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Technical Report

**3rd Generation Partnership Project (3GPP);
TSG-SA Codec Working Group;
Codec(s) for Circuit Switched Multimedia Telephony Service
Terminal Implementor's Guide**

3GPP

Reference

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Intellectual Property Rights

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Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project, Technical Specification Group Services and System Aspects, Working Group 4 (Codec).

The contents of this TR may be subject to continuing work within the 3GPP and may change following formal TSG approval. Should the TSG modify the contents of this TR, it will be re-released with an identifying change of release date and an increase in version number as follows:

Version m.t.e

where:

- m indicates [major version number]
- x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated into the specification.

1 Scope

The present report provides non-mandatory recommendations for the use of the different codec implementation options for the circuit switched multimedia telephony service which is based on ITU-T Recommendation H.324 [4], and Annex C of H.324 in particular. These recommendations address issues specific to the 3G operating environment, including guaranteeing sufficient error resilience and interworking between terminals.

The contents of this document are provided for information to assist in high quality implementation of multimedia telephony terminals. All references to "terminals" in this report are to terminals supporting the Circuit Switched Multimedia Telephony Service as described in [7-9].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1a] ITU-T Recommendation H.223: "Multiplexing protocol for low bitrate multimedia communication"
- [1b] ITU-T Recommendation H.223 – Annex A: " Multiplexing protocol for low bit rate multimedia mobile communication over low error-prone channels "
- [1c] ITU-T Recommendation H.223 – Annex B: " Multiplexing protocol for low bit rate multimedia mobile communication over moderate error-prone channels "
- [1d] ITU-T Recommendation H.223 – Annex C: " Multiplexing protocol for low bit rate multimedia mobile communication over highly error-prone channels "
- [2] ITU-T Recommendation H.245: "Control protocol for multimedia communication"
- [3] ITU-T Recommendation H.261: "Video codec for audiovisual services at px64 kbit/s"
- [4] ITU-T Recommendation H.324: "Terminal for low bitrate multimedia communication"
- [5] ITU-T Recommendation G.723.1: "Dual rate speech coder for multimedia communications transmitting at 5.3 and 6.3 kbit/s"
- [6] ITU-T Recommendation H.263: "Video coding for low bit rate communication"
- [7] 3rd Generation Partnership Project (3GPP), TSG-SA Codec Working Group, 3G TS 26.110, Codec(s) for Circuit Switched Multimedia Telephony Service: General Description
- [8] 3rd Generation Partnership Project (3GPP), TSG-SA Codec Working Group, 3G TS 26.111, Codec(s) for Circuit Switched Multimedia Telephony Service, Modifications to H.324
- [9] 3rd Generation Partnership Project (3GPP), TSG-SA Codec Working Group, 3G TS 26.112, Codec(s) for Circuit Switched Multimedia Telephony Service, Call Set Up Requirements
- [10] 3rd Generation Partnership Project (3GPP), TSG-SA Codec Working Group, 3G TR 26.912, Quantitative performance evaluation of H.324 Annex C over 3G
- [11] International Standard ISO/IEC 14496-2, Information technology -Generic coding of audio-visual objects- Part 2: Visual, 1999
- [12] ISO/IEC JTC1/SC29/WG11 MPEG 99/N2724 "MPEG-4 Applications", March 1999

3 Definitions, symbols and abbreviations

3.1 Definitions

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

3G-324M terminal: A multimedia telephony terminal conforming to 3G TS 26.110 [7] and targeted for use in 3G mobile networks.

3G-324M codec: The implementation of H.324 and all its elements adapted to the 3G environment (known as 3G-324M) is seen as a "codec" consisting of an encoder and a decoder.

3G-324M encoder: Encoder part of the 3G-324M codec.

3G-324M decoder: Decoder part of the 3G-324M codec.

