The ATM Forum
Technical Committee

A Cell-Based Transmission Convergence Sublayer for Clear Channel Interfaces

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1. Introduction

The cell-based transmission convergence sublayer specified in this document is derived from the one defined in ITU-T Recommendation I.432 [1] for 155.52 and 622.08 Mbps optical interfaces but with modifications to make cell scrambling and physical layer OAM facilities optional. It applies to clear channel interfaces.

2. Physical Medium Characteristics

(R) The cell-based transmission convergence sublayer described in this specification shall be used over clear-channel facilities which impose no bit stream coding restrictions (such as a ones density requirement).

V.35, EIA/TIA 449/530, EIA/TIA 612/613 (HSSI), and unframed E1/G.703 physical interfaces are some examples of suitable interfaces. Other interfaces may be also be used.

3. Transmission Convergence (TC) Sublayer Specification

3.1 Transport-Specific TC Functions

3.1.1 Interface Structure

(R) The interface structure shall consist of a continuous stream of 53-octet cells. The cells may be ATM cells, physical layer OAM cells, or idle cells as defined in Sections 2.1 and 2.2 of ITU-T Recommendation I.361 [2] and further refined in Sections 4.2.1.3 and 4.4 of Recommendation I.432 [1].

Note that from the perspective of the physical layer, unassigned cells are not distinguished from other forms of ATM cells. Thus the text in this section should not be interpreted to mean that cell rate decoupling cannot be performed using unassigned cells.

An implementation compliant with this specification may choose either mechanism to perform cell rate decoupling with respect to its own transmission. Irrespective of the mechanism chosen with respect to its own transmission, a compliant implementation must support both cell rate decoupling mechanisms with respect to the data it receives. Support for both mechanisms with respect to cells received must not require prior configuration. Thus the overall system behavior with respect to cells received is to discard both idle and unassigned cells.

3.1.2 OAM Implementation

(R) Since there is no transmission framing in a cell-based transmission convergence sublayer and since transmission over the physical media contemplated for use with this specification either is point-to-point without regenerators or uses regenerators which do not incorporate OAM functionality, F1 and F2 OAM flows do not apply and shall not be implemented.

(O) Since low cost will be an important factor in many applications of this specification, generation and processing of F3 OAM cells shall be optional.

(CR) If implemented, OAM functions shall comply with the relevant sections of Recommendation I.432 [1] and ITU-T Recommendation I.610 [3]. In this case physical layer OAM cells as defined in Sections 4.2.1.3.2 (PL-OAM cell header) and 4.2.1.3.3 (PL-OAM cell payload) of Recommendation I.432 [1] shall be used for the conveyance of physical layer OAM information for the F3 (transmission path) level. The transmission path error monitoring parameters shall be as follows:

- Number of included cells (NIC) shall be set to 128. That is, each F3 OAM cell shall contain transmission path error monitoring and reporting information for the previous 128 ATM or idle cells.

- Monitoring block size (MBS) shall be set to 16. That is, transmission path error monitoring and reporting parameters shall be computed for each block of 16 ATM or idle cells. This results in 6784 bits/block, which lies within the range suggested by ITU-T Recommendation G.826 [4] for data rates from 1.5 Mbps and 160 Mbps.

- Number of monitored blocks (NMB-EDC) shall be set to 8 since there are eight monitored blocks covered by each PL-OAM cell (this parameter indicates how many error detection code octets are present in the F3 OAM cell).

- Number of monitored blocks at the far end (NMB-EB) shall be set to 8 if F3 OAM cells generated in accordance with this specification are received from the remote end. When the link is in a failure condition or if the remote end does not generate F3 OAM cells NMB-EB shall be set to 0. This parameter indicates how many FEBE (far end block error) nibbles (also known as REI (remote error indication) nibbles) are present in the F3 OAM cell.

(CR) If F3 OAM cell flow is supported then transmission path maintenance signals and performance monitoring functions shall be implemented in accordance with Sections 4.2.1.3.4 and 4.2.1.3.5 of Recommendation I.432 [1] subject to the proviso that detection of the loss of maintenance flow (LOM) condition shall not preclude normal operation of the data link.

3.2 ATM-Specific TC Functions

3.2.1 Header Error Control (HEC) Generation/Verification

(R) The HEC field of each cell shall be generated as described in Section 4.3.2 of Recommendation I.432 [1] including the recommended modulo 2 addition of the pattern 01010101 to the remainder of the modulo 2 polynomial division process.

