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1. Introduction

B-ISDN is capable of effective realization of multimedia multiplex for image communication services by use of network characteristics. A multimedia multiplex method, which realizes logical multimedia multiplexing function by intermediate virtual layer (called MUX layer here) placed between codecs and the network(AAL), was discussed at the last Paris meeting. (refer to AVC-53)

This contribution describes a virtual layer approach to consider necessary multimedia multiplexing functions. This approach is not inconsistent with VCI multiplex method agreed as reference at the Paris meeting. Definition of a logical interface between MUX layer and codecs, which absorbs difference of multiplex method caused by the evolution of future network, is also discussed.

2. MUX layer

Cell order control, cell loss detection, etc are considered as minimum functions supplied as network service(i.e. AAL service). However, further supplemental functions are required for media dependent processing(e.g. synchronization of video frame) and for inter-media processing.

Those media oriented and inter-media processings are considered to be executed in MUX layer located between AAL and media source as shown in Fig. 1. Then required multimedia multiplex functions are realized in MUX layer equivalent to H.221(H.242 and part of H.230) of N-ISDN. If all functions are supplied by AAL, however, MUX layer is not required. A detailed example of MUX layer functions is shown in Annex.

3. Logical interface between MUX layer and upper layer

Access format from each media(codec) to lower MUX service is considered as one kind of packet. For example, encoded video signal has structure such as MB, GOB and picture, etc. The logical interface between MUX layer and upper layer can be defined based on these structures. The definition of this logical interface will be chosen from a view point to optimize media characteristics and multimedia multiplex independently of network characteristics, since this in-

terface is located at the immediate lower position of codec and is not connected to AAL directly.

Also, since MUX layer absorbs the difference of the multiplex method, network interface becomes more flexible. That makes it possible to follow evolution of future network functions with minimum change between MUX and AAL and without affecting upper codecs.

4. Conclusions

To consider multimedia multiplexing of B-ISDN using network characteristics effectively, this contribution has discussed a virtual layer approach which is placed at intermediate MUX layer between codec and network(AAL) for logical multimedia multiplexing functions. Also, this contribution has discussed definition of logical interface between the MUX layer and codecs.
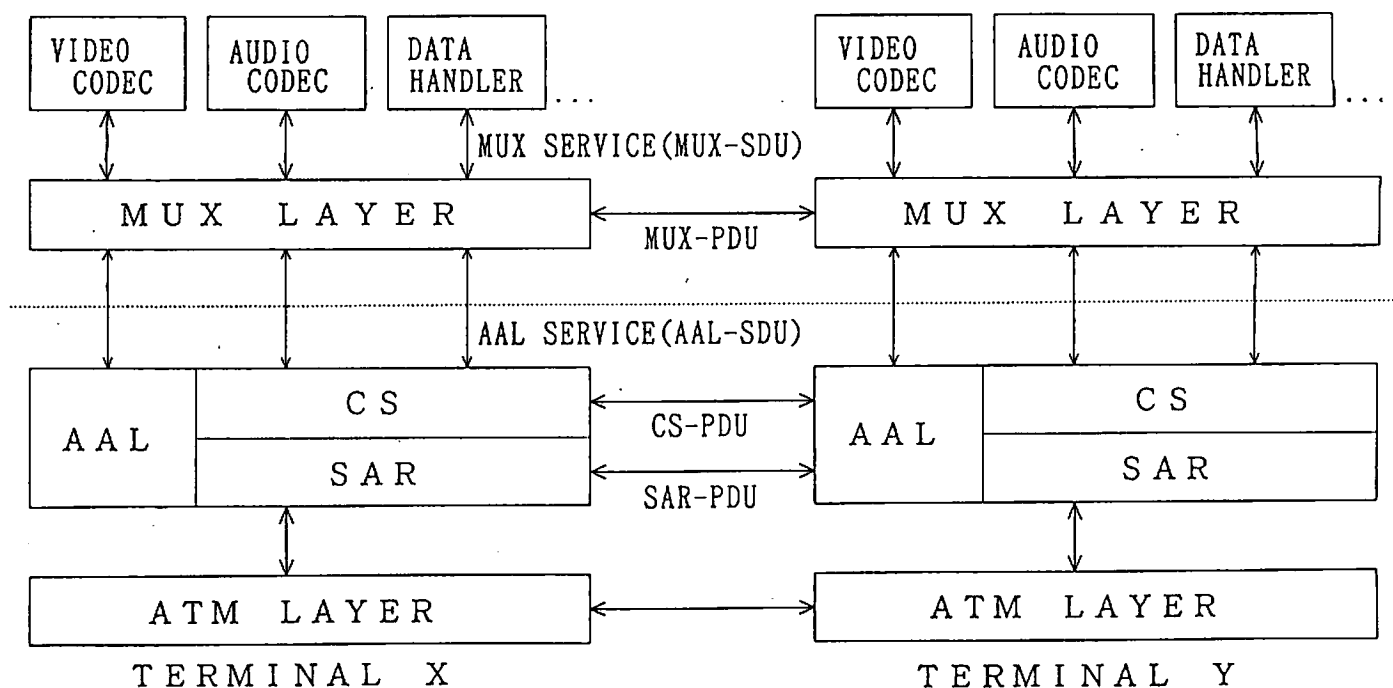
Figure 1 MUX layer.

