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STUDY GROUP 15 - CONTRIBUTION -

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1. Introduction

We have been succeeding in developing necessary Recommendations for audiovisual communication systems in the N-ISDN environments. One of the directions for ITU-TS SG15 activities in this study period is those for the B-ISDN environments.

This contribution raises some materials for discussion on the following;

- Time schedule for system aspects Recommendations
- Consideration of MPEG-2 multimedia multiplex schemes for broadband applications
- Protocols for desktop videoconferencing

2. System configuration

According to the practice of N-ISDN standardization, Recommendations in Figure 1 are assumed. Dotted partitions between multimedia multiplex and AAL etc. are intended to represent the open nature of the current discussion.

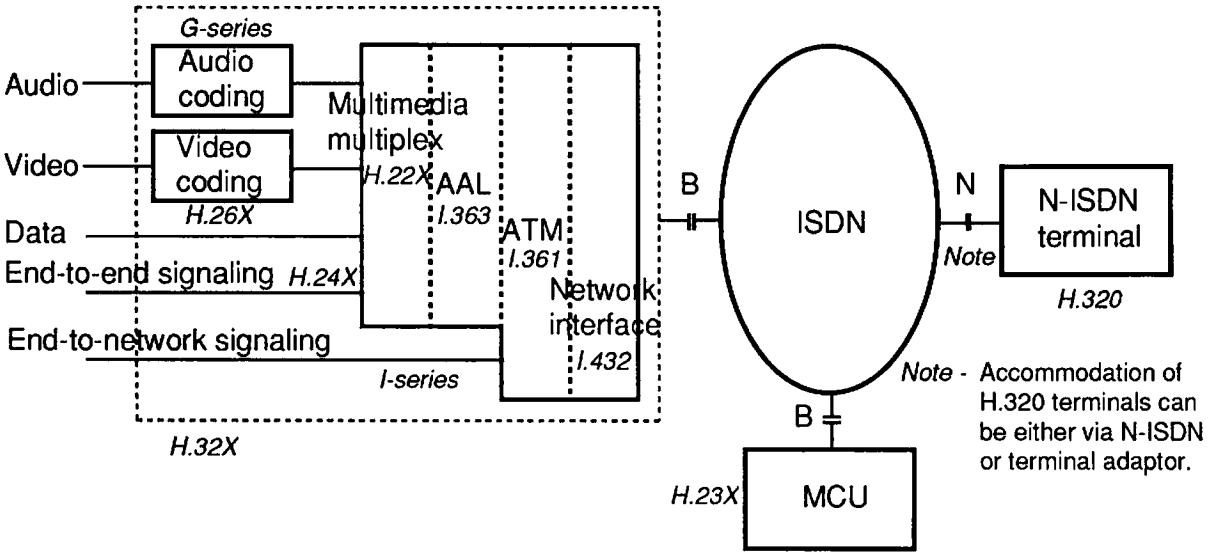


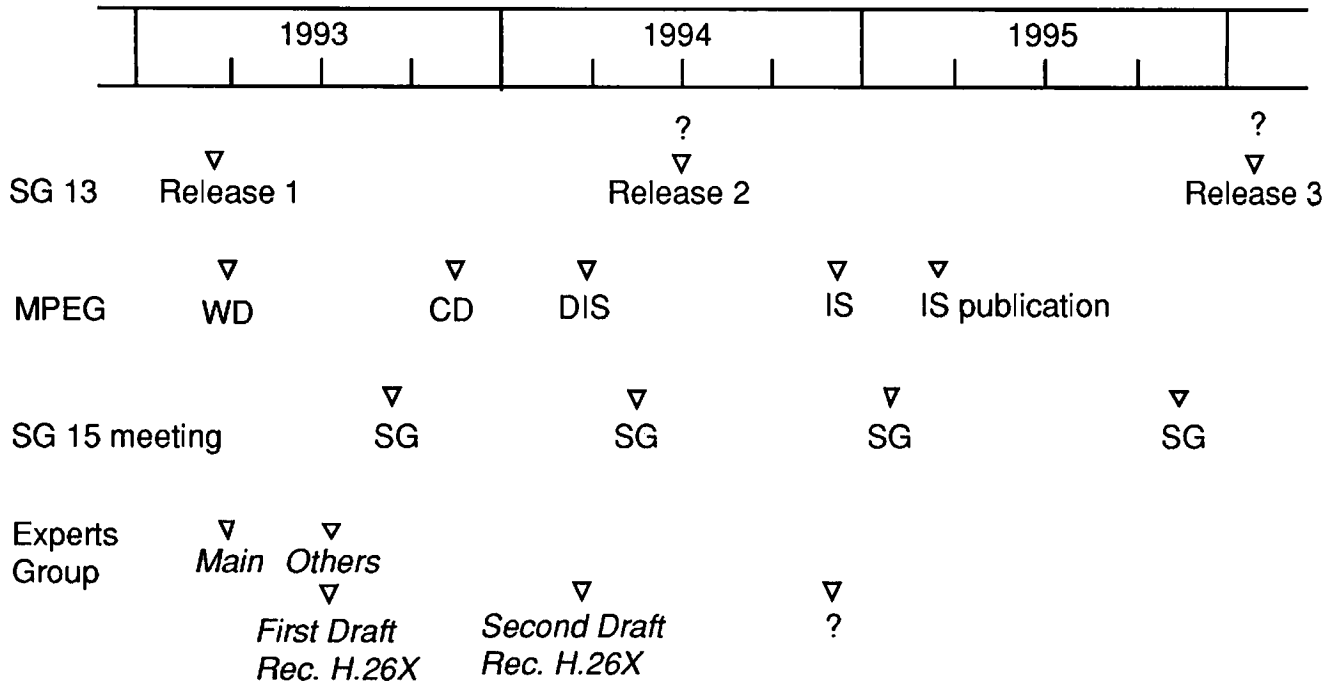
Figure 1 Audiovisual communication terminal and system configuration

3. Timetable for Recommendation H.26X

The Experts Group for ATM Video Coding is working for the video coding Recommendation H.26X, jointly with ISO/IEC JTC1/SC29/WG11 (MPEG), and WPXV/1 endorsed the common text approach for this Recommendation last November. It means that H.26X is generic in nature, leaving most of the application related issues to other system and/or terminal

Recommendations. One typical example is the picture format issue. We could not reach a particular solution due to the lack of perspectives for B-ISDN applications. ITU-TS SG15 should produce Recommendations to allow the total system interoperable.

