Telecommunication Standardization Sector
Study Group 15
Experts Group for ATM Video Coding
(Rapporteur's Group on Part of Q.2/15)

Document AVC-496R
April 7, 1993

Source : CHAIRMAN OF THE EXPERTS GROUP FOR ATM VIDEO CODING
Title : REPORT OF THE ELEVENTH MEETING IN SYDNEY AND MELBOURNE (March 27 - April 7, 1993)
Purpose : Report

Contents

1. General

The eleventh meeting of the Experts Group was held in Australia as follows;

- Joint sessions with ISO/IEC JTC1/SC29/WG11 (MPEG) in Sydney during March 29 - April 2, 1993 at the kind invitation of Standards Australia,
- TSS sole sessions in Melbourne during April 5 - 7 at the kind invitation of Telecom Australia.

At the opening of the joint sessions in Sydney, Mr. John Burton (General Manager, Business Strategy Telecom Australia) made a welcoming address to MPEG and TSS EG members on behalf of the hosting organization. At the opening of the sole sessions in Melbourne, Mr. Ray Ligett (Director of Research, Telecom Australia) welcomed TSS EG members on behalf of the hosting organization.

At the end of the sole sessions, Chairman thanked the hosting organizations for the meeting facilities provided and the excellent secretarial support.

The list of participants appears at the end of this document.

2. Documentation (TD-2)

For the sole sessions, 53 AVC-numbered documents and 16 Temporary Documents have been made available as listed in *Annex 1*. Annex 1 also includes a list of documents for the joint sessions.

3. Tape demonstration (TD-3)

Several video tape demonstrations were given in D1 format to present experimental results as detailed in *Annex 2* .

4. Review of the previous meetings

4.1 World Telecommunication Standardization Conferences (TD-8)

Mr. Zedler outlined the outcome of WTSC-93 held in Helsinki, particularly new structure of ITU focusing on Study Group 15 of Telecommunication Standardization Sector.

4.2 Torino/Roma meeting (AVC-443R,444R)

The meeting shortly reviewed the outcome of sole and joint sessions in Italy.

4.3 CMTT/2 and its SRG

Mr. Zedler introduced current activities of CMTT/2 and its SRG. The meeting recognized the need to have closer relationship looking at the fact that CMTT is now SG 9 in the same TSS umbrella.

4.4 Regional coordination meeting on March 28 (TD-6)

According to the agreement at the Roma closing session, a coordination meeting was held on March 28 to check if there are any contentious matters from TSS's point of view toward the joint sessions. Its report is contained in *Annex 3* to this document.

5. Joint sessions with MPEG in Sydney

5.1 Requirements (TD-7) reported by A. Tabatabai, S. Okubo

The REQUIREMENTS sub-group met every day during the week (March 29 - April 2) under chairmanship of Sakae Okubo. In addition to our own sessions, we had joint sessions with other sub-groups as follows;

- with VIDEO and IMPLEMENTATION, 9:00 - 10:50 on Tuesday to identify open issues regarding the Main Profile at Main Level,
- with VIDEO, 9:40 - 11:35 on Wednesday to have free discuss on other profiles than Main,
- with SYSTEMS, 12:05 - 13:10 on Wednesday to review the "Guide for Systems Work" document,
- with VIDEO, 9:30 - 11:30 on Thursday to review the study results on open issues for Main Profile at Main Level and features of NEXT Profile,
- with AUDIO, 16:30 - 17:00 on Thursday to finalize the "Guide for Audio Work" document.

5.1 1 Background

5.1.1 1 Relevant documents

N0349	Okubo	MPEG/Requirements meeting report (Rome)
N0363	REQ sub-group	Definition of Profiles and the Main Profile

5.1.1.2 Discussion

The meeting started this week discussion with a short review of what happened in the previous Rome meeting and identified items to be worked out at this meeting.

5.1.2 WD

5.1.2.1 Relevant documents

93/305	Savatier	Comments on MPEG-2 Working Draft Version 3
93/334	Kogure	Report of ad-hoc group on MPEG-2 Video WD development
93/423	WD Editing C.	MPEG-2 Working Draft (Video Part), Version 3
93/479	Editorial group	First Working draft

5.1.2.2 Discussion

The meeting reviewed the profile related parts in WD Version 3, and concluded that informative description of the current clause 6 should be moved to subclause 0.3 and normative description to clause 9. Mr. McCann and Mr. Williams drafted instructions for WD editing which were incorporated in the updated version.

5.1.3 Main Profile at Main Level

5.1.3.1 Relevant documents

93/267	NNI	Resolutions of the Dutch National Body NNI for the MPEG meeting in Sydney
93/269	UKNB	List of open issues in MPEG-2 Main Profile
93/319	Wise	Various issues in MPEG-2
93/369	Dunstan	Data partitioning and the main profile
93/376	Corset et al.	Proposal for a 1.75 Mbit max. vbv_buffer for the main profile
93/392	UKNB	Resolutions from the UK
93/396	TSS/J	Syntax modifications for VBR operation
93/424	AFNOR	French contribution to the meeting in Sydney
93/433	Koster	Harmonising/combining low complexity, error resilience, scalability, image quality and compatibility
93/439	ITU-RS TG 11/4	- Comments to Main (Core) Profile of MPEG-2 - The number of active lines for distribution of 525 line signals
93/448	Req. group	List of open issues for main profile at main level
93/472	Req. group	Reply to open issues
93/481	MPEG/Req.	Liaison statement from MPEG to Radiocommunications TG11/4

5.1.3.2 Discussion

The meeting first listed open issues for the Main Profile at Main Level from the requirements point of view as summarized in MPEG93/448 based on several input documents as well as interaction with VIDEO and IMPLEMENTATION. Then we studied them item by item, paying attention to the CCIR requirements presented by Mr. Nishizawa and Mr. Bedford (MPEG93/439) and concentrating on the following;

- support of forward/backward compatibility,
- layered coding for error resilience and hierarchical representation,
- number of coded lines for 525/60 television systems.

5.1.3.3 Agreements

Views of the REQUIREMENTS sub-group for the open issues regarding the Main Profile at Main Level were summarized as in MPEG93/472. Highlights are listed here.

a. Compatibility

We recommend that Main Profile at Main Level decoders should be able to handle MPEG-1 constrained parameter bitstreams.

Backward compatibility is not supported by the Main Profile. Backward compatibility is to be supported by the spatial scalability in other profiles.

b. Layered coding

The hierarchical/scalable feature should be included in a new profile together with 4:2:2.

To cope with uncorrected bit errors or cell losses which may come through even the error protected channel or storage media, the video source decoder should be modestly error

resilient with cost effective means. If we have to cope with higher cell losses (e.g. higher than 1E-3 at 4 Mbit/s), layered coding by using prioritized channels is effective. Possible solutions are scalable coding, and data partitioning. This feature should be considered as a part of new profiles.

Related to this discussion, the meeting agreed to drop the definitive wording for Main Profile from WD because it is not suitable for external use.

c. Number of coded lines for 525/60 television systems

After extensive discussion in the REQUIREMENTS sub-group and consultation with the IMPLEMENTATION sub-group, the meeting reached a conclusion that 480 lines are appropriate for Main Profile at Main Level and his feature should be considered in the design of new profiles together with other features addressed by CCIR.

e. profile_and_level_ID

To cope with undefined number of profiles and levels, we suggest the structure of "1 bit escape + 7 bit information" and 7 bits to consist of 3 bits profile ID and 4 bits level ID.

f. Decoder resource related indications

We recommend these should not be separately included in the syntax, but should be covered by Profile_and_Level indication.

g. Liaison response to Radiocommunication sector TG11/4

The meeting decided to return response as in MPEG93/481 to the CCIR's concern expressed in MPEG93/439

5.1.4 Other Profiles and Levels

5.1.4.1 Relevant documents

92/714	Stevens et al.	Application profile for desktop video conferencing
93/238	Lippman	Suggestion for a revised set of profiles
93/253	PTT Research	Interworking and complexity requirements on scalable video coding algorithms
93/294	Urano et al.	Consideration for EDTV(progress) from the viewpoint of MPEG-2 profile/level
93/314	Sikora	Evaluation of scalable coding schemes
93/339	JNB	Proposal for MPEG-2 video profiles
93/427	Yamada et al.	Multiple profiles and informative profiles proposal
93/477	Teichner	Compatibility between chrominance formats 4:2:2 and 4:2:0
93/450	Koster	Attempt for the definition of the new profile, with the HDTV and TV levels
93/473	REQ sub-group	Profile architecture

5.1.4.2 Discussion

The meeting studied profiles other than Main which need be defined in addition to the Main. At the joint session with VIDEO, the following features were listed as tools additional to those for the Main;

- data partitioning; graceful degradation on different channels
- scalability; satisfying the need of multimedia computers
- multi-layered broadcasting; compatible HDTV
- F/F and more; advanced random access for storage applications

- shorter random access and channel hopping; switching time for channel coding should also be taken into account
- lower delay
- symmetric coding/decoding for camcorders and VCR; inexpensive solutions

Taking into account these and other suggestions contained in the input documents, we first focused on a profile (called NEXT for brevity) which has more functionalities than the Main, hierarchical representation in particular, and are appropriate for terrestrial broadcasting and information technology. Following the practice for development of the Main Profile, we worked to make a skeleton for this new profile by describing purpose, key functionalities, performance and open issues.

An implication of this new profile is that there may appear complex situations for compatibility between MAIN and NEXT encoders and decoders. We discussed extensively possible interoperability scenarios and reached a common understanding that care should be taken to reduce the number of combinations.

There were also expressed interests for low cost version of MAIN. The meeting spent some time to consider this profile as well (called SIMPLE for brevity) and obtained a short description of its skeleton.

Finally, the meeting studied the whole picture of profiles and levels to map MAIN, NEXT and SIMPLE profiles and to identify the remaining areas of further study. Mr. Lippman pointed out that hardware constraints would lead to products which conform to both lower profile at higher level and higher profile at lower level.

At the joint session with VIDEO, we also discussed on the comparison between spatial scalability and frequency scalability. This action is based on the guideline that the standard should not contain two or more tools for the same purpose. This time the objective was mostly to initiate the work, awaiting further contributions to allow early decision.

5.1.4.3 Agreements

The outcome of the profile study was formulated as MPEG93/473 (see *Annex 4* to this document) which shows mapping of subsets of the whole MPEG-2 video standard in terms of profile and level as well as skeletons for NEXT and SIMPLE profiles. This document also indicates issues to be solved.

As part of the interworking scenarios, the meeting considered 4:2:2 and 4:2:0 compatibility and agreed to make the following recommendation of the group to ease the complexity; the REQUIREMENTS sub-group recommend that the VIDEO sub-group incorporates all necessary means to support up- and downward compatibility between 4:2:2 and 4:2:0 chroma formats.

5.1.4.4 Adhoc group

In order to progress The meeting agreed to establish an Ad-hoc group on other Profiles and Levels which is mandated to elaborate description of Profiles and Levels other than Main based on the skeletons obtained at the Sydney meeting. Mr. B.G. Haskell volunteered to chair this adhoc group.

5.1.5 Presentation related indications

5.1.5.1 Relevant documents

93/298	Penney	Syntax for MPEG-2 colorimetry and transfer characteristics
93/356	Wells	Requirement for PAL phase information

5.1.5.2 Discussion

The meeting reviewed the discussion in Rome and recommended that the syntax include a mechanism to accommodate future addition of other indications.