(R) HEC error detection shall be implemented in accordance with Sections 4.3.1 and 4.3.2 of Recommendation I.432 [1].

(O) Single bit error correction as defined in Sections 4.3.1 and 4.3.2 of Recommendation I.432 [1] may be implemented in addition to error detection. In that case the two modes of operation shall interact in accordance with the procedures defined in Section 4.3.1 of Recommendation I.432 [1].

3.2.2 Cell Rate Decoupling

(R) Cell rate decoupling, when required to adapt the ATM layer and PL-OAM cell transfer requirements to the physical layer interface rate, shall be performed by inserting and discarding idle cells as specified in Section 4.4 of Recommendation I.432 [1].

Note: Cell rate decoupling may also be performed at the ATM layer by inserting and discarding unassigned cells as specified in Section 2.2.3 of Recommendation I.361 [2] and Section 3.4.2 of the ATM Forum User-Network Interface (UNI) Specification Version 3.1 [5].

3.2.3 Cell Delineation

(R) Cell delineation shall be performed using the HEC mechanism specified in Section 4.5 of Recommendation I.432 [1].

Note: If optional scrambling is implemented in accordance with Section 3.2.4 of this specification then only the last six bits of the HEC field may be used when checking bit by bit for the correct HEC in the HUNT mode of the cell delineation process. Under steady state operation all HEC bits are available for cell delineation and error detection and correction purposes. See Sections 4.5.3.2.3 and 4.5.1.1 of Recommendation I.432 [1] for further details.

3.2.4 Scrambling

(R) Every implementation of this specification shall be capable of transmitting and receiving unscrambled cells. When this mode of operation is in effect all physical and ATM layer cells shall be sent without any header or payload scrambling.

(O) An implementation may choose to implement the distributed cell scrambler (DSS) described in Section 4.5.3.2 of Recommendation I.432 [1].

(CR) If the DSS is implemented, receiver operation shall be as described in Section 4.5.3.2.3 of Recommendation I.432 [1] including the provision for automatic detection and handling of the absence of scrambling in the incoming signal. Transmitter operation shall be as described in Section 4.5.3.2.2 of Recommendation I.432 [1] with the following additional provisions. When the receiver loses cell delineation or when the transmitter is first started the transmit pseudo-random binary sequence (PRBS) generator shall be seeded with a non-zero value (if it is not already in a non-zero state) in order to enable transmit scrambling. If the receiver achieves steady-state operation with its PRBS generator in the all-zeroes state -- indicating that the incoming signal is unscrambled -- then the transmit PRBS generator shall be re-seeded with zeroes in order to disable transmit scrambling. Otherwise it shall continue to operate with scrambling enabled. This procedure allows a station which implements optional scrambling to interoperate with one which does not and ensures that two stations which implement scrambling will operate with scrambling enabled once steady state operation is achieved.

Abbreviations

DSS	Distributed Sample Scrambler
EDC	Error Detection Code
FEBE	Far End Block Error (see also REI)
HEC	Header Error Control
ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
LOM	Loss of Maintenance flow
NIC	Number of Included Cells
NMB-EB	Number of Monitored Blocks at the Far End
NMB-EDC	Number of Monitored Blocks (number of EDC octets)
MBS	Monitoring Block Size
PRBS	Pseudo-Random Binary Sequence
REI	Remote Error Indication (replaces FEBE terminology)
PL	Physical Layer
OAM	Operation Administration and Maintenance
TC	Transmission Convergence
UNI	User Network Interface

References

[1] Draft Revised ITU-T Recommendation I.432: B-ISDN User Network Interface - Physical Layer Interface Specification (Geneva, November 1994).

[2] ITU-T Recommendation I.361: B-ISDN ATM Layer Specification (Helsinki, March 1993).

[3] ITU-T Recommendation I.610: B-ISDN Operation and Maintenance Principles and Functions (Helsinki, March 1993).

[4] ITU-T Recommendation G.826: Error Performance Parameters and Objectives for International, Constant Bit Rate Digital Paths at or Above the Primary Rate (Geneva, November 1993).

[5] ATM Forum User-Network Interface (UNI) Specification Version 3.1 (September 1994).