The current timetable of MPEG, SG 13 and meeting calendar of SG 15 are shown in Figure 2 together with milestones for the Experts Group.



Note - Exact dates for the ITU-TS SG 13 (former SGXVIII) release 2 and 3 are subject to the SG 13 considerations.

Figure 2 Timetable

If we look at the SG15 meeting calendar and the MPEG plan, we recognize that the first opportunity to make video coding Recommendation H.26X is through approval of SG15 in January 1995.

4. Systems aspects Recommendations

It is quite obvious that the video coding cannot stand alone, we need audio coding, multimedia multiplexing, communication procedures, call control, etc. as illustrated in Figure 1 to make interoperable communication systems. WPXV/1 made a small step at the November 1992 meeting by declaring that they will be "1994+" Recommendations in the "IVS Baseline Document" edited by SG13.

One serious difficulty is that B-ISDN is not as visible as N-ISDN, but the other way to look at the situation is that we are in a good position to do the work before incompatible equipment appears in the market and to reflect audiovisual requirements to the network standardization.

As the SGXV meeting schedule is given for 1993-1995, we may be able to produce a WP workplan more precisely; what Recommendations we intend to make and at what time. If we follow the N-ISDN practice, the timing for a set of Recommendations becomes the same as that for video coding standard (i.e. early 1995). This time, however, we might need more time for establishing the overall system requirements , leading to the target date of early 1996?

In any case, we need good target dates for Recommendations.

