Open IPTV Forum – Release 1 Specification

Volume 2 – Media Formats

V1.0, January 6, 2009

Open IPTV Forum

Open IPTV Forum

Postal address

Open IPTV Forum support office address
650 Route des Lucioles – Sophia Antipolis
Valbonne – FRANCE
Tel.: +33 4 92 94 43 83
Fax: +33 4 92 38 52 90

Internet
http://www.oipf.tv

Contents

Tables

Figures

Foreword

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

This specification provides multiple options for some features. The Open IPTV Forum Profiling specification will complement the Release 1 specifications by defining the Open IPTV Forum implementation and deployment profiles. Any implementation based on Open IPTV Forum specifications that does not follow the Profiling specifications cannot claim Open IPTV Forum compliance.

Introduction

The Open IPTV Forum Release 1 Specification consists of seven volumes:

- Volume 1 - Overview [OVIEW],

- Volume 2 - Media Formats (the present volume),

- Volume 3 - Content Metadata [META],

- Volume 4 – Protocols [PROT],

- Volume 5 - Declarative Application Environment [DAE],

- Volume 6 - Procedural Application Environment [PAE], and

- Volume 7 – Authentication, Content Protection and Service Protection [CSP].

The present volume defines the set of media formats and their usage, available for the implementation of Release 1 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 1 services (described in [OVIEW]), 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 [PROT].

Audio, Video, Subtitle, Teletext Formats						
BBTS	PF		PDCF	MIMPMP	DCF	
TS or TTS			MP4			
Transport Protocols (specified in Volume 4)						
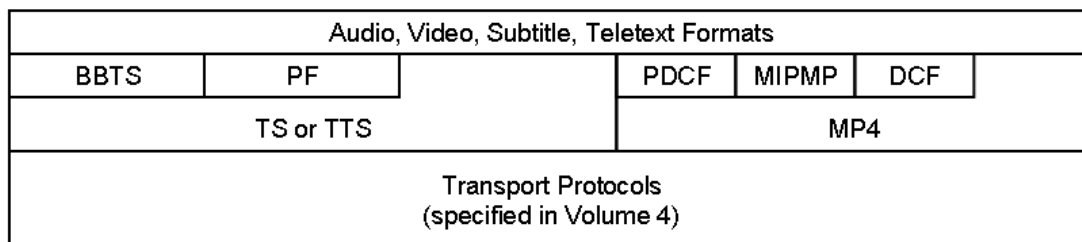
Figure 1 Media formats stack

Moreover, the present document specifies mandatory OITF capabilities with respect to media formats, in section 10. Optional media format capabilities are also documented in section 10.

This volume specifies formats for the A/V content provided by IPTV services and does not apply to the broadcast channel input of hybrid devices.

