

Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Codecs for customer network devices

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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

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1 Scope

The objective of the present document is to define the set of codecs supported by CNDs for NGN services, on the basis of the service requirements contained in TS 181 005 [i.1] and TS 185 005 [i.4], and with reference to the CNDs architecture defined in TS 185 006 [i.11] (for communication services) and TS 185 009 [i.5] (for IPTV services).

Work will address AV/broadcast codecs for IPTV and Conversational codecs for telephony services. It will be fully consistent with the set of codecs identified in TS 181 005 [i.1]. When TS 181 005 [i.1] already specifies a list of codecs for voice services, no new codecs will be added, no codec will be removed nor downgraded in status (mandatory, recommended optional) within this list.

For each service (mainly person to person communication and IPTV) work will be focused on defining subset of default/mandatory which is the only way to guarantee interoperability and avoid transcoding a minimum set of codecs to be supported will be defined.

2 References

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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] ETSI TS 181 005: "Telecommunications and Internet Converged Services and Protocols for Advanced Networking (TISPAN); Service and Capability Requirements".
- [i.2] ETSI TS 181 014: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Requirements for network transport capabilities to support IPTV services".

- [i.3] ETSI TS 181 016: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Service Layer Requirements to integrate NGN Services and IPTV".
- [i.4] ETSI TS 185 005: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Services requirements and capabilities for customer networks connected to TISPAN NGN".
- [i.5] ETSI TS 185 009: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN) Architecture & reference points of a customer network device for IMS based IPTV services".
- [i.6] ETSI TS 126 114: "Universal Mobile Telecommunications System (UMTS); LTE; IP Multimedia Subsystem (IMS); Multimedia telephony; Media handling and interaction (3GPP TS 26.114 version 8.2.1 Release 8)".
- [i.7] ETSI TS 126 235: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Packet switched conversational multimedia applications; Default codecs (3GPP TS 26.235 Release 8)".
- [i.8] ETSI TS 126 236: "Universal Mobile Telecommunications System (UMTS); LTE; Packet switched conversational multimedia applications; Transport protocols (3GPP TS 26.236 Release 8)".
- [i.9] ETSI TS 102 005: "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in DVB services delivered directly over IP protocols".
- [i.10] ETSI TS 101 154: "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream".
- [i.11] ETSI TS 185 006: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Customer Devices architecture and Reference Points".
- [i.12] ITU-T Recommendation G.711: "Pulse Code Modulation (PCM) of voice frequencies".
- [i.13] ITU-T Recommendation G.722: "7 kHz audio-coding within 64 kbit/s".
- [i.14] ITU-T Recommendation G.191: "Software tools for speech and audio coding standardization".
- [i.15] ITU-T Recommendation G.722 Appendix II: "Digital test sequences for the verification of the G.722 64 kbit/s SB-ADPCM 7 kHz codec".
- [i.16] ETSI TS 102 527-1: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Part 1: Wideband speech".
- [i.17] ETSI TR 102 570: "Digital Enhanced Cordless Telecommunications (DECT); New Generation DECT; Overview and Requirements".
- [i.18] IETF RFC 3551: "RTP Profile for Audio and Video Conferences with Minimal Control".
- [i.19] ITU-T Recommendation G.722 Appendix III: "A high quality packet loss concealment algorithm for G.722".
- [i.20] ITU-T Recommendation G.722 Appendix IV: "A low-complexity algorithm for packet loss concealment with G.722".
- [i.21] 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".
- [i.22] ITU-T Recommendation G.729.1 Amendment 3: "Extension of the G.729.1 low delay mode functionality to 14 kbit/s, and corrections to the main body and annex B".
- [i.23] IETF RFC 4749: RTP Payload Format for the G.729.1 Audio Codec.