MUX layer functions

1. AAL

1.1 AAL service

(1) Transfer of AAL-SDU by variable rate(variable length)

(2) Transfer of end-to-end timing information

(3) Indication of unrecoverable cell loss and errors in AAL

(ON/OFF of error correction in AAL)

1.2 AAL functions

(1) Handling of cell delay variations

Cell arrival delay variation will be compensated by buffer.

(2) Handling of lost and misinserted cells

Detect and indicate lost cell and misinserted cell.

(3) Source clock frequency recovery at the receiver

(4) Monitoring of CS-PDU header for bit errors

(5) Monitoring of AAL user information for bit errors and possible corrective action

(Possible correction of bit errors by FEC)

(Correct cell loss by interleaving as an option)

2. MUX layer

The logical interface which should be defined is supplied as MUX layer service. Media dependent logical functions and/or multimedia multiplex functions should be listed as MUX service.

2.1 MUX layer service

(1) Control for use/unuse of each media

(2) Transmission of media information by variable length

(e.g. video packet(GOB, picture), audio packet,...)

(3) Transmission of synchronization information of each media

(e.g. temporal reference of video, etc.)

(4) Transmission of inter media synchronization information

(5) Discard of information including lost cell or errored cell and its indication

2.2 Functions of MUX layer

MUX layer supplies MUX service to upper layer using AAL service, that is to say, it is the function for multimedia multiplex.. Table 1 shows the mapping of MUX functions to AAL functions which is the main function of MUX layer.

<Mandatory functions>

(1) Packetization in variable length (AAL-SDU) of each media information

Each media information from codec is constructed as variable length AAL-SDU.

(2) Recovery of end-to-end synchronization of each media information using timing information from AAL

For example, the end-to-end synchronization of video at frame and/or GOB is recovered based on timing information from AAL.

(3) Handling of AAL-SDU including lost cell and errored cell

By the indication from AAL, when MUX layer recognizes that AAL-SDU includes error due to cell loss and/or transmission error, it notifies to upper layer after whole AAL-SDU is discarded.

<Functions for multiplex>

 (4) Addition/deletion of each media connection

    To add and/or delete media within communication, logical connection is established and/or released corresponding to each media, for instance video, audio, etc. The releace means to disconnect VC itself or to close logical path.

 (5) Recovery of synchronization between media by time stamping at the transmission side

    (This function may not be necessary if difference of delay variation between VCs are within limits.)

    This recovers synchronization (guaranteed delay) between media (between AAL-SDU corresponding to respective media) like audio and video.

 (6) Transmission of control signals (C&I) to multimedia multiplex

    This exchanges C&I signals required for multimedia multiplex

3. Supposed Media

Video 1(layer 1), Video 1(layer 2),..,Video 2,Video3, ..

Audio 1, Audio 2, ...

Data 1, Data 2, ...

Control signal (C&I)

Others

END

Table 1 Mapping of MUX layer functions to AAL functions

MUX layer functions	AAL functions
(1) Packetizing each media information in variable length	Transfer of variable length AAL-SDU (1) Handling of cell delay variation
(2) Recovery of end-to-end timing for each media	(3) Source clock frequency recovery at the receiver
(3) Handling of AAL-SDU including lost or misinserted cells	(2) Handling of lost and misinserted cells (4) Monitoring of AAL header for bit errors (5) Monitoring of user information field for bit errors and possible corrective action
(4) Addition/Deletion of the connection applied to each media	Establishment of suitable connection for media between AALs Transfer of variable length AAL-SDU
(5) Recovery of synchronization among media	(3) Source clock frequency recovery at the receiver
(6) Transmission of C&I signals for multimedia multiplexing	Transfer of variable length AAL-SDU

(number) indicates the corresponding item in § 1.2 and § 2.2.