5.1.6 Requirements for Systems

5.1.6.1 Relevant documents

N0364	REQ group	Guide for Systems work, Rome revision
93/260	Giachetti	Access control requirements on the broadcast multiplex structure
93/316	Curet	A frame oriented broadcast-multiplex with different levels of protection
93/322	Bache et al	General multiplexing requirements for a digital TV broadcast operator
93/439	ITU-RS TG11/4	Comments on "Liaison letters to BR SRG on user requirements" especially on "Systems requirements"
93/471	REQ group	Guide for Systems work, Sydney revision

5.1.6.2 Agreements

At the joint session with SYSTEMS, the meeting adopted a couple of revisions to the Rome version as in MPEG93/471.

5.1.7 Requirements for Audio

5.1.7.1 Relevant documents

93/245	REQ group	Guide for the Audio Work Group
93/337	Brandenburg	Report of Ad-hoc group for new Audio Work Project description and requirement listing
93/338	Rabowsky	Report of Ad-hoc group on guide for MPEG2 Audio work
93/462a	REQ group	Guide for the audio work

5.1.7.2 Agreements

At the joint session with AUDIO, the meeting adopted the normative description of MPEG-2 audio requirements as in MPEG93/462a.

5.1.8 Informative Requirements listing

5.1.8.1 Relevant documents

92/674 a	REQ. group	Information on requirements for MPEG-2

5.1.8.2 Discussion

There was no input at this meeting to update the document.

5.1.9 Verification tests

5.1.9.1 Relevant documents

93/259	Hidaka	Summary of MPEG-2 verification test
93/331	Hidaka	Report of Ad-hoc group on MPEG-2 verification test
93/445	Nasse	Letter to Mr. Hidaka

5.1.9.2 Discussion

Mr. Hidaka presented the current status of verification testing plan focusing on bitstream interchange and picture quality assessment. The latter is going to be carried out with obtaining cooperation of EBU, CCIR and SMPTE. The meeting discussed for short time on how to verify other aspects of the standards; various functionalities in particular. Due to lack of time, the meeting decided to continue this work through correspondence in an adhoc group.

5.1.9.3 Adhoc group

The meeting agreed to establish an adhoc group on requirements for the verification test which is mandated to list test items necessary for verification of the draft standard with respect to bitstream interchange, functionality and performance. Mr. Teichner volunteered to chair this adhoc group.

5.1.10 Very low bit rate audiovisual coding

This session was intended to review the state of the arts for very low bit rate audiovisual coding to prepare for the new project (MPEG-4). The following was presented for this purpose;

- Mr. R. Schaphorst: report of the first meeting of his LBC group in ITU-TS SG 15 (MPEG93/421)
- Mr. J. Ostermann: video coding based on object oriented analysis-synthesis
- Mr. M. Yano: hybrid coding using MC + orthogonal transform of arbitrary shape (MPEG93/469 with tape demonstration)
- Mr. J-H. Jeon: hybrid coding using MC + DCT (MPEG93/436)
- Mr. B. Haskell: report of PCS'93 and information on relevant workshops etc.

In the course of free discussion on how to organize the standardization work, it was recognized that good audio and video test materials typical for MPEG-4 applications would facilitate the study. Members are requested to provide such test materials.

Mr. Haskell suggested to take the competitive and collaborative approach for this new project. There was also raised a question what would be yardsticks for evaluating implementation complexity.

It was a common understanding that some drastically new techniques are required to achieve the objective and that interdisciplinary interaction would help us. The meeting suggested hold a workshop for this purpose during the next meeting in New York, inviting researchers from computer vision, psychology, music synthesis, speech synthesis, etc. Messrs. Kogure, Osterman, Haskell undertook to act as regional contact points.

5.2 Video reported by G. Bjoentegaard

The video group met throughout the week. No subgroups were formed - except for those working on the final version of the syntax. The video group had joint sessions with implementation, requirements and systems.

5.2.1 Open issues for main profile.

Several core experiments related to the main profile were still performed up to this meeting. One of the main issues in the video group was therefore to draw conclusions from these experiments and make proposals for the main profile. The outcomes from the reviews are listed below.

a. Transform: Only 8x8 DCT is allowed.

b. AC Leak: Not supported by main profile.

c. Block size for motion vector

There were experiments to test 16x8 prediction blocks for frame structure pictures. This was dropped. Only 16x16 blocks are allowed for prediction in frame structure pictures.

d. Smart prediction

Only Dual-Prime is allowed as smart prediction - and only for M=1. Since M is undefined in the WD, the exact definition was not quite clear. The understanding was "local M=1" which means that the decoder receives successive I or P pictures.

e. Skipped pictures

Skipping of pictures to obtain low delay is allowed only for M=1. The definition of "M=1" is similar to the definition for smart prediction. There is no picture type for skipped picture. The decoder will receive information on which pictures are skipped from the temporal reference parameter.

f. IDCT mismatch

A new method for oddification of reconstructed transform coefficients was proposed (MPEG93/278). This was adopted as a new oddification rule.

5.2.2 Syntax and working draft

The other main issue at this meeting was to produce a complete working draft. Since the main element of the WD is the syntax, much work was spent on this. Keywords in this work were :

- Simplify.
- Clean up.
- Tune to the outcome of core experiments.

This work seemed successful. The resulting syntax is much cleaner than the old one. The result may be seen in the "WD Video".

5.2.3 Scalability

All the core experiments on scalability continue. For spatial scalability there are no new experiments, whereas frequency scalability has two new core experiments (see TM5). There is still an effort to merge all the scalable approaches. This is subject for further discussion.

5.2.4 New profiles

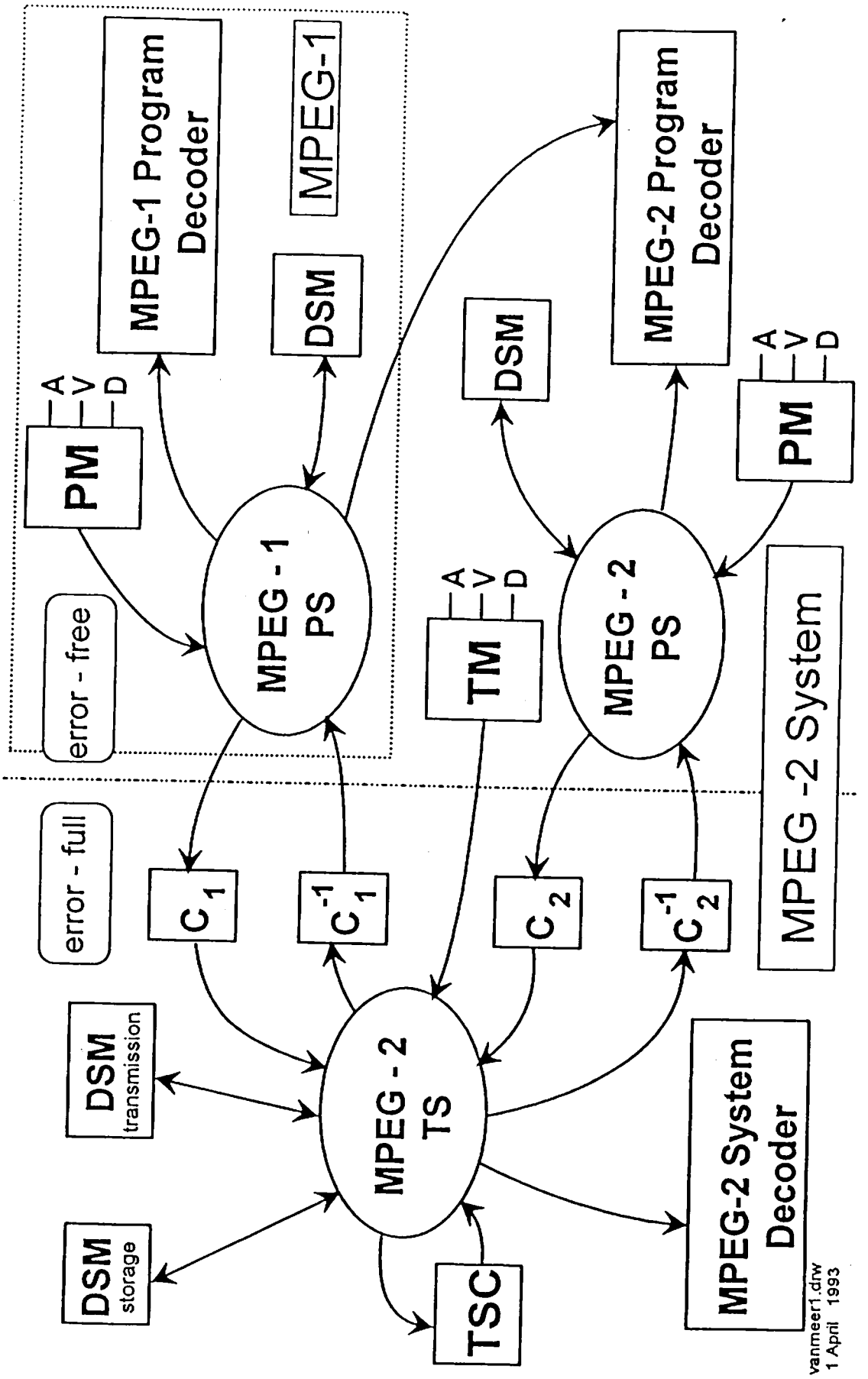
The video group spent practically no time on this issue. At the moment it is considered to be mainly a requirements issue.

Generally, the video group succeeded in its task to finalising the open issues for the main profile and to produce a WD.

5.3 Systems (TD-9) reported by B.G. Haskell, C.J. McGrath

The MPEG 2 Systems sub group met each day during the Sydney meeting of WG11, 29 March to 2 April, 1993. In addition, the ad hoc group established in Rome to manage the writing of the working draft met on Sunday 28 March to continue the discussion and convergence process.

Significant achievements of the week include:


MPEG-1 Program Decoder
MPEG-1
DSM
PM
A
V
D
MPEG-2 Program Decoder
DSM
PM
A
V
D
error - free
MPEG - 1 PS
TM
A
V
D
MPEG - 2 PS
MPEG -2 System
error - full
C1
C-1 1
C2
C-1 2
DSM transmission
MPEG - 2 TS
MPEG-2 System Decoder
DSM storage
TSC
vanmeer1.drw
1 April 1993

INTERNATIONAL ORGANISATION FOR STANDARDISATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC29/WG11
CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

ISO/IEC JTC1/SC29/WG11 **N0399**

MPEG93/
March 1993

Source: MPEG Systems
Title: Response to Telecommunication Standardisation Sector concerning relationship of MPEG Systems to ATM AAL
Purpose: Discussion

MPEG Systems has considered the matter of the relationship between the ongoing MPEG 2 System definition and the ATM AAL, with participation by TSS liason members. It has been pointed out that there could be a conflict in protocol models or redundancy in some cases between the two definitions.

MPEG Systems is defining two distinct stream definitions to meet the requirements of different application areas: the Program Stream, which is similar to MPEG 1 Systems, and the Transport Stream, which is designed for operation in lossy environments and which can carry multiple programs in one stream. The transport stream is designed to solve efficiently an array of problems for applications which are likely to use it, primarily the audio-video broadcast and distribution areas.

While we believe that more study is necessary, some solutions have been discussed for interworking between the MPEG Systems and ATM and AAL specifications.

