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Study Group 15
Experts Group for Video Coding and System in ATM and Other Network Environments

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SOURCE : JAPAN
TITLE : Cell loss correction method in AAL for the transmission of MPEG 2 Transport packets
PURPOSE : Discussion
Relevant sub-group : System

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1. Introduction

The transport packet of MPEG 2 Systems provide the multimedia multiplexing method for application of digital broadcasting services and is also considered as one candidate for H.22X. For broadcasting application, the powerful error correction method is required for transmission. From the view of interoperability between ATM transmission and broadcasting, it is desirable that these error correction methods are harmonized with each other.

In this document, we discuss the error correction methods in AAL 1 (i.e. constant bit-rate operation) for Transport packets transmission over ATM networks.

2. Error correction method for transmission of MPEG 2 Transport packets

2.1 Functions

For delivery of MPEG 2 transport packets over the ATM networks, the following functions may be necessary in the AAL in order to enhance the error resilience against cell loss and bit errors.

- Sequence numbering of cells to detect lost or misinserted cells
- Error detection of each transmitted transport packet
- Error Correction against cell loss and random bit errors
- Alignment with transport packet and ATM cells

2.2 Error correction methods

To perform the above functions, two error correction methods which are summarized in Annex 1 were studied in AVC-594. The method #1 uses existing AAL type 1 and achieves alignment of every 47 transport packets with ATM cells. The advantage of this method is the usage of the existing AAL protocols. The method #2 defines a new AAL type and achieves alignment of every transport packet with ATM cells. In this case, there is no processing delay for interleaving at the transmission side.

In this document, we provide a new error correction method (i.e. method #3) which takes advantages of both methods.

Procedure of method #3

Figure 1 shows the interleaving structure of method #3 which uses AAL type 1 and achieves alignment of every transport packet with ATM cells. The interleaver is organized as a matrix of 47 rows and (190+2m) columns, i.e.(190+2m) ATM cells. In order to detect the bit error within a TS packet, 16-bit CRC(Cyclic Redundancy Code) is calculated using the polynomial of $x^{16} + x^{12} + x^{5} + 1$ and stored in the first row of the CRC cells (i.e. 189th and 190th cells). The transport packet is transported in four ATM cells and stored in the first 4 columns of interleaver in order to make the interleaving. After transmitting 47 Transport packets, the RS(190+2*m* ,190) code is calculated for each row and transmitted by RS cells. The length of the RS code, i.e. 2*m* bytes, might be decided in relation to the network quality.

This method can correct either 2*m* cell losses within (190+2*m*) cells or *m* bytes random error in a row of (190+2*m*) bytes. The overhead is (*m* +1)/(*m* +95) and the processing delay for interleaver is 47×(190+2*m*) bytes. For example, when the value of *m* is 2, the processing delay will be 14.5 msec at 5 Mbit/sec.

For synchronization of the interleaver, PTI(user to user indication) or CSI(CS indicator) bit can be used.

The comparison of these methods is listed in the Table 1.

3. Conclusion

For MPEG 2 Transport Stream packet transmission, the cell loss correction methods using AAL type 1 is discussed to achieve the alignment between Transport packets and ATM cells. This method is the proper correction method in point of alignment, AAL type and delay.

END.