- [i.24] ETSI TS 126 190: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; Transcoding functions (3GPP TS 26.190 Release 8)".
- [i.25] ITU-T Recommendation G.722.2: "Wideband coding of speech at around 16 kbit/s using Adaptive Multi-Rate Wideband (AMR-WB)".
- [i.26] 3GPP2 C.S0014-B v1.0: "Enhanced Variable Rate Codec, Speech Service Option 3 and 68 for Wideband Spread Spectrum Digital Systems".
- [i.27] VoIP Codecs and Protocols, <ftp://ftp.3gpp2.org/TSGC/Working/2007/2007-05-SanDiego/TSG-C-2007-05-SanDiego/WG1/SWG12/C12-20070514-012AR1--Proposed-SC-C.S0085-0-VoIP-Spec.doc>.
- [i.28] 3GPP2, C11-20061204-005-Proposed V&V -Ballot-Text-EVRC-Release-C-Specification.zip.
- [i.29] ISO/IEC 14496-3 (2007): "Information technology - Coding of audio-visual objects - Part 3: Audio, including Amd1 and Amd2".
- [i.30] ETSI TS 126 290 (V7.0.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Audio codec processing functions; Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec; Transcoding functions (3GPP TS 26.290 version 7.0.0 Release 7)".
- [i.31] ETSI TS 102 366: "Digital Audio Compression (AC-3, Enhanced AC-3) Standard".
- [i.32] ETSI TS 126 304: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Extended Adaptive Multi-Rate - Wideband (AMR-WB+) codec; Floating-point ANSI-C code (3GPP TS 26.304 version 8.0.0 Release 8)".
- [i.33] ETSI TS 126 273: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; ANSI-C code for the fixed-point Extended Adaptive Multi-Rate - Wideband (AMR-WB+) speech codec (3GPP TS 26.273 version 8.0.0 Release 8)".
- [i.34] IETF RFC 4352: "RTP Payload Format for the Extended Adaptive Multi-Rate Wideband (AMR-WB+) Audio Codec".
- [i.35] ETSI TR 126 936: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Performance characterization of 3GPP audio codecs (3GPP TR 26.936 version 8.0.0 Release 8)".
- [i.36] IETF RFC 4184: "RTP Payload Format for AC-3 Audio".
- [i.37] IETF RFC 3690: "RTP Payload Format for Transport of MPEG-4 Elementary Streams".
- [i.38] ETSI TS 126 401: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; General audio codec audio processing functions; Enhanced aacPlus general audio codec; General description (3GPP TS 26.401 version 8.0.0 Release 8)".
- [i.39] 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".
- [i.40] IETF RFC 4788: "RTP payload format for Enhanced Variable Rate Wideband Codec (EVRC-WB) and media subtype updates for EVRC-B codec".
- [i.41] ITU-T Recommendation H.263 (2005): "Video coding for low bit rate communication".
- [i.42] ITU-T Recommendation H.264 | ISO/IEC 14496-10: "Advanced video coding for generic audiovisual services".
- [i.43] SMPTE 421M Television - VC-1 Compressed Video Bitstream Format and Decoding Process.
- [i.44] ITU-T Recommendation G.729: "Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)".

- [i.45] ISO/IEC 13818-2: "Information technology -- Generic coding of moving pictures and associated audio information".
- [i.46] ETSI TS 126 171: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; General description (3GPP TS 26.171 Release 8)".
- [i.47] ETSI TS 126 173: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; ANSI-C code for the Adaptive Multi-Rate - Wideband (AMR-WB) speech codec (3GPP TS 26.173 Release 8)".
- [i.48] ETSI TS 126 204: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; ANSI-C code (3GPP TS 26.204 Release 8)".
- [i.49] ETSI TS 126 194: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; Voice Activity Detector (VAD) (3GPP TS 26.194 Release 8)".
- [i.50] ETSI TS 126 192: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; Comfort noise aspects (3GPP TS 26.192 Release 8)".
- [i.51] ETSI TS 126 191: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Speech codec speech processing functions; Adaptive Multi-Rate - Wideband (AMR-WB) speech codec; Error concealment of erroneous or lost frames (3GPP TS 26.191 Release 8)".
- [i.52] ISO/IEC 14496-10 (2008): "Information technology -- Coding of audio-visual objects -- Part 10: Advanced Video Coding".
- [i.53] ITU-T Recommendation H.320: "Narrow-band visual telephone systems and terminal equipment".
- [i.54] ITU-T Recommendation H.321: "Adaptation of H.320 visual telephone terminals to B-ISDN environments".
- [i.55] ITU-T Recommendation H.322: "Visual telephone systems and terminal equipment for local area networks which provide a guaranteed quality of service".
- [i.56] ITU-T Recommendation H.323: "Packet-based multimedia communications systems".
- [i.57] ITU-T Recommendation G.726: "40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)".
- [i.58] ITU-T Recommendation H.245: "Control protocol for multimedia communication".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Customer Network Device (CND): device enabling the final user to have a direct access to services through a specific user interface as defined in TS185006 [i.11]

NOTE 1: A dual-mode (fixed+mobile) CND is a fixed CND when connected to a fixed access and is a mobile CND when connected to a mobile access.