3.2 Symbols

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

<symbol> <Explanation>

3.3 Abbreviations

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

AL1,2,3	H.223 Adaptation layers 1, 2 and 3 (see [1a])
AL-SDU	Adaptation Layer Service Data Unit (see [1a])
AMR	Adaptive Multi-Rate (Audio Codec)
CIF	Common Intermediate Format (a picture format for Video Codec)
CRC	Cyclic Redundancy Check
GOB	Group of blocks (a sub-part of a video picture)

GSM	Global System for Mobile communications
GSTN	General Switched Telephone Network
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
MUX-PDU	Multiplex Packet Data Unit (see [1a])
PSC	Picture start code (synchronization field for Video Codec)
QCIF	Quarter CIF (a picture format for Video Codec)
RVLC	Reversible Variable Length Code (see [11])
SQCIF	Sub QCIF (a picture format for Video Codec)
T401	Acknowledgement timer used by H.245 implementations
VOP	Video Object Plane (see [11])

4 General

The following sections give implementation recommendations for different parts of the 3G-324M codec. The section division loosely follows the structure of ITU-T Recommendation H.324 [4].

Most of the recommendations in this document assume that both transmitting and receiving terminals operate within the 3G system and conform to 3G-324M specifications in [7-9]. Section 11 additionally includes recommendations relevant for interoperability between 3G-324M terminals and other terminals.

The recommendations are primarily targeted for such aspects of the codec implementation which have a significant effect on the quality perceived by the user at the other end of the connection which usually implies emphasizing encoder recommendations over decoder recommendations, although this division cannot be made in all cases. It should be recognized that the H.324 specification leaves substantial amount of freedom for terminal implementations and no definite quality guarantee can be given even if all recommendations in this document are followed.

5 Multiplex Protocol

Multiplexing of video, audio, data, and control information is based on the ITU-T Recommendation H.223 [1a-1d]. The following general guidelines are recommended to be followed in the implementation of H.223.

MUX-PDU size should be limited to be smaller than in typical GSTN use. Specific values depend on the bit-rate and channel characteristics, but suitable upper limits for MUX-PDU size are often in the range of 100-200 octets.

Encoders are recommended to support the boolean H.245 *maxMUXPDUSizeCapability* (section 7.2.2.4 of [2] Version 3) to indicate that they are able to restrict the size of the MUX-PDUs that they transmit. Decoders are recommended to utilize the *maxH223MUXPDUsize* H.245 command (section 7.11.5 of [2] Version 3) to restrict the size of the MUX-PDUs, sent by the encoder, to a maximum of the specified number of octets.

H.324 mandates that H.263 encoders shall align picture start codes (PSC) with the start of an AL-SDU (see [4], Section 6.6.1). It is here further recommended that AL-SDUs that do not start with a PSC should start with a GOB header to improve error resilience.

No more than 1-3 audio frames should be included in one MUX-PDU to avoid excessive delay.

Use of the optional retransmission procedure for video when using Adaptation Layer Type 3 (AL3) is not recommended due to delay considerations. This recommendation implies that receiving terminals should not send retransmission requests. It is recommended that terminals support video also using Adaptation Layer Type 2 (AL2) where retransmission is not possible and overhead is slightly smaller.

The H.223 abort procedures should not be used (see [1a], H.223 Sections 6.4.3, 7.2.3, 7.3.4, and 7.4.4).

6 Control Protocol

It is recommended that terminals support the latest possible version of H.245. Capability to support latest improvements in H.324 are usually dependent on supporting the corresponding signalling in H.245. Most of the recommendations in the present document require support for at least H.245 Version 3 and some require even newer versions.

Recommendations for the control protocol are not limited to this section of the present document. Other sections of this document give recommendations for the different parts of the terminal often implying corresponding support from H.245. These recommendations are not replicated in this section, but they should still be interpreted as recommendations for the H.245 control protocol implementation.

The end-to-end transmission delay in the 3G system is expected to be somewhat higher than in GSTN. This will need to be considered for timer settings in connection with the H.245 implementation. For that reason, H.324 Annex C (and hence also 3G-324M) mandates the use of H.324 Annex E for initializing the timer T401. The following additional guidelines for initializing and updating the timer T401 should be considered: ffs

7 Video Codec

This section gives recommendations for the video codec implementations within 3G-324M terminals. Section 7.1 is applicable to the use of any mandatory or optional video codec. Section 7.2 includes specific recommendations for using the H.263 codec. Section 7.3 gives specific recommendations for the use of MPEG-4 and other possible optional video codecs.

7.1 General Recommendations

Regardless of which specific video codec standard is used, all video decoder implementations should include basic error concealment techniques. These techniques may include replacing erroneous parts of the decoded video frame with interpolated picture material from previous decoded frames or from spatially different locations of the erroneous frame. The decoder should aim to prevent the display of substantially corrupted parts of the picture.