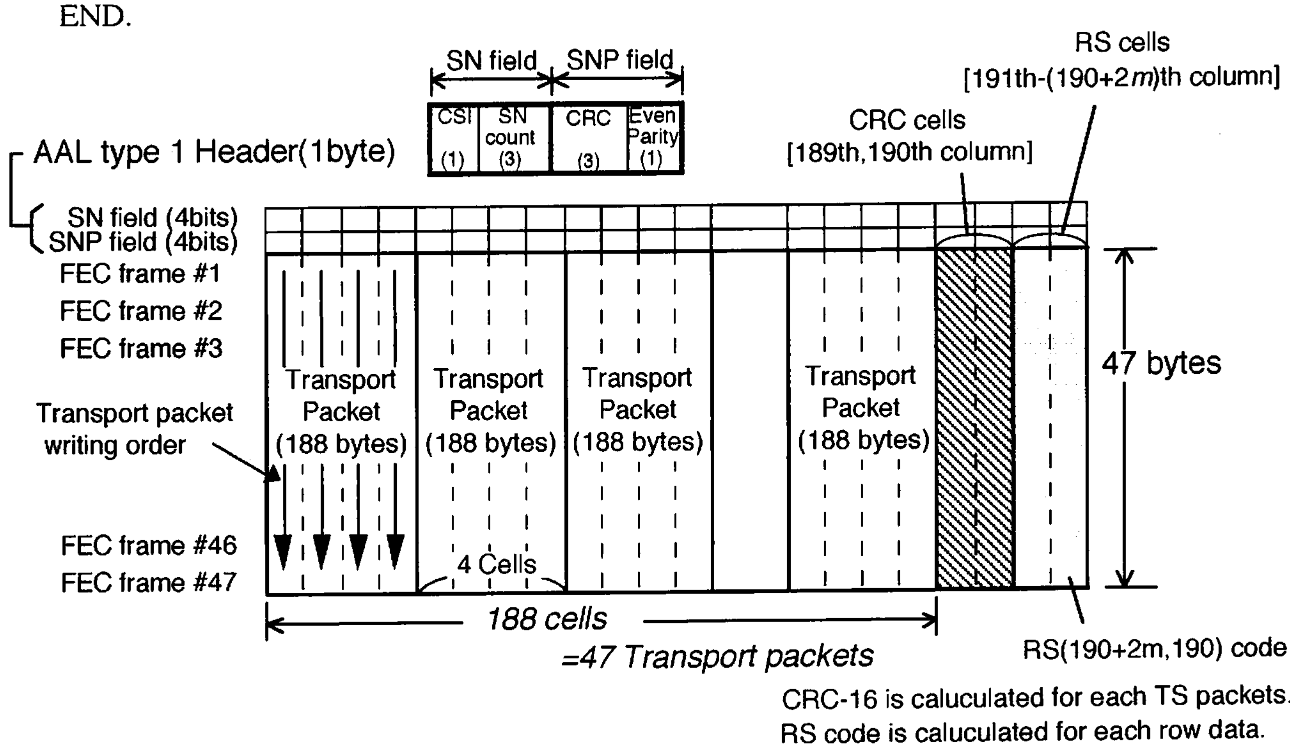

Figure 1. Error correction method for Transport packet transmission (Method #3)

Table 1 Comparison of error correction methods for transport packet transmission over ATM networks

		Method #1	Method #2	Method #3
AAL Type		AAL Type 1	newly defined AAL Type	AAL Type 1
Interleaver Size		$47\times(190+2m)$ [byte]	$47\times(4k+2n)$ [byte]	$47\times(190+2m)$ [byte]
Interleaver synchronization		CSI or PTI bit	CSI or PTI bit	CSI or PTI bit
Alignment with cell		every 47 TS packets	every TS packet	every TS packet
FEC framing	FEC frame length	$(190+2m)$ [byte]	$(4k+2n)$ [byte]	$(190+2m)$ [byte]
	Information field	190 [byte] ; TS packet + CRC-16	$4k$ [byte]	190 [byte] ; TS packet + CRC-16
	Error correction code	$2m$ [byte] ; RS$(190+2m, 190)$	$2n$ [byte] ; RS$(4k+2n, 4k)$	$2m$ [byte] ; RS$(190+2m, 190)$
Lost cell detection		SN count	SN count	SN count
Error detection of TS		CRC -16	CRC-16	CRC-16
Correction capabilities	cell loss	$2m$ [cell] / $(190+2m)$ [cell]	$2n$ [cell] / $(4k+2n)$	$2m$ [cell] / $(190+2m)$ [cell]
	random byte error	m [byte] / $(190+2m)$ [cell]	n [byte] / $(4k+2n)$	m [byte] / $(190+2m)$ [cell]
Overhead		$(m+1)/(95+m)\times100$ [%]	$n/(2k+n)\times100$ [%]	$(m+1)/(95+m)\times100$ [%]
Processing delay in byte (Total)		$47\times(190+2m)\times2$ [byte] 29.0[msec] at 5Mbps ($m=2$)	$47\times(4k+2n)$ [byte] 14.4[msec] at 5Mbps ($k=47, n=2$)	$47\times(190+2m)$ [byte] 14.5[msec] at 5Mbps ($m=2$)

