
ANNEX INFORMATIVE: UPnP Telephony Media
Formats and codecs

For UPnP Version 1.0

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1 Scope

This Informative Annex defines basic media formats and codecs to be used for audio/video sessions managed by Telephony Client (TC) inside the home network according to UPnP Telephony Architecture v1.0.

1.1 Applicability

Since UPnP Telephony Service leverages on the VoIP infrastructure provided by the Telephony Service Provider, which is mainly based on IMS architectures, protocols, solutions, the main reference to take into account in order to define media formats that have been standardized by 3GPP and in particular by 3GPP TS 26.114 (IMS-MT: Media Handling and interaction) and TS 26.141 (IP Multimedia System (IMS) Messaging and Presence; Media formats and codecs). And this annex also refers TTC TR-1021 which specifies media formats for multimedia communication on IP based broadband network (such as NGN) in Japan.

1.2 References

- [1] ITU-T Recommendation G.711 (11/88) G.711 : Pulse code modulation (PCM) of voice frequencies
- [2] 3GPP TS 26.071: "Mandatory Speech Codec speech processing functions; AMR Speech Codec; General description".
- [3] 3GPP TS 26.090: "Mandatory Speech Codec speech processing functions; Adaptive Multi-Rate (AMR) speech codec; Transcoding functions".
- [4] 3GPP TS 26.073: "ANSI-C code for the Adaptive Multi Rate (AMR) speech codec".
- [5] 3GPP TS 26.104: "ANSI-C code for the floating-point Adaptive Multi Rate (AMR) speech codec".
- [6] 3GPP TS 26.114: "IMS-MT: Media Handling and interaction"
- [7] 3GPP TS 26.171: "AMR speech codec; General description".
- [8] 3GPP TS 26.190: "Speech Codec speech processing functions; AMR Wideband speech codec; Transcoding functions".
- [9] 3GPP TS 26.173: "ANSI-C code for the Adaptive Multi Rate - Wideband (AMR-WB) speech codec".
- [10] 3GPP TS 26.204: "ANSI-C code for the Floating-point Adaptive Multi-Rate Wideband (AMR-WB) speech codec".
- [11] ITU-T Recommendation G.729 (01/07) Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)
- [12] ITU G.723: "Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 Kbit/s"
- [13] ITU-T Recommendation (11/88) G.722 page ITU-T Recommendation G.722 (11/88), "7 kHz audio-coding within 64 kbit/s"
- [14] IETF RFC 3550 RTP: A Transport Protocol for Real-Time Applications (July 2003)
- [15] IETF RFC 4867 RTP Payload Format and File Storage Format for the Adaptive Multi-Rate (AMR) and Adaptive Multi-Rate Wideband (AMR-WB) Audio Codecs (April 2007)
- [16] ITU-T Recommendation H.263 (02/98): "Video coding for low bit rate communication".
- [17] ITU-T Recommendation H.263 – Annex X (03/04): "Annex X: Profiles and levels definition".
- [18] ITU-T Recommendation H.264 (2003): "Advanced video coding for generic audiovisual services" ISO/IEC 14496-10:2003: "Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding".
- [19] TTC TR-1021: Audiovisual communication system in NGN environments
- [20] ISO/IEC 14496-3: "Information technology – Coding of audio-visual objects – Part 3: Audio".
- [21] ISO/IEC 14496-2: "Information technology – Coding of audio-visual objects – Part 2: Visual".
- [22] ITU-T Recommendation G.711.1(03/08): "Wideband embedded extension for G.711 pulse code modulation"

1.3 Speech Codec

In order to guarantee the minimum interoperability level between UPnP Telephony devices and towards legacy fixed and mobile networks and phones (which still represents the most of phone users) the recommended set of codec set supported by TC implementation includes:

- For fixed network: G.711 [1] with both the compression algorithms (μ -law in America and Japan and A-law in Europe and rest of the world);
- For mobile network: AMR [2] [3] [4] [5];

Minimum recommended set means that at least one of the two codecs above mentioned is supported by UPnP Telephony TC implementations since they represent the reference codecs for fixed and mobile network respectively. If TC implementations support these codecs, it means to guarantee interoperability towards fixed and mobile telephony network for audio telephony services.

