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3GPP TSG-SA Codec Working Group ***TSGS4#5(99)179R***
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Liaison To:	**TSG-S2, S2 QoS SWG, R3**
From:	**TSG-S4 Codec Working Group**
cc:	**TSG-R1, R2**
Subject:	**Error resilience in real-time packet multimedia payloads**

Scope

This liaison statement provides some basic information with respect to the error resilience of different encoded media streams. It is provided as a contribution to the debate on the benefits of unequal error protection support for real-time packet multimedia services.

Introduction

TSG-S4 is currently considering the issue of H.323 based multimedia services. H.323 employs the H.225.0 packetisation scheme, which in turn uses UDP/IP and RTP to transport each media stream. The structure of an H.323 packet is shown in Figure 1.

It is assumed that some elements of the H.323 header information, which comprises the IP, UDP and RTP headers, can be compressed. It is also assumed that this information will require reliable transmission, such that any errors in the header will result in the loss of the complete H.323 packet. However, for real-time multimedia streams that cannot accommodate a large delay (and therefore packet retransmission), codecs can be used that are tolerant to residual bit errors.

TSG-S4 wishes to highlight the error resilience of audio and visual codecs, and provide some example tolerance figures for media streams of the type that are likely to comprise H.323 payloads.

Factors affecting error resilience

Specific error resilience figures will depend on a number of factors, including:

- the media type;
- the quality of service (QoS) required;
- the specific codec used;

Media streams may also be sub-divided into different classes on the basis of bit error sensitivity as shown in Figure 2. In some cases the most sensitive bits may be protected by in-band checksum information. It should also be noted that, in addition to the effect of residual bit errors in the media stream, the QoS will be further degraded by packet loss due to errors in the H.323 header.

Example figures

TSG-S4 will assess the quality of different codecs which could be used in H.323 packet multimedia applications. However, the following values are indicative of the QoS parameters required by audio and video media streams, including bit error rates (BER) and frame erasure

rates (FER).

For the purposes of example, figures are provided for the AMR speech codec and the MPEG-4 video codec.

AMR speech codec payload

Bit rate:	4.75 - 12.2 kbit/s
Delay:	end-to-end delay not to exceed 100ms (codec frame length is 20ms)
BER	10^{-4} for Class 1 bits
	10^{-3} for Class 2 bits
	for some applications, a higher BER class (~10^{-2}) might be feasible.
FER	< 0.5% (with graceful degradation for higher erasure rates)

MPEG-4 video payload:

Bit rate:	variable, average rate scalable from 24 to 128 kbit/s and higher
Delay:	end-to-end delay between 150 and 400ms
	video codec delay is typically less than 200 ms
BER	10^{-6} - no visible degradation
	10^{-5} - little visible degradation
	10^{-4} – some visible artefacts
	> 10^{-3} - limited practical application
Packet loss rate	for further study

Data and control:

Data and control information must be transmitted reliably (i.e. residual bit errors should result in a lost packet).

Summary

This liaison statement has provided some indicative figures for the residual bit error rates that could be tolerated by audio-visual H.323 payloads in a 3G environment. TSG-S4 invites S2 and R3 to use this information when considering the support of unequal error protection for real-time packet multimedia services.

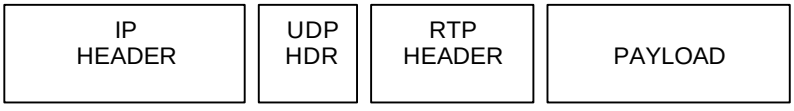

Figure 1: Structure of H.323 packet.

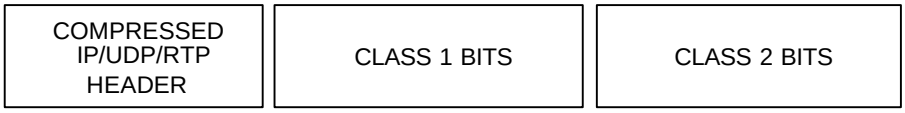

Figure 2: Structure of compressed H.323 packet.
Class 1 bits can tolerate medium BER; Class 2 bits can tolerate high BER.