1. It may be appropriate to carry the transport stream in an ATM environment with a null AAL. This form of application may be relevant for video broadcast applications which wish to use ATM to carry one or more programs, possibly in conjunction with other networks. With the present transport stream definition there is an outstanding issue concerning detection of ATM cell loss and data errors.
2. Audio and video which are meant to be used together, for example in video telephony terminal equipment, may carry these elementary streams in one or more streams following the program stream definition. If more than on program stream is used at a time, they should have a common MPEG system time base. These streams may be carried on one or more VC. ATM AALs may be used as appropriate.
3. B-ISDN call setup may provide functions to which some of the transport stream functions may be redundant. While it may be possible to use the call setup functions instead of the similar functions in the transport stream, the utility of such a design may depend on the entire network topology, where interworking with other networks may be required.

It is well understood that more study is needed in order to provide optimal resolution of the questions that have been raised. The systems group is very interesting in finding such resolutions. To that end, MPEG Systems has established an Ad Hoc Group to study this matter between the April and July 1993 meetings. We welcome further input and close cooperation on this and other matters.

- Approval of a Working Draft Document for MPEG 2 Systems
- Establishment of an AdHoc Group to continue Working Draft revisions
- Meetings set for Atlanta (May 1993) and Brussels (June 1993)
- Establishment of an AdHoc Group to study MPEG Systems / ATM AAL issues
- Approval of "Response to TSS concerning relationship of MPEG Systems to ATM AAL; Document WG11 N0399 is attached.

A high level view of MPEG systems was generated by the group during the week indicating the assumed interactions between MPEG 1 elemental and Program Streams (MPEG - 1 PS), MPEG 2 program streams similar to MPEG 1 streams (MPEG 2 PS), both of which are oriented toward error-free environments such as DSM. The diagram also covers presumed conversions between these Program Streams and MPEG 2 transport streams, presumed to be used for multiple (1 or more) transport of MPEG 2 elemental and program streams in transport environments which typically introduce errors(error-full).

Significant discussion during the week focused on the ease of conversion between the various formats, Program Streams and Transport Streams. There is a simultaneous desire to maintain simplicity and economy in the definition of MPEG - 2 TS streams and to permit a maximum number of applications to be fully defined by the standard. Achieving appropriate balance in this task continues to consume a significant percentage of the groups time.

The issue of overlap among MPEG "layers" of formatting and equivalent (in protocol stack terms) ATM adaptation layers was given considerable consideration, although no firm agreements were reached. An ad hoc was established to specifically address these issues.

The "Guidelines for Systems Work" from Requirements was revised slightly in a joint Systems/Requirements meeting on Wednesday.(MPEG 93/471).

5.4 Implementation reported by P. Stevens, G. Morrison

Sessions were held throughout the week of 29 March to 2 April. The core participants were:

Geoff Morrison	BT Labs (chair)
Doug Bailey	IIT
Steve Haigh	InovaCom
San Narasimhan	IME Singapore
Chadd Fogg	Cascade
Jong Cheul Park	Kaitech Korea
Yasumori Ishikawa	Ricoh Co.
Barth Canfield	TCE
John Gooding	Phoenix VLSI Consultants
Marco Gandini	CSELT
Hock Gin Lim	Monash University Australia
Paul Chiang	Texas Instruments
Thierry Fautier	Philips LEP

The major task was to deal with all open issues so that the Video WD for Main Profile Main Level could be frozen at the end of the week. In the afternoon of 29 March a list of these was draw up. This list was then exchanged with similar ones from the Video and Requirements subgroups to pick up all relevant open issues for each subgroup.

The list of open implementation issues and the conclusions reached on them during the week was documented in MPEG 93/466 as attached.

The subgroup also prepared its recommendations. These are documented together with those of all the WG11 subgroups in the convenor's report.

Source: **Implementation Studies subgroup**
Title: **Open Issues - Implementation**

This document lists the open issues pertinent to the Implementation Studies subgroup identified on 29 March 1993 and the conclusions on them by the afternoon of 1 April 1993.

It must be borne in mind that the assessment of cost/complexity is not based on a single implementation but on consensus over several. Consequently for any specific implementation it is possible that the conclusions given below appear inconsistent.

Localised Questions - Global review needed
We point out that many of the features considered do not individually result in a large cost increase (eg in silicon area). However, the sum total is significant and more importantly, the verification and test cost will depend on the number of permutations of the ways in which a block can be coded.. This is the reason for recommending against coding options and combinations of coding options which give only small benefits.

Dual Prime (MPEG 93/393)
Cost effective design requires a datapath. The processing of dual prime adds a great deal of complexity into the datapath and increases the size, cost, speed and buffering in programmable type solutions.
Recommend:-Dual Prime limited to I, P or removed.

Alternate Scanning (MPEG 93/318, /393)
Is this simply a cover for encoders that cannot make frame field decisions properly?
Increases complexity, but not greatly.
Recommend:- Investigate linking scan path decision and VLC table to frame/field coding bit.

Adaptive VLC
Puts additional constraints on certain implementations. This is especially difficult for software only implementations, necessitating additional tests and branches for each coefficient.
Hardware decoders require faster 'Level' decode circuits and an extra feedback path.
Recommend:- Macroblock flagged OK, self adaptive is expensive, not OK.

Priority Break Point (MPEG 93/312, /369)
It is clear that the priority breakpoint adds significant complexity in normal play modes. It is also clear that FF and error resilience are enhanced by the addition of the PBP. However, it not clear whether the FF and error resilience are requirements of the Main Profile and the Implementation Studies group requests clarification from the Requirements group before proceeding. By constraining the syntax locations pointed to by PBPs it may be possible to reduce the complexity of the scheme.
Recommend: No change to Rome meeting recommendation (main profile decoder able to decode one partition.)

Mixed frame field structures
Accepted at Rome meeting.
Recommend: Rectify believed problem with WD page 30 line 14 (Fautier). Clarify Temporal Reference for frame/field. Clarify whether structures such as the following are permitted:

I B B P (This might occur in edited bit streams)
x B B I

Oddification
We examined two proposals for a new oddification technique. Neither method was preferable in both hardware and software decoder implementations. One method (SONY) was judged to be much preferable in hardware implementations. The other (GCT) has some advantage for software decoders. On balance the former method was selected. The exact modification of the final coefficient needs to be specified.
Recommend: If the MPEG-1 oddification is not adequate, then the technique in document 93/278 be adopted and oddification should be performed by inverting the least significant bit of the (7,7) coefficient.

3:2 pulldown

The general principle of indicating repeated uncoded fields (of which 3:2 pulldown is a specific example) is accepted.

Recommend: General method be part of complete syntax, preferably unified with skipped pictures. VBV section may also require revision.

"PAL bits"

These are perceived as having virtually zero impact on decoders. Relevant data will merely be made available to subsequent processes or ignored.

Recommend: No further action

Huffman (MPEG 93/320)

We were requested to choose between two VLC tables for Intra coefficients. Neither of these were fully acceptable to the Implementation Studies subgroup. Document 320 pointed out that the shorter of the two does not obey certain construction rules which aid some implementations. Other implementators preferred the shorter table. A proposal to allow partially downloadable VLC (programmable lengths but fixed ordering of events) was made by some members.

Recommend: Video subgroup consider proposal by Bailey et al. If not acceptable, Video subgroup to decide between existing two tables.

Chroma post processing flag

It is understood that this information is advisory only and decoders may ignore.

Recommend: WD be clear on this point.

Leaky prediction

The main penalty here is the temporary storage of 64 pels while computing the DC component.

Recommendation: Not have leaky prediction.

Hardware verification

Opinion was that we could not do more than will happen anyway.

Recommend: No further action.

Buffer size

Video subgroup advised 1.75 Mbit

Recommend: No further action.

NTC

Withdrawn in Video subgroup.

Recommend: No further action.

MPEG-1 superset (MPEG 93/319)

Video subgroup has adopted principle of MPEG-2 being superset of MPEG-1.

Recommend: No further action.

8 by 1 DCT

This has non-zero cost because of changed pipelining problems arising from change of latency between 8 by 8 and 8 by 1, the impact on quantisation from changed range, changed scanning order and flow of quantisation weights.

Recommend: 8 by 1 DCT not be included in MPEG-2 unless worthwhile visual improvement.

16 by 8 frame structure

Was discussed in Rome meeting and recommendation made then to exclude 16 by 8 frame. Flexibility of frame/field requires references stored as fields. 16 by 8 frame leads to 16 by 4 (and 8 by 2 chrominance) accesses which have high overhead.

Recommend: No change to previous position of no 16 by 8 frame.

Escape codes

New proposed 13 bit escape leads to 31 bit long codewords. (The 13 bit code is also not of arithmetic construction.) These can be troublesome in decoders, especially when many occur consecutively or with little spacing.

Recommend: 6 bit escape plus run plus 12 bit level selected permanently on MPEG-2.

MQUANT
We were informed of a new non-linear QUANT table agreed by concerned members of the Video subgroup. This four part piece-wise linear law is reasonably amenable to computation.
Recommend: Incorporate this table in WD as only alternative to MPEG-1 table. Use of only one table preferred, eg new table always for MPEG-2. If switched, should be at high layer in video multiplex, ie picture header or above.

Impact of 486 lines versus 480 (MPEG 93/455)
The sentiment expressed in document 455 is that for at least the initial years, economically viable decoders will depend to some extent on statistics of encoded real pictures and will not be able to fully decode worst case bit streams. The probability of such a decoder running out of memory bandwidth increases as more memory cycles are required for larger pictures. Close to the knee, small increases in picture size can have a large effect on the probability of the decoder having insufficient memory bandwidth. Field/frame structures mean that the next effective value (for memory bandwidth considerations) above 480 is 512.
Recommend: Main profile remains limited to 480 lines at 29.97 Hz (and 4:2:0).

Non-contiguous slices
Disallowed by Video subgroup
Recommend: No further action.

Extension data identification (MPEG 93/319)
There was support for this.
Recommend: Add to syntax.

Excessive conditional syntax (MPEG 93/319)
There was support for this.
Recommend: At higher levels of video multiplex where bit consumption is not high, conditional inclusion of data should be removed from syntax.

Vector coding (MPEG 93/319)
The video group decided to retain the MPEG-1 motion vector coding method.
Recommend: No further action.

Picture dimensions and slice vertical position (MPEG 93/275, /319)
Requirements sub group has decided that picture dimensions are limited to 16 K (14 bits). Proposals made in these two contributions for handling pictures larger than is possible with MPEG-1 have no impact on main profile, main level decoders. They are OK for implementations.
Recommend: Video subgroups select one and include in syntax.

Sequence header and GOP (MPEG 93/275, /319)
Already under consideration by Video syntax editing group.

Signalling of resource requirements (MPEG 93/319)
There was support for this concept.
Recommend: Requirements subgroup requested to consider with view to asking for inclusion in video WD.

Syntax cleanup
Underway within Video subgroup.

Skipped pictures
Need clarification whether skipped pictures are only in low delay node or are possible with 'B'. Issue of whether headers for skipped pictures are included or not - may be preferable for decoders to aid in distinguishing between skipped and loss situations.
Recommend: Additional text required in WD?