In order to provide UPnP Telephony users with enhanced communication features such as audio high definition experience the support of the following wideband speech codecs is suggested for TC implementations:

- AMR WB [7] [8] [9] [10];
- G.722 [13]

In addition, for the Japanese market, the following wideband audio codecs are suggested:

- AAC-LC [20]
- AAC-LD [20]
- G.711.1 [22]

Furthermore, in order to obtain a better VoIP bandwidth usage by reducing IP overhead with respect to IP packet payload the following narrowband codec are suggested for TC implementations:

- G.729 [11] @ 8Kbps;
- G.723 [12] @ 5.3/6.3 Kbps

The speech media format based on the above mentioned speech codecs can be transported over IP network inside the HN using the IETF RTP Protocol [14] [15]

1.4 Video Codec

For UPnP TC supporting video, in order to guarantee the minimum interoperability level for videocommunication the minimum recommended set of codec for TC implementations includes:

- ITU-T Recommendation H.263 [16][17] profile 0 level 45
- ITU-T Recommendation H.264 (AVC) Baseline Profile up to level 3.1[18]

The two codecs above mentioned represents the recommended set of video codecs for UPnP Telephony TC implementation since they represent the main stream for videocommunication both for mobile and fixed networks.

In addition, in order to provide enhanced videocommunication features such as HD video the following video codecs are suggested:

- ITU-T Recommendation H.264 (AVC) Main Profile up to level 4 [18]
- ITU-T Recommendation H.264 (AVC) High Profile level 4.0 [18]
- MPEG-4 Simple Profile Level 0 [21]
- MPEG-4 Simple Profile Level 3 [21]
- MPEG-4 Simple Profile Level 4a [21]

The video media format based on the above mentioned speech codecs can be transported over IP network inside the HN using the IETF RTP Protocol [14] [15].

1.5 Details and examples

Having the UPnP TC supporting the above mentioned minimum capability set of audio and video codecs can guarantee the use of the best suited codec in the most of the cases and can also reduce interoperability issues.

Audio Calls from/to PSTN/PLMN

In case of audio calls to/from legacy fixed and mobile networks the support of both G.711 and AMR codec will ensure no interoperability issues since the most of the media gateway functions in the network typically provide the IP to TDM transcoding functions for both these codec.

Audio Calls from/to VoIP customers (IP phones, softphones, OTT clients)

In case of audio calls to/from other IP Phones, SoftPhones, VoIP enabled clients and so on ,the support of G.711 will again ensure the call set-up with no interoperability issues, regardless the specific technology used by the other VoIP peer (i.e: IMS phones, OTT clients). OTT clients typically use proprietary audio codec for the calls inside the specific community, nevertheless the most of them also support G.711 as “common language” to speak towards the other VoIP and legacy customers.

If UPnP TC also supports the above mentioned optional audio codec (G.729 and/or G.723.1), leveraging on the media negotiation functions provided by the signaling protocol within the network, there will be the chance to set-up the audio call better using the IP bandwidth. The overhead introduced by G.711 could be drastically reduced by supporting these codecs too. It means that G.711 will ensure interoperability in this cases; G.729 and G.723.1 which are often supported by IP phones and VoIP clients could also add a better IP bandwidth efficiency.

Video Calls from/to PLMN

The support of both AMR and H.263 will ensure no interoperability issues and consequently no QoS degradation in case of videocalls towards legacy mobile phones, supporting the 3G-324M videocommunication.

High Definition audio and video calls

For the time being, high quality audio calls are typically provided with different proprietary (and no loyalty free) codec, which can be used only inside the OTT community. Due to the variety of those codec and due to the fact that UPnP Telpohony defines a standard and interoperable solution, a standard wideband audio codec can be taken into account.

It means two main options are available: AMR WB and G.722. Considering that the first one is the reference wideband audio codec for 3GPP and also that smartphones and tablet PCs will be widely used in the home network too the AMR WB can be the minimum requirement for UPnP TC supporting high quality audio. The optional usage of G.722 will reduce interoperability problems since this is the reference codec for dect Cat-Iq devices.

For the same reason video codec H.264 BP is considered the minimum requirement for video format, and the optional support of H.264 MP can also ensure to reach the best video quality in case of High Definition videocommunication involving HD TV sets on both sides.