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TITLE : Preliminary studies into ATM mapping of MPEG-2 Transport Layer Packets

PURPOSE: Discussion & Proposal

1. Introduction

This document discusses the current thinking on how the MPEG-2 multiplexed bitstream can be mapped onto ATM networks. The document considers the various comments raised in a recent Bellcore document[1], the MPEG Systems meeting in Amsterdam, and discussions within the ETSI NA5 AAL group. The document highlights some outstanding criteria which require resolving within ITU TS SG15 and ISO MPEG and proposes a soultion based on current understanding of the issues.

2. Summary of the Bellcore document

In May 1993 at Atlanta, Bellcore presented a discussion document on ATM mappings for MPEG-2 which included the perceived requirements and AAL considerations. The considerations were:

Requirements

- Support for multiple Virtual Channels (VCs) for different programs and service types.
- The capability of assigning different priorities for different programs and service types.
- Support for different Transport Packet lengths.
- To minimize mapping overhead.
- To minimize the effect of cell loss.
- To provide simple access to the packet layer from the ATM layer.

Candidate Mappings

- "*Transparent*" - a simplistic approach where the ATM layer treats the MPEG transport layer as a raw bit stream.
- "*Alignment*" - Alignment of the start of a Transport Packet with an ATM cell boundary.
- "*Pointer*" - an enhancement to "Transparent" mapping using a pointer within the cell payload to indicate the start of a Transport Packet.
- "*Multiple packet*" - an enhancement to "alignment" mapping where alignment is only carried out on a group of Transport Packets.

Candidate AALs

- AAL Type 1 - designed for 'real-time' services.
- AAL Type 5 - low overhead AAL primarily designed for data services.

3. Output of the MPEG Systems ad hoc meeting

In June 1993 at Amsterdam the MPEG System group held an ad hoc meeting from which a number of points were raised regarding the transportation of MPEG Transport Packet over ATM networks. The following requirements were identified:

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1 "ATM mappings of Transport Layer Packets", Bellcore, ISO/IEC JTC1/Sc29/WG11, May 1993, Atlanta USA

- MPEG-2 Transport Packets should be mapped in ATM cells on cell boundaries
- Make provision for a timing function to measure packet/cell jitter which can be indicated to the *interface device*
- Provide Forward Error Correction on a packet basis
- Provide a continuity counter for error protection
- Be able to detect the start of an MPEG-2 Transport Packets at the ATM/AAL level
- Maintain a (48*n)-4 MPEG-2 Transport Packet length
- Provide Variable Bit Rate capability

4. Discussions within ETSI NA5 AAL

ETSI NA5 AAL group has established a small correspondence group to discuss the options for mapping MPEG Transport Packets onto ATM cells for transmission over the future Broadband Integrated Services Digital Network (B-ISDN). The group's preliminary discussions have focused on the content of the previously mentioned sources and have made the following comments from the B-ISDN network standpoint:

- The Bellcore document assumes that the CLP bit in the ATM Header is available for prioritising two video components. However the use of this parameter is currently not a user option as its value may be modified by the network.
- The "Pointer" method is an elegant solution provided that cell loss resilience is not a major consideration and that greater flexibility in Transport Packet length is essential. In the event of cell loss it is possible that two consecutive Transport Packets would be in error.
- It is desirable to keep the number of AAL Types to a minimum and efforts should be made to adopt an existing or planned AAL.
- Is it an application requirement to fully recover lost cells or just detect lost cells at reception?

5. Proposal

Assuming that the requirements raised in the Bellcore document and the Amsterdam ATM Systems meeting are valid and that transmission efficiency and cell loss resilience are of prime importance then the following suggested scenario offers the best compromise, based on current understanding:

- Use AAL Type 1 (an existing standardized AAL), providing:
  - A Segmentation and Reassembly (SAR) layer comprising of a SAR Header (1 octet) and SAR Payload (47 octets).
  - Detection of lost or misinserted cells by the use of a Sequence Number (a cell based continuity counter) located within the protected SAR Header.
  - High transmission efficiency (98%).
  - A timing function at cell level is supported by the use of the Convergence Sub-layer Indicator.

- Use "Alignment" mapping of MPEG-2 Transport Packets with no padding octets in order to maximize transmission efficiency.

- Use Transport Packets lengths of n x 47 octets, e.g. MPEG-2 transport packet 141, 188 or 235 octets (inclusive of any FEC) should be supported.

If there is an application or service requirement for different Transport Packet lengths then padding octets will be required to maintain packet alignment with cell boundaries which will reduce transmission efficiency.

If transmission efficiency is of higher importance than cell loss resilience then an alternative mapping scenario based on the "pointer" method may be acceptable. However this method may require the use of additional protection mechanisms may be necessary, such a frame interleaving which will introduce further transmission delay.