5.5 TM5 (AVC-445b,491b)

5.5.1 Addition to TM5

Mr. Koster presented AVC-491 "Test Model 5" as outcome of the Sydney meeting, highlighting new experiments and pointing out that overlap with WD has been avoided. There were comments that the following need be further incorporated;

- to resurrect the spatio-temporal weighting experiment (Mr. Ueno),
- to include Experiments I.14 (Mr. Sikora),
- to update low delay description reflecting the frozen specifications (Mr. Bjoentegaard).

These and other modifications were included in the second version of TM5 (AVC-491b) which was distributed by Mr. Koster during the Melbourne meeting.

5.5.2 Test sequences typical for videophone/videoconferencing at 1-2 Mbit/s

Mr. Tabatabai raised a question whether current test sequences are appropriate for studying application of videophone and videoconferencing at lower bit rates. Susie is deemed too easy, and others too difficult and unlikely. The following was suggested as candidates;

- split-screen,
- desktop videoconferencing (graphics + conferees),
- panning and zooming of conferees.

Immediate actions were not decided, but Mr. Schaphorst offered to demonstrate at the next meeting NTSC analog test pictures which T1A1 is to use for the video quality assessment.

5.6 WD (AVC-449,492) S. Okubo

The WD refinement process and outcome were briefly presented.

6. Source coding

6.1 Prediction/quantization (AVC-453,488)

Experimental results were presented on 8x1 DCT and SVMC; neither was adopted in Main but the former was maintained in the TM at the joints sessions in Sydney.

6.2 Low delay mode (AVC-450,451,481; TD-10)

6.2.1 Input documents

Three AVC documents addressed the following;

- reference pictures when picture skipping involved,
- VBV operation and vbv_delay setting for skipped pictures,
- provision for low bit rate operation.

6.2.2 Low delay operation

After having reviewed the outcome of the Sydney joint sessions represented in WD and TM5, the meeting felt it necessary to further clarify the relevant encoder/decoder operations. It was confirmed that picture skipping is allowed only in local IPPP... environments and that M=2 field structure coding is ruled out for low delay operation as two fields should be now in pair, thus M=2 exceeds the criterion for total of reordering and buffering delay (see §H.1.1/AVC-445b). It was also pointed out that the current VBV description would need an additional specification on the maximum number of bits per picture.

Mr. Bjoentegaard undertook to draft necessary clarification on the WD description on the above matters and produced a summary as in TD-10. At the final session, the meeting reviewed this draft and commented that the specifications should be such that the decoder need not distinguish between low/high delay and with/without picture skipping. Mr. Morrison suggested that an only extension from the MPEG-1 specification is to make picture extraction conditional on a complete picture being available in the VBV buffer.

The meeting agreed on the procedure that Mr. Bjoentegaard will redraft the clarification to get approval through correspondence after the meeting and put it forward to the WD Editing Committee. See the outcome in *Annex 5*.

The following items await further study;

- compliance test specification for the low delay mode operation,
- Time Stamps for "large" pictures.

6.2.3 Low bit rate operation

The meeting discussed the items raised in AVC-481 concerning low bit rate operation which involves regular picture skipping. The meeting reached common understanding that the temporal reference should be according to the source picture number as described in §H.1.1/AVC-445b.

A pending issue is how to indicate limited decoding capability such as 10 Hz picture rate. Since decoders of Main Profile at Main Level can handle up to 30 Hz picture rate, this may need definition of a new Level. In audiovisual communications, negotiation between decoder and encoder will be needed as in the case of H.261.

6.3 Error resilience

6.3.1 AC-leaky prediction (AVC-454,455,456,485)

Experimental results were presented on the leaky prediction addressing;

- picture quality and coding efficiency,
- temporal localization of error,
- channel hopping.

They show comparable coding performance with non-leaky coding, improvement of cell loss resilience and faster channel hopping time. Some members stated that starting with blocky pictures after a channel change in AC-leaky prediction may not be preferred. The overall evaluation, however, depends on the trade-off between several requirements. Mr. Haskell drew attention of the meeting to that CCIR would provide prioritization of those requirements and make input for required delay and channel hopping time at the next meeting, and indicated that AT&T would provide some trade-off consideration.

The meeting encourages members' effort to make SNR values closer among experimenters; methods of rate control and intra/inter selection need be clarified.

6.3.2 Data partitioning (AVC-458,472,476,490,495; TD-11)

Three experimental results were presented in AVC-458,472 and 490 which indicate improvement of cell loss resilience performance with data partitioning compared to the single layer scheme. AVC-476 gave a proposal to include two layer partitioning in the Main Profile which was rather decided to be a possible feature of NEXT Profile at the joint sessions. AVC-495 listed information to be carried in Systems Layer to support multi-layer video coding.

The meeting was concerned with necessary provisions inside and outside the video decoder to achieve this data partitioning, or more generally layered coding. It was felt necessary to make

illustration of a total system and interactions between protocol layers for utilizing data partitioning. Note that some related description is given in AVC-490.

Mr. Morrison undertook to coordinate a small group to further discuss this aspect and produced a report as in *Annex 6*. Members are requested to make a complete picture of data partitioning based on this outcome.

The meeting recalled that high priority channel should be modeled as CBR in B-ISDN to achieve very low cell loss rate and that use of CLP requires controlling both the high priority (CLP=0) flow and the aggregate (CLP=0+1) flow to obtain desired QoS. These should be taken into account when we carry out error resilience experiments (see §L.3/AVC-491b for rate control in the data partition experiments).

Mr. Morrison commented that the term "partition" be carefully used since this English word means that "one partition makes two or more parts".

6.3.3 Adaptive slice size (AVC-471)

Experimental results were presented on the cell loss resilience performance of adaptive slice size technique which varies the number of macroblocks within a slice to match the length of a slice to a multiple of the cell payload length.

The meeting recognized that interaction between AAL and user layers be studied, particularly when stored video data are transmitted through ATM networks.

6.3.4 Error on multiplexed bitstream (Annex 2 to AVC-463)

Impact of errors at the multiplexed bitstream on video reconstruction were discussed, resulting in the following;

- Impacts of "Type 2 errors" may be translated into probability increase of "Type 1 errors".
- How to cope with errors is not a matter of standardization.
- The issue is the method of experimentation; whether we are not underestimating the impact of errors. Current experiments are assuming "Type 1 errors".

6.3.5 WD informative text (AVC-473,477)

Current status of the text development for error resilience techniques was presented including additional material for layered coding. Members of the TSS Experts Group are strongly requested to contribute to completing this work since this is an areas of our prime concern.

After some discussion, the following was agreed;

- to include concealment by use of neighboring macroblocks
- to indicate sets of combination for applicable range of cell loss rate
- to provide text on
  - basic intra picture/slice technique (Mr. Bjoentegaard)
  - use of intra motion vector (Mr. Biggar)
  - short slices, adaptive slice sizes (Mr. Sakai)
  - to add scalability for layered coding (Mr. Dunstan, perhaps editor's note only at this moment)

6.4 Scalability

6.4.1 Spatial scalability

a. Quantization for compatible macroblocks (AVC-460,480)

Both documents support no change from the current TM specifications in this respect. The meeting was in agreement with this conclusion.

b. Coding of prediction weight code (AVC-474)

Coding the field only if it changes was discussed. It was pointed out that experimental setting should be checked against TM Mr. Koster offered raw statistical data of the experiment results for further analysis.

The current status of spatio-temporal weighting is that it has been proved effective, particularly for the low bit rate base layer of H.261 and that switching is recommended since continuos weighting is considered costly in implementation.

However, Mr. Ueno expressed his concern about whether effectiveness of continuous weighting has sufficiently been demonstrated. It was also pointed out that the use of continuos weighting instead of switching should be reviewed by Implementation Study group in the light of that spatio-temporal weighting is not used for bi-directionally predicted pictures, thus memory access would not be problematic

c. Low cost version (AVC-482)

Possibility of spatial scalable scheme covering both single and double loop decoders was shown. It was clarified that he purpose of low cost version is to meet functionalities provided by frequency scalability.

It was also stressed that switching capability in the decoder as in Figure 7/AVC-482 will allow supporting both of high Level single loop and low Level double loop configurations.

d. Upconversion filters, H.261 compatibility (AVC-461)

Three alternative methods for specifying upconversion filters in the spatial scalable scheme were reviewed. The meeting felt that the solution may be to define a minimum number of sets and to choose a closest one for each particular case.

Members are requested to provide specification proposals for the H.261 compatibility support assuming that spatial scalability may be the solution for this purpose (Note that system consideration is awaiting further study, see §6.4.3 of this report). The following items are particularly noted (see AVC-366);

- filters for CIF-CCIR601(525/60) conversion,
- selection of corresponding lower layer pictures when picture rates are different between higher and lower layers including the case that picture skipping is involved in the lower layer,
- multiplexing method for the two layer signals.

e. Application to stereoscopic coding (AVC-469)

Application of spatial scalable scheme to stereoscopic coding was presented. During the discussion, it was clarified that application standards will define "user_data" and "disparity compensated prediction".

f. Hooks for spatial scalability extension (AVC-470)

The meeting confirmed that necessary hooks for this and other purposes have been provided by **extension_start_code** and **extension_id** in the frozen syntax for Main Profile at main Level.

g. Comparison between pyramidal and spatio-temporal prediction schemes (AVC-494)

Experimental results were presented indicating that the two schemes are very similar in performance at 15+20 Mbit/s and that it was very hard to distinguish the subjective difference for a "Fashion show" sequence.

There was a comment whether the results are the same for fast moving sequences as well.

6.4.2 Frequency scalability

a. Data partitioning (AVC-457)

Experimental results were presented for reconstructing pictures only from the base layer data, indicating that obtained pictures are very limited in quality.

Mr. Sikora clarified that possible applications of this from of frequency scalability would be FF/FR and displaying lower resolution pictures even if drift is involved.

There was some discussion on possible reasons for different values of the base layer data percentage in Table 2/AVC-457 and Table 2/AVC-472. Difference of N values, difference of 525 line and 626 line versions of Flower Garden were mentioned.

b. Extraction for interlaced materials (AVC-478)

Experimental results were presented with tape demonstration to show that simple field based decimation leads to a better quality extracted image.

c. Scalable side information (AVC-489)

Experimental results for the use of SSI syntax extensions were presented. The meeting felt that details of experimental set up need be clarified to compare the results from different organizations.

There was a general comment that a combination of extraction in the DCT domain and decimation in the pel domain should be carefully handled. GCT method of decoder only solution (§D.10/AVC-491b) was also noted in this regard.

6.4.3 Comparison (AVC-467,479,486; TD-4,5,12,14)

Three contributions provided comparison study results on the two scalable schemes; spatial scalable and frequency scalable schemes. The issue is whether we need both in the standard or there is possibility to have an integrated scheme (Note - clarification is needed whether integration is for syntax or decoder or both). Advantages and disadvantages are compared in terms of functionality and performance. After a general questions and answers session, Mr. Tabatabai undertook to coordinate a small group to further elaborate the comparison, to identify functionalities which are overlapping between the two, and to identify open issues.

The outcome is shown in *Annex 7*. The meeting recognized that this comparison table would give a good start for another round of elaboration and agreed to adding disclaimer indicating that the comparison table is an interim summary. It should be noted that several features may not necessarily be obtained concurrently.

As to the scalable system configurations illustrated in TD-4 (spatial scalable) and TD-5 (frequency scalable), the following comments have been obtained;

- Multimedia multiplexing can be also VC based (ss and fs).
- Scalable schemes can be used for browsing database, continuous presence multipoint systems (ss and fs).
- MCU in TD-4 may be generalized to cover B-N interworking (ss).

