Telecommunication Standardization Sector
Study Group 15
Experts Group for Video Coding and Systems in
ATM and Other Network Environments

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SOURCE : JAPAN
TITLE : Jitter due to the FEC framing
PURPOSE : Information

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1. Introduction

This document describes about TS packet jitter accompanied by FEC framing that will be defined in H.222.1. The analysis is concentrated on TS packet mapping on FEC frame and FEC frame mapping on AAL.

2. An assumed premise

〈 FEC frame contains no optional field as depicted in Figure 1.

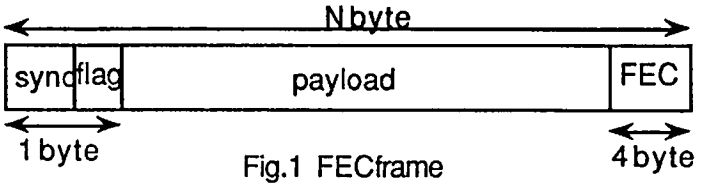


Fig.1 FECframe

〈 The required time for FEC processing and cell segmentation/reassemble is zero.

〈 TS packet doesn't align with FEC frame.

〈 Cells are transmitted in CBR.

〈 FEC frame is passed into H.222.1 in constant period at the receiver.

The premise for section 3 and 4

〈 FEC frame aligns with AAL-SDU.

The premises for section 5.

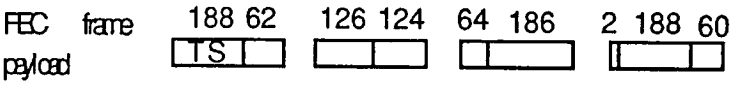
〈 FEC frame aligns with AAL-SDU.

3. Case study on mapping from TS packet to FEC frame

3.1 N=193 (FEC frame contains only 1 TS packet.)

[Delay variation]
There is no delay variation accompanied with FEC framing.
[Padding]
AAL1 : 193 + 42 (padding) = 47 x 5 (cell)
AAL5 : 193 + 8 (CPCS trailer) + 39 (padding) = 48 x 5 (cell)

3.2 N=255 (The maximum value of N.)



[Delay variation]
250 (FEC frame payload) - 188 (TS packet) = 62 (a part of next TS)
188 / 62 = 3.0...
Once a 4 TS packet, whole TS packet is contained in 1 FEC frame.
Otherwise, TS packet is split into 2 FEC frame.

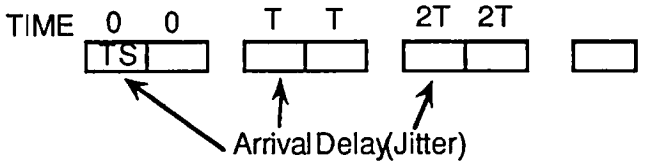
[padding]
AAL1 : 255 + 27 (padding) = 47 x 6 (cell)
AAL5 : 255 + 8 (CPCS trailer) + 25 (padding) = 48 x 6 (cell)

3.3 (Minimum padding for both AAL1 and AAL5)

[Delay variation]
227 (FEC frame payload) - 188 (TS packet) = 39 (a part of next TS)
188 / 39 = 4.8...
Once a 5 TS packet, whole TS packet is contained in 1 FEC frame.
Otherwise, TS packet is split into 2 FEC frame.
[padding]
AAL1 : 184 + 4 (padding) = 47 x 4 (cell)
AAL5 : 184 + 8 (CPCS trailer) + 0 (padding) = 48 x 4 (cell)

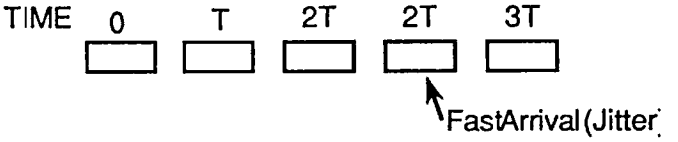
4. TS packet jitter caused by mapping on two FEC frame

Example : The reason why The ATM Forum employs PCR awareness method
In the case of 2 TS mapping on 8 cell, TS arrival time at H.222.1 is as following.



Here, it is assumed that AAL5-SDU is passed through AAL-SAP by constant period T. It is concluded from figure that TS packet with PCR field is the delayed packet with probability 0.5.

In the case of section 3.2, the packet delay is zero once a 4 TS packet, otherwise the delay is T. Therefore TS packet arrival time is varied as depicted in the following figure.



In this case, PCR awareness method like The ATM Forum is not applicable, because TS packet doesn't align with FEC frame.

5. TS packet mapping on FEC frame with no alignment

Case study for N=193 :

AAL1 :
193 (FEC frame) / 47 (SDU) = 4 (cell) remainder 5 (byte)
47 (SDU) / 5 (byte) = 9.4
This equation means that
once a 10 FEC frame, one FEC frame is mapped on 6 cell,
otherwise, one FEC frame is mapped on 5 cell.

AAL5 : (In the case AAL5-PDU is 192 byte)
193 (FEC frame) - 184 (AAL5 payload) = 9
48 (cell payload) / 9 = 5.3...
This equation means that
once a 6 FEC frame, one FEC frame is mapped on 6 cell,
otherwise, one FEC frame is mapped on 5 cell.

It is observed from above analysis that FEC frame arrival time contains one cell period jitter.

6. Conclusion

TS packet mapping on FEC frame causes jitter which is one TS packet period time. In addition, if FEC frame doesn't align with AAL-SDU, that causes another jitter which is one cell period time. If FEC frame aligns with AAL-SDU, that decreases efficiency by padding. Above mentioned TS packet jitter cannot be ignored, because the jitter is not negligible compared to the network jitter and that jitter doesn't satisfy MPEG RTI-LJ.

(c.f.) 1 TS period 250 micro second in the case of 6Mbps
1 cell period 70 micro second in the case of 6Mbps (with traffic shaping)

References

[1] ITU-T SG15 AVC-741: An AAL for variable bit rate services, KPN and BT.
[2] ITU-T SG15 AVC-742: H.222.1 issues, BT.
[3] ITU-T SG15 AVC-743R Annex 7: Network adaptation for the broadband audiovisual communication, Rapporteur.

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