Annex 1 to AVC-617

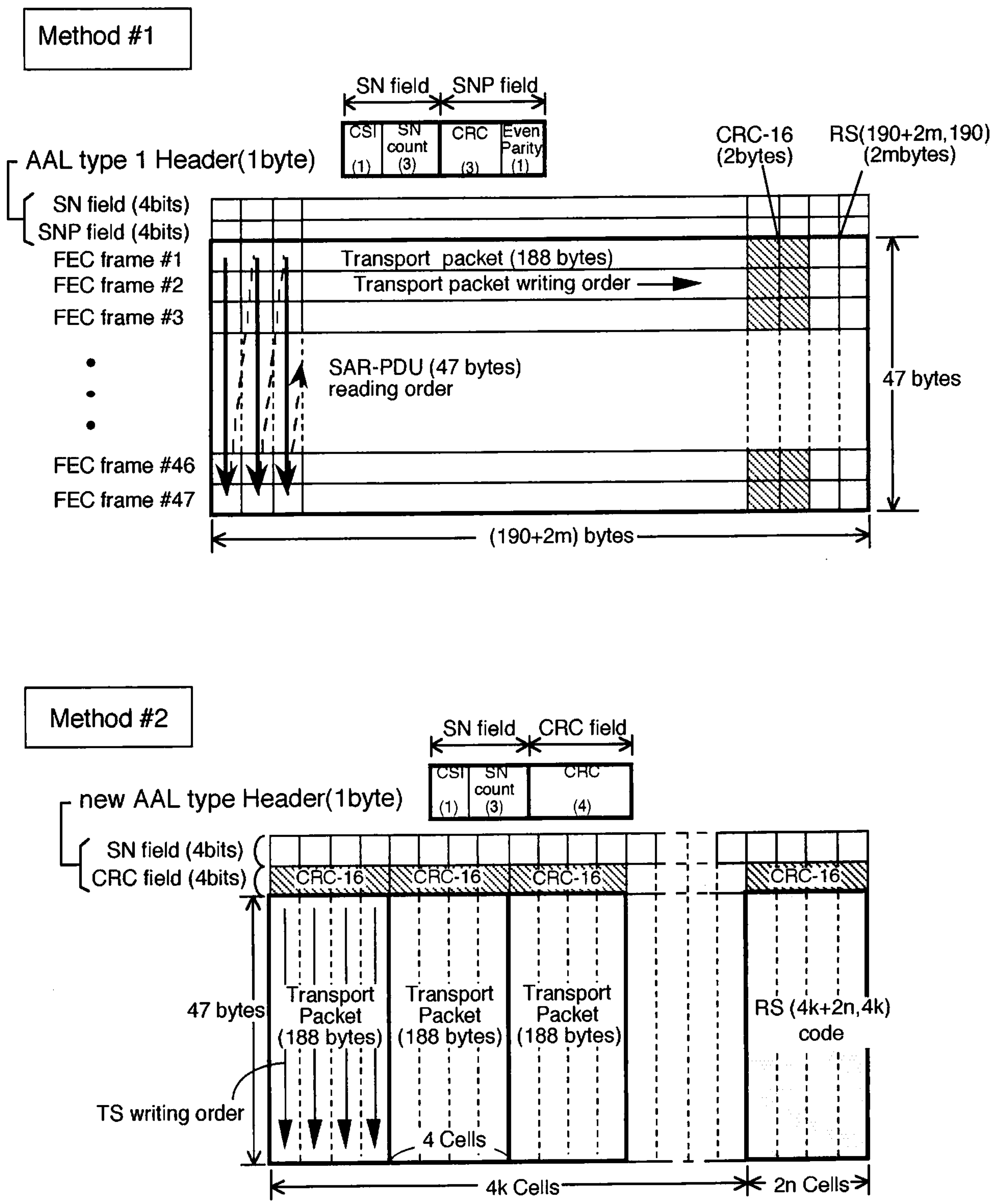

Figure 1/Annex 1. Error correction method for Transport packet transmission