- Interconnection between MCU and H.320 terminal have two possibilities; MCU having an N-ISDN interface or having a B-ISDN interface but connected through B-N interworking unit.

Chairman emphasized that we should continue system consideration for audiovisual communications; spatial scalable, frequency scalable, simulcast and switchable solutions should be fully compared in the light of overall system design.

6.5 VBR

6.4.1 ***bit_rate*** *and vbv related fields in the sequence header* (AVC-452)

It was reported that the joint sessions did not accept proposals of bit rate indication and VBV extensions for VBR operation due to lack of common understanding on the necessity of such extensions in the video decoding process.

We recognized, however, that a case of data retrieval from DSM (database) which contains VBR coded data should be studied and that communication with Systems Committee is needed.

6.4.2 UPC (AVC-447,462)

The SGXVIII response to our question indicated that UPC time constant in the range of seconds or more is not likely implemented in the network. Since the message needs some clarification, Chairman will get contact with Mr. Coudreuse for better understanding of the message, .the second last paragraph in particular mentioning time constant relevance to the delay requirements.

The second report on leaky bucket size experiments was presented, indicating that Leaky Bucket Size does not have critical effect on encoder buffer delay for the applied coding parameter control method (VBR mode if Leaky Bucket occupancy < 90 % of Leaky Bucket Size, otherwise CBR operation). Additionally it was mentioned that smaller leaky bucket counter size may be required if slice to slice control is used instead of the current picture to picture

6.6 Syntax (AVC-483; TD-16)

It was clarified that most of the proposals in the contribution had been reflected in the frozen syntax (AVC-492), but with some restrictions on the combination of syntactic elements. The new sequence layer syntax is illustrated in TD-16.

7. Network aspects

7.1 Multimedia multiplex

7.1.1 Use of MPEG Program Stream (AVC-463)

A case study was presented for multimedia multiplexing in videoconferencing by using MPEG-1 Systems. During the discussion, there was a comment that the current limitation of 300 packets per second for Constrained System Parameter Stream came from cheapest implementation software decoding and the value is not so scientifically grounded. The meeting recognized that reflection of AV communication requirements to MPEG-2 Systems is urgent.

It was also pointed out that priority for the transmission of elementary data (Audio, Video, Data and Control packets) need be studied and the case study should be continued for other type of AALs with impact of different QoS use taken into account.

Chairman raised a question whether we seek the common text approach for multimedia multiplexing Recommendation as well. Members are requested to consider this point toward the next meeting.

7.1.2 Video clock recovery (AVC-465)

Use of network clock source was proposed for the environments that it is commonly available to the encoder and decoder. The meeting accepted this proposal as the cell arrival time jitter is still to be buffered out in the video clock recovery method using SCR and Time Stamps. It was concluded that placing the flag in the pack header is appropriate.

This proposal will be put forward to the Systems Committee as a proposal of the TSS Experts Group.

7.2 AAL/ATM

7.2.1 Error correction in AAL (AVC-447,459)

SGXVIII returned to us their response on support of H.320 terminals in B-ISDN, suggesting use of FEC in AAL at bit rates not lower than 384 kbit/s. Resilience to random bit error in the cell has been awaiting study. AVC-459 provided an FEC scheme using Reed-Solomon code to meet these requirements.

The meeting supported this method in principle, encouraged the contributor efforts to further reduce the delay, and agreed to reach a firm conclusion in July and propose it to SG13.

7.2.2 Relationship between MPEG-2 Systems and AAL/ATM
(AVC-464,468,475; TD-15)

Three contributions addressed comparison of functionalities between transport stream and AAL/ATM. After some questions and answers, Mr. Dunstan undertook to lead further discussion. The outcome is contained in *Annex 8*.

The meeting reached common understanding that we need a good protocol reference model and reflect it to the discussion in the MPEG Systems Committee and "Adhoc group on relationships to ATM AAL". To achieve this objective, the meeting asked Mr. Dunstan to organize drafting the model and a tutorial on AAL/ATM through correspondence with the support of Mr. D. Beaumont and Mr. T. Tanaka.

7.3 DSM CC (AVC-466)

Mr. Koster outlined and commented on the current DSM CC activities which are projected to become a part of MPEG-2 Systems standard. The meeting noted its relevance to the terminal-to-terminal inband procedures for audiovisual communications.

8. Work plan

8.1 Network development (AVC-448)

A recent version of "IVS Baseline Document" has been received, which was approved at the January meeting of SGXVIII. This version includes the updated list of standardization programs in relevant standardization groups such as SGXVIII, SGXV, MPEG.

8.2 Recommendations (AVC-484)

Chairman presented an updated version of "List of open issues" which reflects the achievements in the Torino/Roma meeting. This document also includes timetable and target dates for related Recommendations and priority.

As to the common text approach for H.26X|MPEG-2, Mr. Sebestyen drew attention of the meeting to the guide for collaboration between CCITT and JTC1 which was distributed at the Torino meeting.

Chairman stressed the importance of generating not only video coding Recommendation but also total system Recommendations to allow realization of audiovisual communication systems in ATM environments. He raised a target date of early 1995 for such Recommendations, when H.26X|MPEG-2 is expected to be approved by Study Group XV.

Though the network service provision is not yet fully clarified, the meeting felt sympathy for ideas of making necessary Recommendations before proprietary solutions appear in the market and avoiding a situation of having no terminals to connect when the network starts service.

Chairman will prepare a framework of such Recommendations for the consideration of the next meeting in July 1993.

9. Others

9.1 Intellectual property (AVC-487)

Mr. Sebestyen drew attention of the meeting to the CCITT code of practice concerning patents handling in the development of Recommendations, particularly to the point that technical proposals should be accompanied by information on any known patents or any known pending application.

Some difficulty was expressed for disclosing "pending application", i.e. those patents not yet in the public domain, due to different patent systems in different countries.

Members are requested to follow this code of practice

9.2 Future meetings

Meeting	Date	Sole sessions	Joint sessions with MPEG
12th	July 1993	July 7-9 in Boston	July 12-16 in New York
13th	September 1993	two days in Brussels	September 6-10? in Brussels
14th	November 1993	three days in Korea	November 1-5 in Seoul

END

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Annexes

Annex 1 Documentation
Annex 2 List of tape demonstrations
Annex 3 Report of regional coordination meeting on 28 March 1993
Annex 4 Profile architecture
Annex 5 Video buffering verifier
Annex 6 Support aspects required for "Layered" video coding algorithms
Annex 7 Comparison table for spatial scalability and frequency scalability
Annex 8 Comparison of MPEG-2 Systems and AAL/ATM

Participants of the eleventh meeting of Experts Group for ATM Video Coding
29 March - 7 April 1993 in Sydney and Melbourne

			S	M	
FRG	Mr. B. Hammer	Siemens	X	X	
	Mr. I. Sebestyen	Siemens	X	X	
	Mr. G. Zedler	DBP TELEKOM	X	X	CM
Australia	Mr. R. J. Arnold	Australian Defence Force Academy	X	X	
	Mr. M. Biggar	Telecom Australia	X	X	CM
	Mr. M. Chang	Telecom Australia		X	
	Mr. M. Delahoy	Department of Transportation and Communications	X	X	
	Mr. S. Dunstan	Siemens	X	X	
	Mr. S. Hall	Monash University		X	
	Mr. A. Johnson	Telecom Australia	X	X	
	Mr. M. Leditschke	Telecom Australia	X	X	
	Mr. K. Ngan	Monash University		X	
	Mr. J. Princen	Telecom Australia	X	X	
	Mr. T. Sikora	Monash University	X	X	
	Mr. P. Stevens	Siemens	X	X	
	Mr. T-K. Tan	Monash University	X	X	
Belgium	Mr. O. Poncin	Belgacom	X	X	CM
Korea	Mr. J-H. Jeon	Korea Telecom	X	X	
	Mr. J-Y. Nam	ETRI	X	X	CM
	Mr. S-H. Park	Korea Telecom	X	X	
	Mr. H-J. Yun	ETRI	X	X	
USA	Mr. E. Hannah	Intel	X	X	
	Mr. B.G. Haskell	AT&T Bell Labs	X	X	
	Mr. D. Klenke	CLI	X	X	
	Mr. R. Schaphorst	DIS	X	X	
	Mr. G. Sullivan	PictureTel	X	X	
	Mr. A. Tabatabai	Tektronix	X	X	CM
	Ms. A. Wong	Bellcore	X	X	
France	Mr. G. Eude	CNET	X	X	
	Mr. J. Guichard	CNET	X	X	CM
Italy	Ms. L. Conte	CSELT	X	X	CM
Japan	Mr. K. Hibi	Sharp	X	X	
	Mr. Y. Machida	Matsushita	X	X	
	Mr. T. Murakami	Mitsubishi	X	X	
	Mr. S. Okubo	NTT	X	X	Chairman
	Mr. K. Sakai	Fujitsu	X	X	
	Mr. Y. Takishima	KDD	X	X	(CM)
	Mr. T. Tanaka	NTT		X	CM
	Mr. H. Ueno	Toshiba	X	X	
Netherlands	Mr. A. Koster	PTT Research	X	X	(CM)
Norway	Mr. G. Bjøntegaard	NTR	X	X	(CM)
UK	Mr. G. Morrison	BT	X	X	CM
	Mr. I. Parke	BT	X	X	
Sweden	Ms. C. Verreth	Telia Research	X	X	CM