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

1 References

1.1 Normative References

1.1.1 Standard References

[RFC2119]	RFC 2119 (1997-03), IETF, "Key words for use in RFCs to Indicate Requirement Levels".
[TS101154]	ETSI TS 101 154 V1.8.1 (2007-07), "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream".
[TS102034]	ETSI TS 102 034 V1.3.1 (2007-10), "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Networks".
[MPEG2TS]	ISO/IEC 13818-1:2000/Amd.3:2004, "Generic coding of moving pictures and associated audio information: Systems".
[EN300468]	ETSI EN 300 468 V1.9.1 (2008-11), "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".
[DLNAMEDIA]	DLNA Networked Device Interoperability Guidelines expanded: October 2006. Volume 2: Media Format Profiles. Digital Living Network Alliance.
[MRL BBTS]	Marlin Developer Community, "Marlin Broadband Transport Stream Specification", Version 1.0, July 2008.
[ISOFF]	ISO/IEC 14496-12:2005, "Information Technology - Coding of Audio-Visual Objects - Part 12: ISO Base Media file format", International Standards Organization.
[MP4FF]	ISO/IEC 14496-14:2003, "Information Technology – Coding of Audio-Visual Objects – Part 14: MP4 file format", International Standards Organization.
[AVCFF]	ISO/IEC 14496-15:2004, "Information Technology - Coding of Audio-Visual Objects - Part 15: Advanced Video Coding (AVC) file format", International Standards Organization.
[OMARLIN]	Marlin Developer Community, "OMArlin Specification", Version 1.0.1, July 2008.
[MRL FF]	Marlin Developer Community, "Marlin - File Formats Specification", Version 1.1, July 2008, and latest version of "Marlin Errata: Marlin - File Formats Specification V1.1".
[H264]	ITU-T Recommendation H.264 / ISO/IEC 14496-10:2005: "Information technology – Coding of audio-visual objects- Part 10: Advanced Video Coding".
[H262]	ITU-T Recommendation H.262 / ISO/IEC 13818-2: "Information Technology – Generic Coding of moving pictures and associated audio information: Video".
[DVBSUBT]	ETSI EN 300 743 V1.3.1 (2006-11), "Digital Video Broadcasting (DVB) – Subtitling systems".
[CEACC]	Consumer Electronics Association CEA-708-C (2006), "Digital Television (DTV) Closed Captioning".
[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".
[AAC]	ISO/IEC 14496-3:2005, "Information Technology – Coding of audio-visual objects – Part 3: Audio".
[AC3]	ATSC A/52B, "Digital Audio Compression Standard (AC-3, E-AC-3) Revision B" and ATSC A/53 Part 5:2007, "AC-3 Audio System Characteristics".
[MPEG1]	ISO/IEC 11172-3:1993/Cor 1:1996, "Information Technology – Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s – Part 3: Audio".
[ITUT81]	ITU-T T.81 (09/92), "Information Technology - Digital Compression and Coding of Continuous-tone Still Images: Requirements and guidelines".
[JFIF]	JPEG File Interchange Format, Version 1.02, Eric Hamilton, C-Cube Microsystems, September 1, 1992
[GIF]	Graphics Interchange Format version 89a, © 1987, 1988, 1989, 1990, CompuServe Incorporated, Columbus, Ohio.
[PNG]	ISO/IEC 15948:2004, "Information technology -- Computer graphics and image processing -- Portable Network Graphics (PNG): Functional specification".
[CEA2014]	CEA-2014-A, July 2007, "Web-based Protocol Framework for Remote User Interface on UPnP Networks and the Internet (Web4CE)", including the August 28, 2008 Errata.
[GEM]	DVB Bluebook A108r1: "Globally Executable MHP (GEM) Version 1.2.1", available at http://www.mhp.org

1.1.2 Open IPTV Forum References

[ARCH]	Open IPTV Forum, "Functional Architecture", V1.2, January 2008
[SVCS]	Open IPTV Forum, "Services and Functions for Release 1", September 2007
[OVIEW]	Open IPTV Forum, "Release 1 Specification, Volume 1 – Overview", V1.0, January 2009
[META]	Open IPTV Forum, "Release 1 Specification, Volume 3 – Metadata", V1.0, January 2009
[PROT]	Open IPTV Forum, "Release 1 Specification, Volume 4 – Protocols", V1.0, January 2009
[DAE]	Open IPTV Forum, "Release 1 Specification, Volume 5 - Declarative Application Environment", V1.0, January 2009
[PAE]	Open IPTV Forum, "Release 1 Specification, Volume 6 - Procedural Application Environment", V1.0, January 2009
[CSP]	Open IPTV Forum, "Release 1 Specification, Volume 7 - Authentication, Content Protection and Service Protection", V1.0, January 2009

1.2 Informative References

[DTS]	ETSI TS 102 114 v1.2.1, DTS Coherent Acoustics; Core and Extensions.
[SPDIF]	ISO/IEC 60958-3:2006, Digital audio interface – part 3: Consumer applications.

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

No new terms are defined within the scope of the present Volume.

2.2.2 Abbreviations

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

Acronym	Explanation
AAC	Adaptive Audio Coding
AAC LC	AAC Low Complexity
ATSC	Advanced Television Systems Committee
DVB	Digital Video Broadcasting
DVB-SI	DVB Service Information
ETSI	European Telecommunications Standards Institute
fps	Frames per Second
GIF	Graphics Interchange Format
GOP	Group Of Pictures
HDMI	High-Definition Multimedia Interface
HE-AAC	High Efficiency-AAC
JPEG	Joint Photographic Experts Group
MPEG	Moving Pictures Expert Group
PiP	Picture in Picture
PNG	Portable Network Graphics
PSI	Programme Specific Information
SBR	Spectral Band Replication
SI	Service Information
S/PDIF	Sony/Philips Digital Interconnect Format

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 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 [META] of the present specification describes how the media format of content is signaled in the metadata.

