combination with MPEG Surround, HE AAC format audio for A/V content SHALL utilise Level 2 encoding or Level 4 encoding as specified in [AAC].

8.1.1.2 Audio clips

HEAAC format audio for audible notifications and audio clip content SHALL utilise Level 2 encoding as specified in [AAC], consisting of a sequence of single of multiple audio frames whereby an audio frame consists of an ADTS header and an audio frame data pair.

8.1.1.3 HE-AAC metadata

HEAAC format audio MAY contain metadata as specified in [AAC] or [TS101154], specifically:

- Dynamic Range Control parameters as defined in [AAC] section 4.5.2.7 or [TS101154] section 6.4.3 and Annex C.5
- Down-mix parameters as defined in [AAC] section 4.5.1.2.2 or [TS101154] Annex C.5.

The Dynamic Range Control metadata SHALL be used, if present in the encoded audio data.

For stereo output of 5.1 surround audio streams, the down-mix parameters SHALL be used, if present in the encoded audio data.

8.1.2 AC-3

AC-3 audio coding SHALL be compliant with [AC3], constrained according to [TS101154] clause 6.2, with the following additional constraints:

- AC-3 audio streams shall be encoded at a sample rate of 48 kHz

This format corresponds to the audio format label AC3.

8.1.3 Enhanced AC-3

Enhanced AC-3 audio coding SHALL be compliant with [AC3], constrained according to [TS101154] clause 6.2, with the following additional constraints:

- Enhanced AC-3 audio streams shall be encoded at a sample rate of 48 kHz

This format corresponds to the audio format label E-AC3

8.1.4 MPEG-1 Layer II

MPEG-1 Layer II audio coding SHALL be compliant with [MPEG1] constrained according to [TS101154] clause 6.1.

This format corresponds to the audio format label MPEG1_L2.

8.1.5 MPEG-1 Layer III

MPEG-1 Layer III audio coding SHALL only be used for audio only services. It SHALL NOT be used in conjunction with a video stream to form an A/V service.

MPEG-1 Layer III encoding SHALL be compliant with [MPEG1], constrained according to [DLNAMEDIA]. Either of the MP3 and MP3X profiles from [DLNAMEDIA] MAY be used.

This format corresponds to the audio format label MPEG1_L3.

8.1.6 WAVE

Wave format (Audio Format: WAV) audio coding MAY be used for audible notifications and audio clips within the Declarative Application Environment [OIPF_DAE2]. The following characteristics SHALL be supported by the OITF.

Sampling Frequency: From 12 kHz up to 16 kHz

Codec(s): Uncompressed (PCM), ADPCM

Quantisation Bit Rate: 16 bits

Channels: From mono up to 5.1 channels

This format corresponds to the audio format label WAV.

8.1.7 DTS-HD

DTS-HD is an expansion on the original DTS Coherent Acoustics definition. DTS-HD maintains support for Coherent Acoustics and extends the range of capabilities, which have been commercialized as:

- DTS Express®
- DTS-HD High Resolution Audio®
- DTS-HD Master Audio®

This is in addition to the original DTS family which were commercialized as:

- DTS®
- DTS-ES®
- DTS 96/24®

Using the DTS-HD audio descriptor, as defined in [EN300468], and transport requirements as defined in [TS101154], support for DTS-HD is seamless across the variations.

DTS-HD format (Audio Format: DTS) audio coding shall be compliant with [DTS] and according to [TS101154] section 6.3.

- Usage of DTS-HD in ISOBMFF is defined in Annex E of [DTS].

8.1.8 MPEG Surround

MPEG Surround SHALL be compliant with [MPS] and SHALL be used in combination with MPEG-4 AAC or HE AAC constrained according to section 8.1.1 or in combination with MPEG-1 Layer II constrained according to section 8.1.4. Its use is further constrained according to [TS101154] clause 6.1 and clause 6.4 and the following:

- Sampling frequency
    - **Encoding:** For audio encoded using MPEG Surround, the sampling frequency of the MPEG Surround data SHALL be equal to the sampling frequency of the core audio stream.

The combination of MPEG Surround and MPEG-4 AAC or HE-AAC corresponds to the audio format label HEAAC_MPS.

The combination of MPEG Surround and MPEG-1 Layer II corresponds to the audio format label MPEG1_L2_MPS.

8.1.9 Audio Formats for voice and video telephony

G.711 audio coding SHALL be compliant with [ITUTG711] according to [TS181005] clause 6.2; this format corresponds to the audio format label G711.

AMR audio coding SHALL be compliant with [3GPPAMR] according to [TS126114] clause 5.2.1 and [TS181005] clause 6.2; this format corresponds to the audio format label AMR.

G.729 audio coding SHALL be compliant with [ITUTG729] according to [TS181005] clause 6.2; this format corresponds to the audio format label G729A.

G.722 audio coding SHALL be compliant with [ITUTG722] according to [TS181005] clause 6.3.2; this format corresponds to the audio format label G722.