3G-324M encoders and decoders are recommended to support the 1:1 pixel format (square format) . Encoders should signal this capability using H.245 capability exchange and the appropriate header fields in video codecs so that unnecessary pixel shape conversions can be avoided.

7.2 H.263

Several of the optional annexes of H.263 are useful for improving the compression efficiency and error resilience of the codec. Implementors are recommended to carefully consider supporting a set of selected annexes. For example, there is wide consensus that Annex K (Slice Structured mode) improves error resilience of the codec.

Non-empty GOB headers should be used frequently to improve error resilience (see [6], Section 5.2).

7.3 Other Video Codecs

It is recommended that all terminals additionally support the ISO/IEC 14496-2 (MPEG-4 Visual) video codec [11]. The explanatory text below gives justification and further detail for this recommendation.

One of the main target environments for MPEG-4 Visual is mobile use. For this purpose the following error resilient techniques have been adopted in MPEG-4 Visual: Resynch Marker, Header Extension Code, Data Partitioning, and Reversible Variable Length Code. With these techniques MPEG-4 Visual codec can be used over errorprone channels enabling highly efficient low delay multimedia communication services for 3G networks. Support for MPEG-4 Visual potentially provides capabilities for communicating with heterogeneous networks without transcoding, or reusing pictures/video from 3G multimedia telephony service by different applications and vice versa.

MPEG-4 Visual and H.263 have substantial technical similarities. MPEG-4 Visual also includes support for the H.263 baseline codec.

Because of multi-functionality of MPEG-4 Visual, subsets of different tools have been defined in order to allow effective implementations of the standard. These subsets, called "Profiles", limit the tool set which shall be implemented. For each of these Profiles one or more Levels have been set to restrict the computational complexity of implementations. It is here recommended that the Simple Visual Profile with [Level 1] is supported to achieve adequate error resilience for transmission error and low complexity simultaneously. No other Profiles are recommended to be supported. Higher Levels for this Simple Visual Profile may be supported depending on the terminal capabilities.

MPEG-4 Visual accepts various sizes of input picture within the capability specified from the Profile and Level. Picture size of [QCIF] for Level 1 and [CIF] for Levels 2 and 3 shall be used while other sizes shall not be used for the sake of interoperability.

All of the error resilience tools in Simple Visual Profile are recommended to be activated.

More than [3] Resynch Markers per one frame should be inserted into the bitstream. It means that the bitstream of one frame is constructed from at least [4] Video Packets.

At least [1] Video Packet in one frame should include Header Extension Code. The decoder should utilize information derived from the Header Extension Code to avoid total discard of the VOP when VOP header could not be received.

Data Partitioning syntax should be used by decoders to detect errors and localize their effects. The decoder should not discard whole Video Packets with errors when motion information or I-VOP DC coefficients are decoded correctly, but reconstruct corresponding part of the picture using the above information or coefficients.

Reversible Variable Length Code (RVLC) should be used. RVLC decoding operation should be made as described in section E.1.4 of Annex E in [11].

To prevent extended propagation of degraded video, Intra Refresh should be used. More than [5 %] of the macroblocks per one frame should be refreshed. Adaptive Intra Refresh (AIR) described in section E.1.5 in Annex E of [11] should be used in conjunction with cyclic Intra Refresh.

One Video Packet of MPEG-4 Visual should be mapped to one AL-SDU of ITU-T H.223 Adaptive Layer.

8 Audio Codec

8.1 AMR Codec

FFS. This section will include guidance on how to utilize the different modes of the AMR codec.

8.2 Other Audio Codecs

FFS.

9 Data Protocols

FFS.

10 Terminal Procedures

FFS.

11 Interoperation with Other Terminals

11.1 Audio Codecs

It is recommended that terminals additionally support the ITU-T G.723.1 audio codec [5] when it is expected that interoperability with GSTN is needed, because it cannot be guaranteed that H.324 terminals developed for GSTN use will support the AMR codec.

12 Optional Enhancements

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13 Multipoint Considerations

FFS.

14 Other Recommendations

FFS.

History

Document history		
V 0.0.1	April 1999	First draft
V 0.1.0	April 1999	Comments included from the discussion in the Codec WG meeting
V 1.0.0	April 1999	Version Presented for Information to TSG-SA
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