Table 1 Target dates for broadband audiovisual systems Recommendations

Stage	Item	Network standardization	Target date for establishing Rec.
Stage 1	Common text for H.26x|MPEG-2		early 1995
Stage 2	Minimum configuration for the total audiovisual communication system	Release 1 (1992) - CBR - point-to-point - limited N-ISDN interworking	early 1995 or early 1996 ?
Stage 3	Enhanced configuration for the total audiovisual communication system	Release 2 (1994) - CBR and VBR - multicasting, multipoint, distribution - renegotiation within call - full N-ISDN interworking	??
Stage 4	Full configuration for the total audiovisual communication system	Release 3 (1994+) - Broadcasting - Full B-ISDN	???

The same thing can be said to N-ISDN audiovisual systems Recommendations as well.

5. Multimedia multiplexing method

MPEG Phase 2 work includes video coding, audio coding and "system coding" as well which addresses multimedia synchronization and multiplexing. MPEG-2 Systems are going to consist of the following syntax (see attached overview for more details);

- "Program Stream" which is similar to MPEG-1 Systems in functionality. This is designed for use in error free environments.

- "Transport Stream" which has functionality of multiple program multiplexing (typically for broadcasting applications) and are designed for use in error prone environments.

In the interest of service integration on B-ISDN, it is desirable that multimedia multiplexing is also common among various applications. WPXV/1 already expressed this view at its meeting in November 1992 and sent a liaison letter to ISO/IEC JTC1/SC29 (higher body of MPEG) stating that;

In the interest of harmonisation, WPXV/1 proposes to adopt as far as possible the "core" of the multiplex now under development in MPEG-2, rather than produce an independent multiplex which may cause interworking difficulties."

and MPEG welcomed this statement.

SG15 should decide how our Recommendation H.22X is structured in relationship with the MPEG-2 Systems standard; common text, technically aligned, or other approach. It should also be noted that the above mentioned Transport Stream has close relevance to AAL/ATM specifications in functionality (see attached overview for more details).

6. Protocols for desktop videoconferencing and videophone over LANs

There are now several commercial products or announcements for desktop videoconferencing and videophone which are designed for LANs and WS/PC environments. Stack of protocols

for this purpose may be an area of ITU-TS SG15 responsibility. Such systems have the following features among other things;

- Bandwidth available for a communication session is not fixed nor guaranteed, it depends on other traffic over the LAN. Delay is not guaranteed either; transmission may sometimes be not realtime.

- Data is inherent in these systems. Audiovisual is rather an optional extension.

- For end-to-end communication procedures, H.242 may not be optimum if the above facts are considered . We may need appropriate procedures.

- Interworking with audiovisual systems on N-ISDN and/or B-ISDN may be required.

SG15 should consider to provide Recommendations necessary to allow interworking between independently designed desktop videoconferencing and videophone systems.over LANs.

7. Conclusion

Strictly speaking those system issues are not under responsibility of the Experts Group, but since we are the only body in SG15 which is studying broadband audiovisual communication systems, we are willing to contribute to the work progress of the SG15. We are trying to make a clearer workplan of the Experts Group to better organize the group. A criticism has been that the group does not have firm objectives in terms of Recommendations we are aiming at.

In this respect, we need advice from the Working Party and SG15, particularly in establishing target dates for Recommendations. Some specific topics of relevance, multimedia multiplexing and protocols for desktop videoconferencing and videophone, have also been raised.

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Comparison of MPEG-2 Systems and AAL/ATM

1. Introduction

MPEG 2 systems will specify syntax for a *program stream* and a *transport stream.* Figure 1 shows the relationship between these two streams. Figure 1 illustrates that a service, or program, may consist of multiple elementary streams i.e multiple video, audio, and data streams.

