Technical Specification Group Services and System Aspects
Meeting #3, Yokohama, Japan, April 26-28 1999

TSGS#3(99)205

Source: TSG-S4

3G TR 26.911 V 1.0.0 (1999-04)

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
TSG-SA4-W2 (<Shortfilename>.PDF)

Keywords
H.324, multimedia telephony, video telephony

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Contents

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

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)

VOP Video Object Plane (see [11])

4 General

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

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

Transmitters 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. Receivers are recommended to utilize the *maxH223MUXPDUsize* H.245 command (section 7.11.5 of [2] Vesion 3) to restrict the size of the MUX-PDUs, sent by the transmitter, 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.

Special consideration should be paid to timer parameters. This is for further study.

7 Video Codec

Regardless of the specific Video Codec standard, all video codec 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.

7.1 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).

7.2 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 ths 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

FFS.

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