AMR-WB/G.722.2 audio coding SHALL be compliant with [3GPPAMRWB] according to [TS181005] clause 6.3.2; this format corresponds to the audio format label AMRWB.

G.729.1 audio coding SHALL be compliant with [ITUTG729-1] according to [TS181005] clause 6.3.2; this format corresponds to the audio format label G7291.

G.719 audio coding SHALL be compliant with [ITUTG719]; this format corresponds to the audio format label G719.

8.1.9.1 MPEG-4 AAC LD and ELD

MPEG-4 AAC LD audio coding SHALL be compliant with the Low Delay AAC Profile as defined in clause 1.5.2.1 of [AAC] (profile-level-id=52 as defined in clause 1.5.2.4, table 1.4 of [AAC]); this format corresponds to the audio format label AACLD.

MPEG-4 AAC ELD audio coding SHALL be compliant with AAC Enhanced Low Delay as defined in clause 1.5.1, Table 1.1 of [AAC] and described in clause 1.5.1.2.37 of [AAC] (audio object type = “ER AAC ELD”, object type ID = 39); this format corresponds to the audio format label AACELD.

8.1.10 Audio Formats for Mobile A/V Services

For Mobile A/V Services the following applies:

- AMR content SHALL be compliant with [3GPPAMR]. This format corresponds to label AMR.
- AMR-WB content SHALL be compliant with [3GPPAMRWB]. This format corresponds to label AMR-WB.
- AAC and HE-AAC content SHALL be compliant with [3GPPEAAC+]. This format corresponds to label HEAAC.
- Enhanced aacPlus content SHALL be compliant with [3GPPEAAC+]. This format corresponds to label HEAAC2.
- Extended AMR-WB SHALL be compliant with [3GPPAMRWB+]. This format corresponds to label AMR-WB+.

8.2 Platform Usage

8.2.1 Audible Notifications and Audio Clips

IPTV Service Providers MAY utilize the following audio formats for audible notifications and audio clips within either declarative or procedural applications used to provide services, as specified in [OIPF_DAE2] and [OIPF_PAE2]:

- AAC formatted files with a maximum file size of 512KB identified with the MIME type “audio/mp4”,
- WAV formatted files with a maximum file size of 512KB identified with the MIME type “audio/x-wav” (DAE only),
- MPEG1_L3 formatted files identified with the MIME type “audio/mpeg” (PAE only).

8.2.2 Audio Description

If audio description is provided for the service, then the method to provide Audio Description SHALL be either the provision of a pre-mixed combination of audio description and the main audio as a suitably signalled HE-AAC stream or according to Annex E of [TS101154]. In either case, either the HE-AAC, MPEG-1 Audio Layer II or Enhanced E-AC3 audio codec MAY be used (the latter two codecs only when supported).

However, if the optional MPEG-1 Audio Layer II codec is supported, then the method for Audio Description defined in Annex E of [TS101154] MAY be applied.

If the service platform requires the deployment of any other of the optional audio codec for A/V services, then that optional codec MAY also be used to provide audio description as a pre-mixed combination of audio description and the main audio as a suitably signalled stream.

8.2.3 Clean Audio

Clean Audio is a supplementary audio service that enhances the listening experience for the hearing impaired. If Clean Audio is provided for the IPTV service then it SHALL be provided as specified in [TS101154] Annex E.4.

8.2.4 Audio output Interfaces

For stereo output interfaces, 5.1 surround audio streams SHALL be down-mixed to stereo.

For digital outputs (e.g. S/PDIF or HDMI) one of the following conversions MAY be used:

- Conversion of the received Enhanced AC-3 audio streams to AC-3 [AC3]
- Transcoding of the received HEAAC, HEAAC_MPS or MPEG1_L2_MPS audio streams to the AC3 [AC3] or DTS-HD [DTS] formats
- Decoding of the received DTS, HEAAC, HEAAC_MPS or MPEG1_L2_MPS audio streams and output of PCM multi-channel over HDMI

9 Still Pictures and Graphics

9.1 Formats

Still pictures and graphics content are used within both the Declarative (DAE) and the Procedural Application Environments (PAE).

The usage of still pictures and graphics formats within declarative applications is specified in [OIPF_DAE2]. The formats adopted in the DAE are defined in [CEA-2014-A].

The usage of still pictures and graphics formats within procedural applications is specified in [OIPF_PAE2]. The formats adopted in the PAE are defined in [GEM].

The present volume just notes the labels applied to the used formats – JPEG [JFIF], GIF [GIF] and PNG [PNG].

9.1.1 JPEG

This format corresponds to the graphics format label JPEG.

The mime type of “image/jpeg” SHALL be used for compliant JPEG images.

9.1.2 GIF

This format corresponds to the graphics format label GIF.

The mime type of “image/gif” SHALL be used for compliant GIF images.

9.1.3 PNG

This format corresponds to the graphics format label PNG.

The mime type of “image/png” SHALL be used for compliant PNG images.