CM: Coordinating Member
(CM): Substitute for CM

A1.1 Documents for the sole sessions in Melbourne

Normal Documents

AVC number	MPEG 93/...	Pur-pose	Title (source)
AVC-443R	414	R	REPORT OF THE NINTH MEETING IN TORINO and ROMA - PARTS I,II (CHAIRMAN)
AVC-444R	414	R	REPORT OF THE NINTH MEETING IN TORINO and ROMA - PART III (CHAIRMAN)
AVC-445b	225b	R	Test Model 4 (Test Model Editing Committee)
AVC-446	92/ 091	R	MPEG-2 Working Draft - Video Part - Version 1, Revision 2 (Working Draft Editing Committee)
AVC-447	-	R	Liaison statements (SGXVIII)
AVC-448	-	R	IVS Baseline Document (D. Dorman, Editor)
AVC-449	423	R	MPEG-2 Working Draft - Video Part - Version 3 (Working Draft Editing Committee)
AVC-450	404	P	Selecting rule of reference pictures in the low delay mode (Japan)
AVC-451	403	P	Clarifications of VBV operation (Japan)
AVC-452	396	P/D	Syntax modification for VBR operation (Japan)
AVC-453	401	I	Report of non-8x8 DCT experiment (Japan)
AVC-454	402	I	Report of AC-leaky prediction (Japan)
AVC-455	-	I	Fix for the noisy background problem in leaky prediction(Japan)
AVC-456	398	I	Experiment on leaky prediction (Japan)
AVC-457	405	I	Experiments on data partitioning by PBP (Japan)
AVC-458	397	I	Experiments on error concealment with Data Partitioning (Japan)
AVC-459	-	D	A study on forward error correction method in AAL Type 1 (Japan)
AVC-460	387	I	Quantization of Intra-compatible MBs (Japan)
AVC-461	399	P	Up-sampling methods for spatial scalability (Japan)
AVC-462	-	I	VBR coding under Usage Parameter Control (Part 2) (Japan)
AVC-463	406	D	Consideration of MPEG-1 Systems as multimedia multiplexing for audiovisual communications (Japan)
AVC-464	407	I/D	Relation between MPEG-2 transport mux and ATM/AAL (Japan)
AVC-465	408	P	Video source clock recovery using network clock (Japan)
AVC-466	252	D	Preliminary DSM control command requirements (PTT Research - NL)
AVC-467	253	D	Interworking and complexity requirements on scalable video coding algorithms (PTT Research - NL)
AVC-468	255	D	System multiplexing and priorities (PTT Research - NL)
AVC-469	254	I	Stereoscopic video transmission: a future application of spatial embedded coding (PTT Research - NL)
AVC-470	-	P	MPEG-2 syntax (F, UK, B, I, N, D, NL, CH)
AVC-471	394	I	Variable slice sizes vs small fixed slice sizes (Australia)
AVC-472	395	I	Cell loss resilience of data partitioning (Australia)
AVC-473	327	I/P	Report of Ad-hoc Group on ATM Cell Loss Error Resilience (Australia)
AVC-474	342	P	Bitsavings on the prediction_weigth_code (BT, PTT Research)
AVC-475	368	D	MPEG Systems and B-ISDN (Australia)
AVC-476	369	D	Data Partitioning and the Main Profile" (Australia)
AVC-477	370	D	Layered coding informative text (Australia)
AVC-478	367	I	Effectiveness of Data Extraction for Interlaced Source Material (Australia)
AVC-479	314	I	Evaluation of Scalable Coding Schemes (Australia)
AVC-480	371	I	Quantization of spatially scalable prediction errors (BT)
AVC-481	372	D/P	The use of MPEG-2/H.26x for low bit rate applications (BT)
AVC-482	373	D	Enhancement of spatial scalability for reduced cost decoders (BT)
AVC-483	321	D/P	Sequence Layer Syntax (BT)
AVC-484	-	D	List of open issues, Version 2 (Chairman)
AVC-485	366		Experimental results with AC leaky prediction (AT&T)
AVC-486	433	D	Harmonising/combining low complexity, error resilience, scalability, image quality and compatibility (PTT Research)
AVC-487	-	D	CCITT patent policy and MPEG-2 patent status (Siemens AG)
AVC-488	383	D	Results on TM4 prediction Core Experiment on mod. SVMC-Prime (Tektronix)

AVC-489	297	I	Some results on Frequency scalability Experiments I.4 (Tektronix)
AVC-490	459	D	H.26X error resiliency based on data partitioning and concealment (Tektronix)
AVC-491	457	R	Test Model 5 (Test Model Editing Committee)
AVC-492		R	Revised syntax and semantics for MPEG-2 video (Video syntax sub-group)
AVC-493		R	MPEG-2 Systems Working Draft (Systems Committee)
AVC-494		I	Simulation results on CTV/HDTV compatible coding (ETRI)
AVC-495	483	I	Multi-channel information carried by Systems layer (Australian UVC, IBM, Tektronix)

Temporary Documents

TD-1	Chairman	Agenda for the sole sessions in Melbourne
TD-2	Chairman	Available documents for the Sydney/Melbourne meeting
TD-3	Chairman	List of tape demonstrations
TD-4	Chairman	Audiovisual communication system using a spatially scalable bitstream
TD-5	Chairman	Audiovisual communication system using a frequency scalable bitstream
TD-6	Chairman	Report of regional coordination meeting
TD-7	Requirements sub-group	Profile architecture
TD-8	WTSC-93	New structure of the ITU
TD-9	C. J. McGrath	MPEG-2 Systems meeting in Sydney
TD-10	G. Bjoentegaard	VBV operation to take care of skipped pictures
TD-11	G. Morrison	Support aspects required for "Layered" video coding algorithms
TD-12	A. Tabatabai, T. Sikora	Comparison table
TD-13	Chairman	Memorandum on agreements
TD-14	A. Koster	Systems video 'Relation' stream (MPEG93/451)
TD-15	S. Dunstan	MPEG Systems outline
TD-16	Syntax editing team	Sequence layer syntax in WD

Abstracts for AVC-numbered documents

AVC-443R REPORT OF THE TENTH MEETING IN TORINO and ROMA - PARTS I and II (CHAIRMAN)
AVC-444R REPORT OF THE TENTH MEETING IN TORINO and ROMA - PART III (CHAIRMAN)

These two documents report the outcome of the sole and joint sessions held in January 1993.

AVC-445b Test Model 4 (Test Model Editing Committee)

Achievements and clarification obtained at the Roma meeting were incorporated into Test Model 4, and several core experiments were defined for action.

AVC-446 MPEG-2 Working Draft - Video Part - Version 1, Revision 2 (Working Draft Editing Committee)
AVC-449 MPEG-2 Working Draft - Video Part - Version 3 (Working Draft Editing Committee)

Working Draft is a document which should evolve into Committee Draft in November 1993. This video part is substantially structured as follows;

- Profiles and levels
- Video bitstream syntax and semantics
- The video decoding process
- Defined profiles and levels

AVC-447 Liaison statements (SGXVIII)

Three liaison statements we re generated at the January 1993 meeting of SGXVIII (now ITU-TSS SG13) regarding the following items;

- Update of the IVS Baseline Document
- Request of information on maximum allowable AAL delay for supporting H.320 terminals in B-ISDN by introducing a forward error correction in AAL Type 1.
- Traffic parameters for average cell rates, particularly measuring time constants of seconds or more
- Interworking issues when using CLP bit and resource allocation options

AVC-448 IVS Baseline Document (D. Dorman, Editor)

This is a version revised at the January 1993 meeting of the Working Parties of SGXVIII (now ITU-TSS SG13) to incorporate inputs from other groups and SGXVIII achievements. The principal amendments include:

- revision of standardization time tables for SGXVIII, SGXV, TG CMTT/2,
- revision of summary table for multimedia multiplex methods,
- updated and prioritized open issues list for multimedia Recommendation I.374,
- inclusion of possible functions for video signal support of AAL Type 1 and Type 2,
- list of open issued generated at the IVS Technical Session in October 1992.

AVC-450 Selecting rule of reference pictures in the low delay mode (Japan)

Taking into account of the case to use skipped pictures, a consistent rule of selecting reference pictures is proposed for forward and backward prediction in Frame pictures and Field pictures. Forward prediction refers to the latest available coded picture(s) while backward prediction refers to the latest coded picture, if it exists, which follows the current picture in the source order but precedes in the coding order

AVC-451 Clarifications of VBV operation (Japan)

This document first clarifies VBV related items when picture skipping is involved and then usage of the vbv_delay and VBV operation are specified. Encoding operation and setting of vbv_delay are also described which satisfy the VBV specifications. Modified description for "Video Buffer Verifier" and "Low Delay Coding" in WD is provided.

AVC-452 Syntax modification for VBR operation (Japan)

In order to acommodate VBR in the Main Profile, this document proposes extension of bit_rate filed to vbr_mode (1 bit), bit_rate (18 bits) and ave_rate (18 bits) and extension of vbv_buffer_size to 16 bits. How to set vbv_delay in VBR operation is also discussed concluding that further study is required.

AVC-453 Report of non-8x8 DCT experiment (Japan)

Experimental results are reported which indicate that 8x8/8x1 DCT improves field-picture coding and frame-picture coding by 0.47-0.75 dB and 0.22-0.40 dB, respectively. It is also reported that if 8x8/8x1 DCT is used, further use of Frame/Field DCT gives only 0.02-0.31 dB improvements.

AVC-454 Report of AC-leaky prediction (Japan)

Experimental results for AC-leaky prediction and more frequent intra DC refresh are given to show that the technique is efficient and effective for temporal localization of errors.

AVC-455 Fix for the noisy background problem in leaky prediction(Japan)

Experimental results are reported that a combination of periodic stronger leak and adaptive MB quantization for background areas give SNR performance and subjective quality very close to the intra slice method.

AVC-456 Experiment on leaky prediction (Japan)

Experimental results are reported on comparison between TM3, AC-leaky prediction and Adaptive DC quantization, concluding that both of the leaky prediction methods could not achieve as good picture quality as that of TM3 at 4 Mbit/s due to remaining background noise.

AVC-457 Experiments on data partitioning by PBP (Japan)

Experimental results are reported on reconstructing pictures only from the base layer information partitioned by PBP, concluding that adequate quality for practical use can not be obtained due to accumulation of mismatch errors even if the intra slice updating is used.

AVC-458 Experiments on error concealment with Data Partitioning (Japan)

Experimental results are reported on error concealment in the two layer partition by PBP (base and additional bitstreams) when cell loss takes place only in the additional stream. It is concluded that simple error concealment provide sufficient error resilience for PBP value 0 inter macroblocks. For intra macroblocks, more coefficients needed to be transmitted via the high priority channel for which suggested changes in the PBP semantics are given.

AVC-459 A study on forward error correction method in AAL Type 1 (Japan)

Application of RD(48,44) code to AAL Type 1 is considered for cell loss correction and random eerror correction in a cell. This FEC provides for transmission efficiency of 91.5% and error correction processing delay of 32 ms at 384 kbit/s.

AVC-460 Quantization of Intra-compatible MBs (Japan)

Experimental results are reported on applying intra quantization to intra-compatible macroblocks for both interlace-interlace and interlace-progressive cases. Though 0.6-0.87 dB gain is obtained for I pictures with this method, improvements at the total sequence is not so large as to justify such change from the current quantization.

AVC-461 Up-sampling methods for spatial scalability (Japan)

Three methods of specifying upsampling filters for spatial scalability are discussed; 1) specifying unique set of filters, 2) downloading the coefficients from encoder to decoder, 3) tolerating filter coefficient mismatch between encoder and decoder. In the interest of hardware overload, the second method is concluded as undesirable.

AVC-462 VBR coding under Usage Parameter Control (Part 2) (Japan)

Hardware experimental results are reported for the relationship between the encoder buffer delay and the Leaky Bucket Size, concluding that apart from the obvious relationship (e.g. encoder buffer delay is inversely proportional to the Peak Rate) Leaky Bucket Size does not have critical effect on encoder buffer delay for the applied coding parameter control method (VBR mode if Leaky Bucket occupancy < 90 % of Leaky Bucket Size, otherwise CBR operation).

AVC-463 Consideration of MPEG-1 Systems as multimedia multiplexing for audiovisual communications (Japan)

A case study of applying MPEG-1 Systems to the multimedia multiplex for high quality videoconferencing indicates that it is a possible method. Several items are discussed; constraint on number of packets per second which determines packetizing delay, correspondence between medium and stream_id which influences cross application bitstream interchange, implementation, impact of cell losses and rate control. It is concluded that necessary changes to the MPEG-2 program mux be urgently discussed and decided.

AVC-464 Relation between MPEG-2 transport mux and ATM/AAL (Japan)

An MPEG-2 transport mux being currently considered is compared with ATM/AAL Type 4 in functionality, indicating similarity to a great extend and encouraging further study.

AVC-465 Video source clock recovery using network clock (Japan)

Use of high quality network clock, if commonly available to the encoder and decoder, is discussed for video clock recovery. As a conclusion, addition of a one bit flag is proposed to indicate which of the internal or external sources is used by the encoder.

AVC-466 Preliminary DSM control command requirements (PTT Research - NL)

By listing a number of control commands related to the network database access, discussion is encouraged on an appropriate positioning of the MPEG specific controls in the complete control command picture.