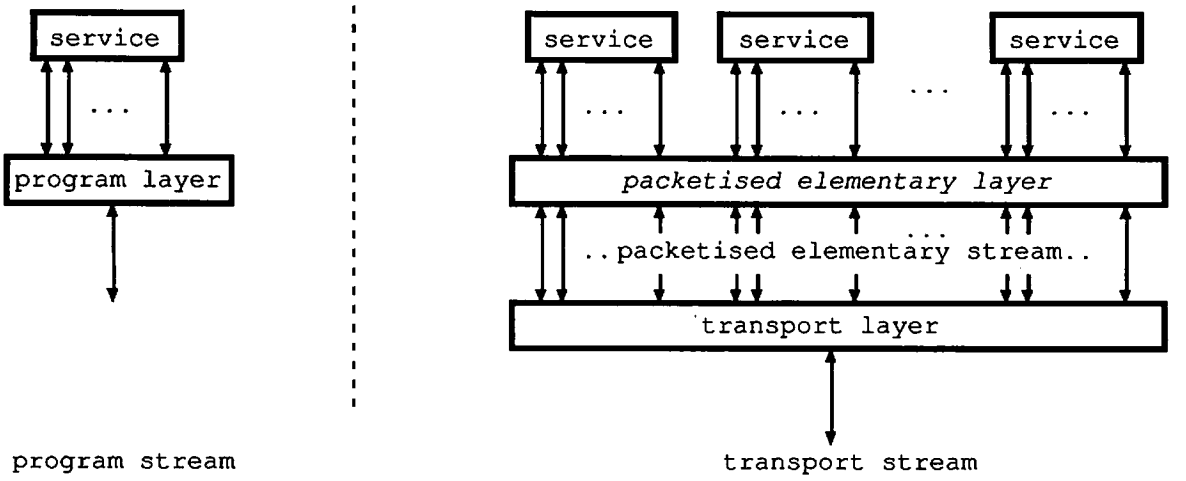
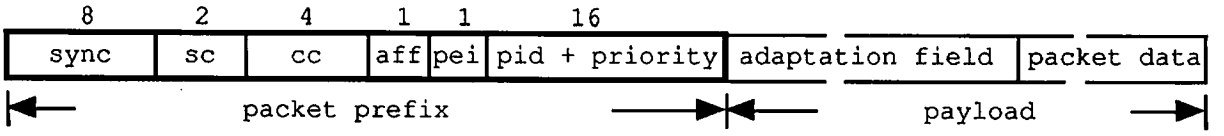


Figure 1. Relationship between MPEG 2 system program stream and transport stream.

The program stream is for error free transmission mediums. It has similar functionality and syntax to the MPEG 1 system. The program stream carries elementary streams for one program only. Program stream description tables hold parameters relating to each elementary stream. A program stream directory may also be defined.
The transport stream is designed for use on lossy transmissions mediums. The transport stream consists of packets with payloads which are relatively short, compared to an MPEG 1 system packet. Elementary streams belonging to one program, or service, are identified by a mulitplex map, which lists programs and the elementary streams that make up each program. The terminology of Figure 1 is used here for explanation and is not necessarily that used by the MPEG systems group. In addition the transport stream model shown in Figure 1 is not yet definite. Alternatives include a one layer structure in which all functions are carried out at the transport layer.

2. Transport Stream

A transport packet consists of a fixed length packet prefix (header) and a payload. The packet length is fixed on one data link, but may be different on different links. The first part of the payload in some packets may be a variable length adaptation field.
Figure 2 shows the structure of the MPEG 2 transport packet as currently defined.



sc - scrambling_control_field
cc - continuity_counter
aff - adaptation_field_flag
pei - packet_error_indicator
pid - packet_id

Figure 2. Current structure of MPEG 2 transport packet

The functions of the transport layer as currently defined include

packet synchronization - facilitated by a synchronization byte in the packet prefix

packet loss detection - uses a 4 bit packet continuity count

multiplexing - the packet prefix contains a packet identification field. A packet identification field value is uniquely associated with one elementary stream only

priority indication - some bits are available in the packet prefix for explicit packet priority indication

timing - the program clock reference (PCR) field is contained in the application field. PCR provides the same function as the system clock reference (SCR) in MPEG 1

error indication - a field is provided to convey packet error indication to the decoder

Figure 3 illustrates a general requirement of a transport layer multiplexer. Transport packets are of fixed length on a physical link, but may be different on different links. This allows optimisation of packet length for a particular physical medium.