Section 10 specifies the A/V media formats that are either REQUIRED to be supported in the OITF or are OPTIONAL for the OITF to support.

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

System Format	Video Format	Audio Format	Mime Type
TS	AVC_HD_25 AVC_SD_25	HEAAC AC3	video/mpeg
TTS	AVC_HD_25 AVC_SD_25	HEAAC AC3	video/vnd.dlna.mpeg-tts
MP4	AVC_HD_25 AVC_SD_25	HEAAC AC3	video/mp4
TS	MPEG2_HD_25 MPEG2_SD_25	AC3	video/mpeg
TTS	MPEG2_HD_25 MPEG2_SD_25	AC3	video/vnd.dlna.mpeg-tts
TS	MPEG2_SD_25 AVC_SD_25	MPEG1_L2	video/mpeg
TTS	MPEG2_SD_25 AVC_SD_25	MPEG1_L2	video/vnd.dlna.mpeg-tts

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

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

System Format	Video Format	Audio Format	Mime Type
TS	AVC_HD_30 AVC_SD_30	HEAAC AC3	video/mpeg
TTS	AVC_HD_30 AVC_SD_30	HEAAC AC3	video/vnd.dlna.mpeg-tts
MP4	AVC_HD_30 AVC_SD_30	HEAAC	video/mp4

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

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

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
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	(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

Table 3 Protected A/V media formats

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

Audio Format	Mime Type
MPEG1_L3	audio/mpeg
HEAAC	audio/mp4
WAV	audio/x-wav

Table 4 Pure audio media formats

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

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

Table 5Graphics media formats

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 [CSP]. 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 [META] of the present specification.

- 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.

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 9.2.25, 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 [CSP] 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.

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 9.3.29 of [DLNAMEDIA], except for 9.3.29.3 and 9.3.29.10. This is the preferred format for MP4-based unprotected content. Moreover, the following additional constraints apply:

- The *largesize* defined in 4.2 of [ISOFF] SHALL NOT be used. Note that larger MP4 files are still able to be generated and used in IPTV services by means of movie fragments.

- The *stco* box defined in 8.19 of [ISOFF] SHALL be used. i.e. the *co64* box defined in 8.19 of [ISOFF] SHALL NOT be used.

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 *moov* and *moof* boxes SHALL be used according to section 9.3.29.10 of [DLNAMEDIA].

- Use of the *pdin* box, defined in 8.43 of [ISOFF], is RECOMMENDED.

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

The methods to protect (encrypt) MP4-based file formats are specified in [CSP]. Three 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.

4.3 Service Usage

The scheduled content and unicast streamed CoD services on managed networks SHALL use either the TS format or the TTS format as specified above.

NOTE: Systems layer formats usage for content download services and streamed CoD on unmanaged networks will use one of either the TS/TTS or MP4 based formats, but the criteria that determine which is used, and under which circumstances, are out of the scope of the present document.

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.

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.

5.1 Formats

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

- High Definition (HD), and

- Standard Definition (SD).

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 H.264/AVC GOP Structure

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

- *slice_type* value SHALL be set to 5 (P slice), 6 (B slice) or 7 (I slice). All slices in the same picture SHALL be of the same type.

- I picture: A picture with *slice_type*=7 or IDR picture

- P picture: A picture with *slice_type*=5.

- B picture: A picture with *slice_type*=6.

- 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.

  o I or P frames or complementary reference field pairs of I or P pictures that immediately precedes/follows in display order.

- Reference B field MAY refer to the reference field that consists of the complementary reference field pair.

- Non-reference B picture SHALL refer to the following.

  o I or P frames or complementary reference field pairs of I or P pictures that immediately precedes/follows in display order.

  o 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.

5.2 Service Usage

The video formats specified are applicable to A/V content provided within any of the Release 1 IPTV services.

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

Either of the following subtitle formats SHALL be used in an IPTV service:

- Based on DVB subtitles [DVBSUBT] and EBU Teletext [DVBTTXT].

- Based on CEA-708-C [CEACC].

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

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 [DAE].

7.1 Formats

Teletext information SHALL be based on EBU Teletext [DVBTTXT].

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 [AAC] (audio format label: HEAAC) is the preferred audio codec for A/V content.