AVC-467 Interworking and complexity requirements on scalable video coding algorithms (PTT Research - NL)

Pel-split and DCT-split schemes to achieve scalable video coding are compared in terms of interworking, complexity, flexibility and visual quality, leading to the former as a conclusion.

AVC-468 System multiplexing and priorities (PTT Research - NL)

Relationship between the MPEG-2 transport mux and B-ISDN functionalities is discussed with a focus on the transmitting priority.

AVC-469 Stereoscopic video transmission: a future application of spatial embedded coding (PTT Research - NL)

Stereoscopic video transmission is given as an effective application of the spatial scalable embedded coding, where disparity compensated prediction is used to improve coding efficiency of the second channel.

AVC-470 MPEG-2 syntax (F, UK, B, I, N, D, NL, CH)

A proposal is made to maintain hooks in the MPEG-2 syntax for spatial scalability/compatibility for providing HD/ED/SD/LFDV and communication applications.

AVC-471 Variable slice sizes vs small fixed slice sizes (Australia)

This contribution considers the effect of trying to match the length of a slice to a multiple of the cell payload length by varying the number of macroblocks within a slice and to start a slice as soon as possible after the start of a cell. A number of different multiples of the cell payload length are investigated to determine the change in overall sequence quality and average number of cells in a slice. Error resilience of this approach is compared with that of a fixed number of macroblocks per slice, resulting in no significant difference.

AVC-472 Cell loss resilience of data partitioning (Australia)

Experimental results are presented for two layer data partitioning by the PBP method. First, portions of the bits in the lower layer are given for different values of PBP. Then, error resilience experiments are reported comparing non-partitioned and partitioned streams, summarizing that the data partitioning offered improved quality under cell loss even when only one priority level is used and that the quality improvement was more noticeable under high cell loss conditions.

AVC-473 Report of Ad-hoc Group on ATM Cell Loss Error Resilience (Australia)

This document is a report of the adhoc group activities established at the Rome meeting, which contains a proposed informative text for error resilience techniques in WD covering error concealment (decoder only and encoder assisted), spatial localization and temporal localization.

AVC-474 Bitsavings on the prediction_weight_code (BT, PTT Research)

Based on the coding efficiency gain for the *prediction_weight_code* of 1.04 % in the top layer of 1.15+2.85 Mbit/s environment, differential coding like *quantizer_scale* is proposed.

AVC-475 MPEG Systems and B-ISDN (Australia)

After comparing layered protocol models between B-ISDN and MPEG systems under consideration, AAL Type 2 possibilities and relevant MPEG-2 systems functions are discussed. As a conclusion, it is proposed that a layered MPEG-2 systems protocol model be defined which will allow the service in a lower layer to be provided by further MPEG-2 systems layers, or an appropriate B-ISDN layer.

AVC-476 Data Partitioning and the Main Profile (Australia)

Desirability is sated that the main profile decode be able to handle two partitions because this will provide improved performance at a small increase in decoder complexity.

AVC-477 Layered coding informative text (Australia)

Description for layered coding is given to provide for information on three strategies; data partitioning, frequency scalable pyramid, spatial scalable pyramid. As an illustration of error resilient coding, a two layer data partitioning scheme and the use of two channels with different error performance are detailed.

AVC-478 Effectiveness of Data Extraction for Interlaced Source Material (Australia)

Experimental results are reported for two modes of 4x4 data extraction from coded Bus sequence; field mode with simple extraction and frame mode with 4x3+4x1 extraction. It is concluded that the former method leads to a better quality extracted image.

AVC-479 Evaluation of Scalable Coding Schemes (Australia)

Two scalable coding approaches, frequency scalable and spatial scalable, are compared with simulcast concerning interworking capabilities, coding performance, network issues, compatibility with existing standards hardware complexity, functionality and applications. It is concluded that though both methods can provide layered coding with resolution scalability, they do not serve as alternatives; emphasis on flexibility and compatibility leads to spatial scalable scheme, emphasis on efficiency and simplicity leads to frequency scalable scheme.

AVC-480 Quantization of spatially scalable prediction errors (BT)

Experimental results are reported for comparison between four quantization methods for 1.5 + 2.5 Mbit/s compatible coding; 1) normal quantization for all transform coefficients and the inter weighting matrix, 2) normal but with a step size of 8, 3) normal but with intra weighting matrix, 4) DC-8 + intra weighting matrix. As a conclusion, it is proposed that the first quantization method for spatially scalable macroblocks be standardized.

AVC-481 The use of MPEG-2/H.26X for low bit rate applications (BT)

This document first argues that MPEG-2/H.26X should support low bit rate operations as it is a generic standard. Then, limitations of the current syntax and some proposed changes are provided; 1) skipping any macroblock be allowed, and all macroblock coding parameters have default values, 2) picture skipping with no data at all be allowed, 3) indication of required maximum decodable rate be included in the sequence layer.

AVC-482 Enhancement of spatial scalability for reduced cost decoders (BT)

This document describes the current spatial scalable scheme and a variation of it that allows reduced cost decoders and show that the two schemes can be merged into a hybrid scheme to allow the use of reduced cost decoders. The two schemes are compared in terms of implementation aspects and error resilience.

AVC-483 Sequence Layer Syntax (BT)

This document describes some of the limitations of the current sequence level syntax and proposes changes to overcome these limitations;

1) to allow change of prediction weighting matrices when sequence data is repeated,
2) to allow user data to appear before extension data and for sequence header data to occur without the to have preceding group of pictures and intra data,
3) to make it a syntax element,
4) to give the same status to sequence_data, pictures, extension_data, and user_data.
5) to attach syntax diagrams to the standard,
6)to include profile and level ID instead of constrained parameter flag.

AVC-484 List of open issues, Version 2 (Chairman)

This is an updated version of AVC_436. Open issues are listed with description of options, status, input required. aimed Recommendation, applications and target date according to the following categories;

- framework for video coding standardization,
- picture format,
- video coding,
- VBR vs CBR,
- interface with networks,
- end-to-end signalling,
- multipoint communication system,
- B-N interworking,
- audio coding.

Background information such as system configuration, applications, milestones and target date (priority) is also contained.

AVC-485 Experimental results with AC leaky prediction (AT&T)

Experimental results are reported concerning quality without cell losses or channel changing, speed of channel changing and quality with cell losses. Fast forward and fast reverse modes using AC leak is also discussed.

AVC-486 Harmonising/combining low complexity, error resilience, scalability, image quality and compatibility (PTT Research)

Configurations of decoder and encoder are discussed which allow integration of low complexity, error resilient, SNR scalability, resolution scalability and compatibility without changing the current macroblock layer syntax.

AVC-487 CCITT patent policy and MPEG-2 patent status (Siemens AG)

It is pointed out that technical proposals should include patent information according to the CCITT patent policy.

AVC-488 Results on TM4 prediction Core Experiment on mod. SVMC-Prime (Tektronix)

Experimental results are reported on SNR among prediction modes; Frame/Field, Frame/Field,/Dual-prime, and Frame/Field/Dual-prime/SVMC-prime. As a conclusion, it is recommended that SVMC-prime be dropped from further considerations.

AVC-489 Some results on Frequency scalability Experiments I.4 (Tektronix)

Experimental results are reported on multichannel scalability using Scalable Side Information syntax extensions; three layers (1/4, 1, 1) and two layers (1/4,1), (1/16,1) with lower scale layer reference signal derived from field DCT subsampling. It is concluded that the SSI syntax should support field or field/frame adaptive processing since frame based coding shows less coding efficiency for fast motion sequences, and that Extended MQUANT may be required for difficult to code sequences at constrained low bit rates.

AVC-490 H.26X error resiliency based on data partitioning and concealment (Tektronix)

Experimental results are reported for the two layer partition of PBP_1(0) and PBP_1(2) with motion interpolation concealment under cell loss ratio of 10**(-3). It is concluded that a combination of data partitioning and concealment techniques provide a powerful and yet simple tool for cell loss protection.

AVC-491b Test Model 5 (Test Model Editing Committee)

This is a revision reflecting the achievements obtained at the Sydney meeting.

AVC-492 Revised syntax and semantics for MPEG-2 video (Video syntax sub-group)

This is a delta document to the Working Draft (AVC-449) containing specifications for Main Profile at Main Level which has been frozen at the Sydney meeting.

AVC-493 MPEG-2 Systems Working Draft (Systems Committee)

This is a revised document of WD which reflects the achievements at the Sydney meeting.

AVC-494 Simulation results on CTV/HDTV compatible coding (ETRI)

Experimental results are reported for comparison between pyramidal coding and spatio-temporal compatible coding. Both are coding HDTV (1920x1024 luminance pels, 4:2:2) and embedded CTV (960x512 luminance pels, 4:2:2). It is concluded that both performance of compatible coding methods is quite similar and that both schemes give quite compatible picture quality.

AVC-495 Multi-channel information carried by Systems layer (Australian UVC, IBM, Tektronix)

It is discussed that certain basic information describing the multi-layer video need be carried in the Systems layer; at t he very minimum a service mapping table which relates packets and multi-layer entry types such as FSn (frequency scalable layer n), SSn (spatial scalable layer n) and DPn (data partitioning layer n).

END

A1.2 Documents for the joint sessions in Sydney

MPEG93/	Source	Title
243	Lameillieure	A TV sequence "Kiel Harbour" simulating the conversion from film to interlaced video
244	Lameillieure	A 60 Hz version of the new HDTV sequence "Kiel Harbour"
245	Okubo	Guide for the Audio Work Group
246	Juhola et al.	Results for core experiment no. G.3 SNR scalability
247	Knoll	A frequency hierarchical system
248	Giachetti	Description of a pseudo- random byte sequences generator
249	Perkins	Simulation results on 16x8 and 8x8 motion compensation (L16)
250	Schamel	Comparison between 3-layer frequency and 3-layer spatial scalability
251	Boyce	Fast scan technology for MPEG video tape recorders
252	PTT Research	Preliminary DSM control command requirements
253	PTT Research	Inter working and complexity requirements on scalable video coding algorithms
254	PTT Research	Stereoscopic video transmission : a future application of special embedded coding
255	PTT Research	System multiplexing and priorities
256	Marchisio	The DSM CC in the context of the AVI applications
257	Rodi	The Microsoft Windows MCI programming interface (an overview)
258	Hidaka	Contribution HDTV pictures for MPEG-2 Verification Test
259	Hidaka	Summary of MPEG-2 Verification Test
260	Giachetti	Access control requirements on the broad- cast multiplex structure
261	Noordam	CCIR terminology with respect to scrambling encryption
262	Noordam	Scrambling
263	Noordam	Layered hierarchical transmission of MPEG streams
264	Noordam	Relative importance of data in an elementary strem
265	Kogure	New work proposal (NP) for MPEG DSM Control Commands (draft)
266	Kogure	Simulation results on special prediction modes (L-14)
267	NNI	Resolutions of the Dutch National Body NNI for the MPEG Meeting in Sydney
268	DIN	Response to WG11's request for providing useful guidelines to improve the handling patent issues in WG11
269	UKN Body	List of open issues in MPEG-2 Main profile
270	JNB	Comments for Sydney meeting
271	Sugiyama	Results of AC-Leaky Prediction Experiment
272	Sugiyama	Results of Non-8x8 DCT Experiments
273	Sugiyama	Proposal about Field Picture Coding
274	Sugiyama	Comments about Prediction Experiments
275	Yagasaki	Some Video Issues
276	Yagasaki	Simulation results of core experiment Q.4 (NTC)
277	Tahara	Results on experiment G.7- Chroma Scalability
278	Yagasaki	Oddification problem for iDCT miss-match
279	Odaka	Minor revision for special prediction mode in TM4 main part
280	Kameyama	Core Experiments Results on New L.14
281	Kameyama	A comparison of MC Filters for Drift Correc- tion in Frequency Scalability
282	Kameyama	Motion Vector Coding
283	Kameyama	Protection of IDCT Mismatch
284	Convenor	Procedure for freezing MP@ML
285	Takahashi	Syntax Extension for Fast Forward/Reverse on Storage Media
286	Nakajima	Results of modified L.14 Special Prediction mode and Q.1 Independent Scanning
287	Nakasu	Consideration on the effectiveness of 8x1 DCT
288	Noguchi	A study on FF/FR
289	Yamakata	Contribution of New 1125/60 HDTV Test Sequences
290	Nagata	Results of Experiments on Motion Vector Coding
291	Itoh	Results of Core Experiments on Spatial Scalable Coding for Chrominance Formats
292	Itoh	Experiments on MQUANT Table
293	Urano	Comments on MPEG-2 Verification Test
294	Urano	Consideration for EDTV (progressive) from the viewpoint of MPEG-2 profile/level
295	Galbi	Simplification to MPEG System Stream