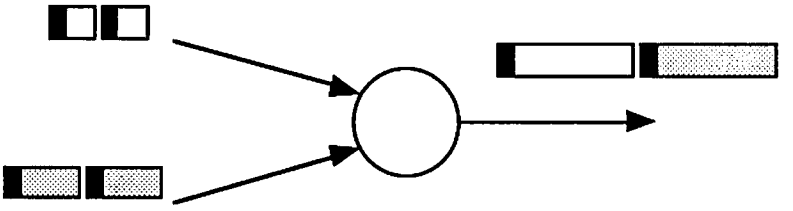


Figure 3. General requirement of a transport layer multiplexer.

The transport layer PCR field, or equivalently a PCR delta field, may require modification at each multiplexing and demultiplexing point, even where packet lengths do not change. It may be possible to deal with small changes in packet position i.e delay jitter, through use of a phase locked loop and a packet buffer at the decoder.

3. Packetised Elementary Layer

The packetised elementary layer resembles the MPEG 1 *packet layer*. The MPEG 1 packet layer performs the following functions

multiplexing - supported by the *stream_id* field

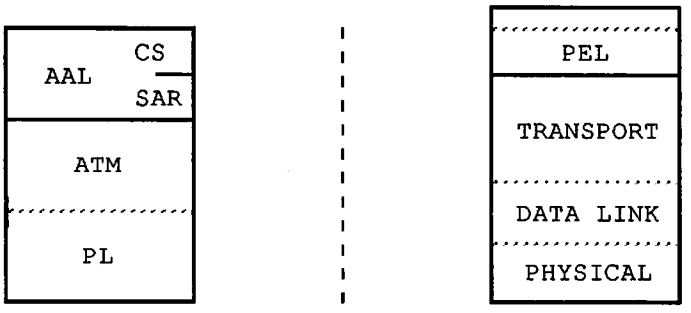
stream synchronization - supported by presentation time stamps (PTS) and decoder time stamps (DTS)

decoder buffer signalling - buffer size requirements are transmitted at this level

In the MPEG 2 transport model no multiplexing is performed at the packetised elementary layer. All multiplexing is done at the transport layer. This supports simple drop and insert capabilities in the transport stream. Currently the packetised elementary stream does not contain pack headers i.e. the packetised elementary stream does not support system clock reference (SCR). The equivalent field is the transport layer PCR field.
The packetised elementary stream may or may not be synchronized with the transport layer packets.

4. MPEG 2 system transport model and B-ISDN protocol model relationship

The MPEG 2 transport layer is a packet multiplex that may be viewed as possessing similar functionality to the B-ISDN ATM layer. The transport layer also contains a continuity counter, a function that in B-ISDN is typically included in the Segmentation and Reassembly (SAR) sublayer. Figure 4 shows approximate equivalence between the B-ISDN Protocol Reference Model (PRM) and an implied MPEG 2 system transport model. The relationship between the lower layers of the two models is not clear. These boundaries are shown shaded.



B-ISDN PRM

MPEG 2 transport model

AAL - ATM Adaptation Layer
CS - Convergence Sublayer
SAR - Segmentation and Reassembly sublayer

ATM - Asynchronous Transfer Mode
PL - Physical Layer
PEL - Packetised Elementary Layer

Figure 4. Approximate relationship between B-ISDN PRM and implied MPEG 2 system transport model.