MPEG-1 Audio Layer II [MPEG1] or AC-3 (Dolby Digital) [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

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 [DAE] and Procedural Application Environments [PAE], as specified in section 8.2.1.

8.1 Formats

8.1.1 HE-AAC and AAC

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

- Either the MPEG-4 AAC Profile or the MPEG-4 HE-AAC Profile SHALL be used.

- The MPEG-4 HE-AAC v2 Profile SHALL NOT be used.

This format corresponds to the audio format label HEAAC.

8.1.1.1 A/V content

HEAAC format audio for A/V content SHALL utilise 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.

8.1.2 AC-3

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

- The AC-3 format SHALL be used.

- The Enhanced AC-3 format SHALL NOT be used.

This format corresponds to the audio format label AC3.

8.1.3 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.

8.1.4 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.

8.1.5 WAVE

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

Sampling Frequency: 12kHz

Codec(s): Uncompressed (PCM), ADPCM

Quantisation Bit Rate: 16 bits

Channels: Mono

This format corresponds to the audio format label WAV.

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 [DAE] and [PAE]:

- 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 96KB 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 the provision of a pre-mixed combination of audio description and the main audio as a suitably-signalled HE-AAC stream.

The current alternative standard method for Audio Description, defined in Annex E of [TS101154], is not generally applicable, as it stipulates the use of the MPEG-1 Audio Layer II audio codec, which is an optional codec in the present specification.

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.

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 [DAE]. The formats adopted in the DAE are defined in [CEA2014].

The usage of still pictures and graphics formats within procedural applications is specified in [DAE]. 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.

10 OITF media format capabilities

10.1 Mandatory capabilities

The mandatory minimum OITF capability with regard to A/V media formats is to support the decoding of the mandatory video and audio content formats, namely:

- The OITF SHALL support the decoding and rendering of H.264/AVC video, either SD and HD resolution, or SD resolution only, depending on the related optional capability of the OITF.

- The OITF SHALL support the decoding of HE-AAC audio in up to 5.1 channel surround format. If the OITF does not make use of 5.1 surround mode then it SHALL be capable of down-mixing the 5.1 surround audio stream to stereo. Note that decoders supporting the MPEG-4 HE-AAC profile inherently also support the MPEG-4 AAC profile.

If the OITF supports the scheduled content service or the unicast streamed content on demand service on managed networks then it SHALL support the TS systems layer format.

If the OITF supports the DAE function then it SHALL support all the still picture, graphics and audio clip formats required by the DAE function and referenced in the relevant sections of this specification.

10.2 Optional capabilities

Media format related optional capabilities of the OITF arise from two aspects:

- Optional codecs and formats support, and

- Optional features support within the usage of each individual codec.

Optional capabilities are described in the following sub-sections, grouped into systems, video and audio capabilities. The support of each individual capability is made apparent through the list of supported media formats that are specified in section 3.

If the OITF supports the DAE function then it SHALL signal its support of each optional media format capability using he mechanism specified in Volume 5 [DAE].

10.2.1 Optional systems layer capabilities

10.2.1.1 Timestamped MPEG-2 transport stream

Support of the TTS systems layer format in the OITF is OPTIONAL.

10.2.2 Optional video capabilities

10.2.2.1 HD format video

Support of HD format video decoding in the OITF is OPTIONAL.

10.2.2.2 MPEG-2 video

Support of the MPEG-2 video format in the OITF is OPTIONAL.

10.2.3 Optional audio capabilities

If the device hosting the OITF is equipped with digital outputs (e.g. S/PDIF [SPDIF] or HDMI) then it SHOULD include the capability to transcode the received HE-AAC audio streams to the AC3/E-AC3 or DTS [DTS] formats for use with existing consumer A/V equipment.

10.2.3.1 AC-3 format audio

Support of the AC3 audio format in the OITF is OPTIONAL.

Note: The support of the AC3 audio format is expected to be required in certain 30Hz video format regions.

10.2.3.2 MPEG-1 layer 2 audio

Support of the MPEG1_L2 audio format in the OITF is OPTIONAL.

10.2.3.3 MP3 audio

Support of the MPEG1_L3 audio format in the OITF is OPTIONAL.

10.2.3.4 WAV audio

Support of the WAV audio format in the OITF is OPTIONAL.