NOTE 2: In case the CND consists of more than one part, the codec function may be built in any part of the CND.

fixed CND: CND connected to the TISPAN NGN network either via a corded interface or a fixed-wireless interface (Wi-Fi, Bluetooth or DECT/DECT-NG)

fixed narrowband CND: fixed CND supporting narrowband speech

fixed wideband CND: fixed CND supporting wideband speech

mobile CND: CND connected to a mobile network such as a 3GPP or 3GPP2 network via the mobile interface

mobile narrowband CND: mobile CND supporting narrowband speech

mobile wideband CND: mobile CND supporting wideband speech

NOTE: Wideband CNDs are also required to support narrowband speech.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AAC	Advanced Audio Coding
ACELP	Algebraic Code-Excited Linear Prediction
ADPCM	Adaptive Differential Pulse-Code Modulation
AMR	Adaptive Multi-Rate
AMR-WB	Adaptive Multi-Rate - Wide Band
AVC	Advanced Video Coding
CELP	Code Excited Linear Prediction
CND	Customer Network Device
CPN	Customer Premises Network
DECT	Digital Enhanced Cordless Telecommunications
DECT-NG	Digital Enhanced Cordless Telecommunications - Next Generation
DTH	Direct To Home television
DTS	Digital Theatre System
DTT	Digital Terrestrial Television
DTX	Discontinuous Transmission system
DVB	Digital Video Broadcasting
EFR	Enhanced Full Rate
EVRC	Enhanced Variable Rate Coding
EVRC-B	Enhanced Variable Rate Coding-narrow Band
EVRC-WB	Enhanced Variable Rate Coding-Wide Band
FEC	Frame Erasure Concealment
HF	High Frequency
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPTV	Internet Protocol TeleVision
ISDN	Integrated Services Digital Network
LC	Low Complexity
LF	Low Frequency
LPC	Linear Predictive Coding
LSP	Line Spectrum Pair
MBMS	Multimedia Broadcast/Multicast Service
MDCT	Modified Discrete Cosine Transform
MIPS	Million Instructions Per Second
MMS	Multimedia Messaging Service
MPEG	Moving Picture Experts Group
MPEGLA	MPEG Lisenced Administrator
MPEGTS	MPEG Transport Stream
NGN	Next Generation Network
PCM	Pulse-Code Modulation
PoC	Push-to-talk over Cellular
PS	Parametric Stereo
PSS	Packet-switched Streaming Service
PSTN	Public Switched Telephone Network

QMF	Quadrature Mirror Filters
RTP	Real-Time Protocol
SBR	Spectral Band Replication
SNR	Signal-to-Noise Ratio
SVC	Scalable Video Coding
TDAC	Time-Domain Aliasing Cancellation
TDBWE	Time-Domain BandWidth Extension
VOD	Video On Demand
VoIP	Voice over IP
WMOPS	Weighted Millions of Operations Per Second

4 Codecs for telephony services

4.1 Services

Services to be supported by conversational speech codecs are IP multimedia services including a voice and/or audio conversational or interactive voice/audio session. Especially, the following services have been specified in TS 181 005 [i.1]:

- PSTN/ISDN emulation service.
- Video telephony service.

4.2 Codecs

4.2.1 General

Speech codecs for telephony services are supported by Customer Network Devices (CND) defined in draft TS 185 006 [i.11] as final devices allowing customers to have access to speech & audio services. This can be a non IP or IP (IMS capable or not) devices either fixed or mobile.

For speech conversational codecs for telephony services, both encoder and decoder have to be supported in CND whereas only the decoder has to be supported in receivers for broadcast/streaming services. This puts design constraints on speech codecs regarding encoding and decoding delay limitation (for conversation interactivity), encoder and decoder complexity limitation and optimization of quality performance for speech.

The voice encoded bandwidth can be narrow band (300 Hz to 3 400 Hz) or wide band (50 Hz to 7 000 Hz) range (or even further extended for some applications). Wideband coding allows enhancing decisively the voice quality: voice is better encoded over all its significant frequencies which produces a feeling of more transparent communication, a greatly improved sensation of presence and an increased intelligibility and listening comfort.

TS 181 005 [i.1] specifies that "*the NGN shall allow end-to-end negotiation of any codec between NGN entities (terminal, network elements)*". The interoperability without transcoding can be consequently achieved if one common codec can be negotiated from end to end between CNDs.

If no common codec is supported between CNDs, transcoding function (decoding and re encoding between the 2 coding formats) has to be implemented (in telco or customer network gateways). However, transcoding degrade quality, add delay, increase network costs and should be consequently reduced. As a consequence, encoding/decoding operations should occur only in CNDs and should be avoided as much as possible in all other devices of the Customer Premises Network (like Customer Network Gateway etc.).

In order to ensure minimum interoperability for narrow band voice services, ETSI 181 005 [i.1] specifies that "narrow band speech encoded format ITU-T Recommendation G.711 [i.12] must be supported". To further improve this interoperability ITU-T Recommendation G.729 [i.44], AMR and EVRC/EVRC-B are recommended. In addition and if wideband optional capability is supported, a restricted list of recommended wideband codecs consisting in ITU-T Recommendation G.722 [i.13], AMR-WB, ITU-T Recommendation G.729.1[i.21] and EVRC WB is specified for better wideband voice interoperability and quality.