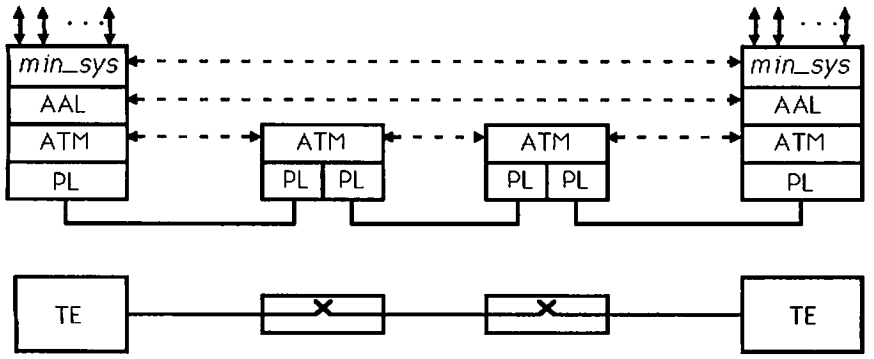
5. MPEG 2 system and B-ISDN interaction

A number of scenarios are possible as to the interaction of MPEG 2 systems and B-ISDN. Possible ones are

MPEG 2 on B-ISDN - figure 5 illustrates protocol models for connection between two B-ISDN terminals using MPEG video and audio elementary streams. In this case only that functionality not provided by an AAL needs to be provided by MPEG 2 systems (*min_sys*). This could be provided by the MPEG 2 program stream, with one elementary stream per program stream, using a common clock between program streams, or if appropriate, by the packetised elementary stream.

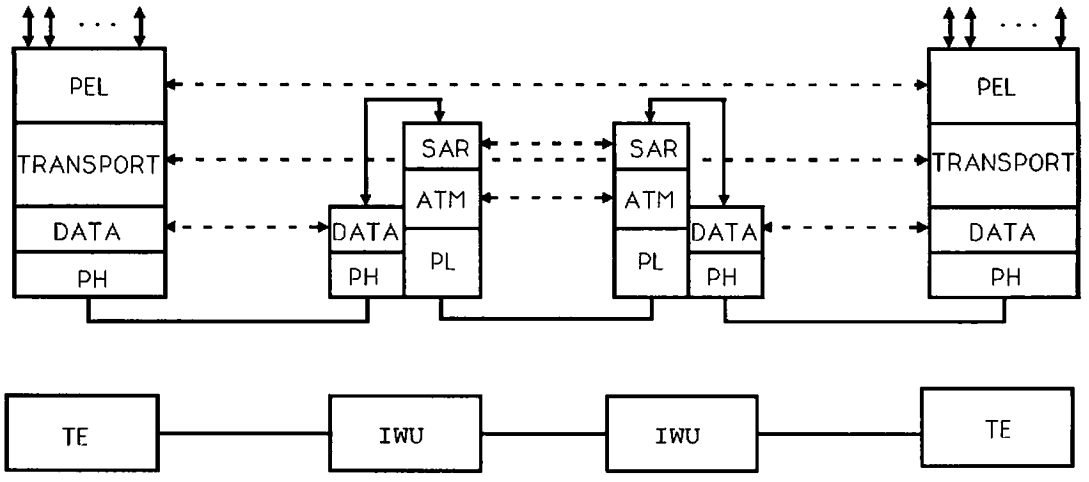
MPEG 2 transport stream connected to B-ISDN for service delivery to B-ISDN terminal - in this case the MPEG 2 transport stream may need to be terminated at an interworking unit, such that one of the reference points described above is available.

MPEG 2 network interconnection using B-ISDN - in this case the MPEG 2 transport or program stream might be transported transparently by the B-ISDN. Figure 6 illustrates this for the case of the transport stream. Minimal SAR functionality of error detection might be required.



HL - Higher Layers
AAL - ATM Adaptation Layer
ATM - Asynchronous Transfer Mode
PL - Physical Layer
TE - Terminal Equipment
min_sys - MPEG 2 systems functionality not provided by AAL

Figure 5. Possible use of MPEG 2 systems for connection between B-ISDN terminals.



PEL - Packetised Elementary Layer
PH - Physical Layer
IWU - Interworking Unit
TE - Terminal Equipment
SAR - Segmentation and Reassembly sublayer
PL - Physical Layer

Figure 6. Possible MPEG 2 network transport stream interconnection using B-ISDN.

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