296	Holborow	Performance of Packet Headers With and Without Error Correction
297	Tektronik	Some Results on Frequency Scalability Experimen I.4
298	Penney	Syntax for MPEG-2 Colorimetry and Transfer Characteristics
299	EBU	MPEG-2 verification tests procedure
300	McGrath	Text and Drawings Generated by MPEG Systems in Rome
301	Savatier	Simulation Results on non-linear MQUANT
302	Savatier	Simulation Results on Motion Vector Coding
303	Savatier	Simulation Results on Modified L-14 and Dual-prime
304	Savatier	Extension of Slice Vertical Position Syntax for Large Pictures
305	Savatier	Comments on MPEG-2 Working Draft version 3
306	Zdepski	Experimental Results on Core Experiment F.6: Intra MB motion vectors
307	Zdepski	Results of Core Experiment F.5: Data Parti- titoning
308	Zdepski	Results of Core Experiment F.4: Structure Packing
309	Rault	Low sampling frequency MPEG 2 audio coding at 24 kHz
310	Decotignie	Conversion between program and transport multiplexed streams
311	Decotignie	MPEG Systems glossary version 3.0
312	Tan	Frequency Scalability Extension to Data Partitioning
313	Tan	Frequency Scalable Video Coding with M=1 and N=12
314	Sikora	Evaluation of Scalable Coding Schemes
315	Aravind	Different MQUANT Tables give Same Perfor- mance
316	Curet	A frame oriented broadcast-multiplex with different levels of protection
317	Wise	New Syntactic Level for Interlaced Pictures
318	Wise	Alternate Scan Patterns and Quantisation Matrix Download
319	Wise	Various issues in MPEG-2
320	Wise	Huffman Codes
321	Nilsson	Sequence Layer Syntax
322	Bache et al.	General multiplexing requirements for a digital TV broadcast operator
323	Fogg	Report of Ad-hoc group on Video Technical Report
324	Koster	Report of Ad-hoc group on coordination of experiments, syntax issues and test model editing
325	Wells	Report of Ad-hoc group to coordinate prediction and quantisation experiments to be performed to the Sydney Meeting
326	Parke	Report of Ad-hoc group on experiments with layered coding, compatibility and spatial and frequency domain scalability
327	Biggar	Report of Ad-hoc group on error resilience
328	Yagasaki	Report of Ad-hoc group on FF/FR mode in DSMs
329	Mac Innis	Report of Ad-hoc group to revise the System Working Draft
330	Decotignie	Same as 329
331	Hidaka	Report of Ad-hoc group on MPEG-2 Verification Tests
332	Kogure	Report of Ad-hoc group on DSM NP
333	Van der Meer	Report of Ad-hoc group on MPEG-1 Conformance Testing WD improvement
334	Kogure	Report of Ad-hoc group on MPEG-2 Video WD Development
335	Pan	Report of Ad-hoc group for Audio software simulation
336	Laczko	Report of Ad-hoc group on MPEG 2 Audio
337	Brandenburg	Report of Ad-hoc group for New Audio Work Project Description and Requirement Listing
338	Rabowsky	Report of Ad-hoc group on guide for MPEG 2 audio work
339	JNB	Proposal for MPEG-2 Video Profiles (Draft)
340	D. Anastassiou	Invitation to 23rd MPEG meeting
341	Lee	A Syntax Extension for Fast Forward/Reverse at Digital Storage Media
342	BT & PTT	Bit saving on the prediction weight code
343	Brandenburg	Draft requirements list for audio coding for archiving and studio applications
344	Brandenburg	Draft requirements list for low bit- rate audio coding
345	Brandenburg	New work item proposal for audio coding for archiving and studio applications (Draft)
346	Brandenburg	New work item proposal for low bit-rate audio coding (draft)
347	Philips	Proposal for a new HDTV test sequence for MPEG-2
348	Van der Meer	Overview of discussion items
349	De With et al.	Proposal for an MPEG video format for recording applications
350	Van der Meer	Time stamps in video or in systems layer
351	Wasilweski et al	A revised proposal for MPEG-2 Transport Multiplex Syntax
352	Lhuillier	Time stamp assignment and video syntax for 3:2 pulldown material
353	Wendorf et al	Description of a dedicated packet format for data file transmission

354	Wendorf et al	Program streams, transport streams and multi transport streams mapping
355	Erdem et al.	Experiments on compression of 10 bits/pixel source data
356	Wells	Requirement for PAL phase information
357	Wells	PAL coding and decoding for test sequences
358	Balakrishnan	Decoder implementation cost of B- frames
359	McGrath	MPEG-2 Systems - Analysis Model X3L3.1 meeting
360	Biggar	Proposed liaison to CCITT SG XVII
361	Kogure	Experimental results of bitrate reduction for multichannel audio coding
362	Savatier	Lossless coefficient coding experiment
363	Wilson	Formation of SMPTE ad-hoc group for MPEG liaison
364	Holborow et al.	Suggestions for harmonizing transport multiplex proposals
365	Juhola et al.	Results for spatial scalability experiment G.2 (3) and G.6.3
366	Reibman et al	Experimental results with AC leaky prediction
367	Arnold et al.	Effectiveness of data extraction for interlaced source material
368	Dunstan	MPEG systems and B-ISDN
369	Dunstan	Data partitioning and the main profile
370	Dunstan	Layered coding informative text
371	Nilsson et al.	Quantization of spatially scalable prediction errors
372	Nilsson et al.	Skipped picture syntax
373	Nilsson et al.	Enhancement of spatial scalability for reduced cost decoders
374	Veltman	Improving the AV sync error resilience of elementary streams
375	Nocture et al	Proposal for an "escape_2"mechanism for large run-level coding
376	Corset et al	Proposal for a 1.75 Mbit max. vbv_buffer for the main profile
377	Nocture et al	Results of experiment G.6.1 of TM4 on SNR_scalability
378	Logston et al	Packet demarcation in MPEG-2 Transport packet stream
379	Herpel	HDTV comparison of spatial scalability and simulcast
380	Herpel	Spatial scalability vs. simulcast results
381	Herpel	Reordering of macroblock syntax elements
382	Herpel	Additional PBP in data partitioning syntax
383	Borgwardt	Results on the TM4 prediction core experiment on mod. SVMC-Prime
384	Luthra et al.	Results on TM4 experiment Q.2 on weightening matrix adaptation
385	Galbi	Improved syntax for userdata
386	Noordam	Individual user addressing issues
387	TSS/J	Quantisation of intra-compatible MBs
388	Puri	Scan and VLC experiment results
389	Schmidt et al.	Prediction coding experiment (L.16) Results
390	Puri	Picture format scalable coding for HDTV
391	Puri et al.	Frequency scalability using modified PBP
392	UK NB	Resolutions from the UK
393	SGS-Thomson	Hardware issues in MPEG-2
394	Leditschke	Variable slice sizes vs small fixed slices
395	Leditschke	Cell loss resilience of data partitioning
396	TSS/J	Syntax modifications for VBR operation
397	TSS/J	Experiments on error concealment with data partitioning
398	TSS/J	Experiments on leaky prediction
399	TSS/J	Upsampling methods for spatial scalability
400	Convenor	Terms of reference
401	TSS/J	Report of non-8x8 DCT experiment
402	TSS/J	Report of AC-leaky prediction
403	TSS/J	Clarification of VBV operation
404	TSS/J	Selecting rule of reference picture in low-delay mode
405	TSS/J	Experiments on data partitioning by PBP
406	TSS/J	Consideration of MPEG-1 Systems as multimedia multiplexing for audio-visual communication
407	TSS/J	Relation between MPEG-2 transport mux and ATM/ALL
408	TSS/J	Video source clock recovery using network clock
409	Smith	Letter to Convenor
410	Brannon	Letter to Convenor
411	Irmer	Liaison letter to MPEG on the new sound coding system
412	BR TG10/1-2-3	Liaison letter to MPEG
413	SC1	Proposal for a new work item: Information Technology - Vocabulary - Part 31: Hypermedia and Multimedia
414	CCITT EG	Report of the tenth meeting in Torino and Roma
415	Miyagaya	Letter to SC29 Convenors

416	SC29	Proposal for a New Work Item: Image compression across multiple companents
417	SC29	Proposal for a New Work Item: Lossy coding of bi-level images
418	SC29	Proposal for a New Work Item: Hierarchical compression of 5-D images with 1-16 bpp
419	SC29	Proposal for a New Work Item: Next generation lossless compression of continuous-tone still pictures
420	SC29	Proposal for a New Work Item: Very-low bitrate audiovisual coding
421	Schaphorst	Report of the first meeting of LBC
422	van der Meer	Draft of CD 11172-4
423	WD Edit. group	MPEG-2 Working Draft (Video part)
424	AFNOR	French contribution to the meeting in Sydney
425	Uz et al.	Results of core experiment F.3: AC-leaky prediction
426	Nasse	Letter to Mr. Hidaka
427	Yamada	Multiple profiles and informative profiles proposal
428	EBU/ETSI JTC	Liaison statement from JTC to MPEG
429	Hidaka	Letter to Mr. Nasse
430	Convenor	MPEG-2 development procedure and workplan
431	Convenor	MPEG membership list
432	Convenor	MPEG five-year meeting schedule
433	Koster	Harmonising/combining low complexity, error resilience, scalability, image quality and compatibility
434	Schaphorst	Liaison statement to JTC1/SC29/WG11
435	Madec	Core experiment G.3 SNR scalability with quantisation structure
436	Jeon et al	Prediction refinement for very-low bitrate audiovisual coding
437	Krause	Results of core experiment L.16
438	Krause	Self adaptive VLC simulation results
439	CCIR TG11/4	Liaison statement from Radiocommunications TG11/4 on the number of active lines for distribution of 525 signals
440	Stoll et al	Proposed modification of joint stereo coding using dynamic crosstalk
441	Convenor	List of MPEG-2 related patent statements received in Sydney
442	Zindal	Indian national programme on advanced television systems(INPATS)
443	Knoll	New HDTV sequences: 1.Testchart and 2.Bert
444	Convenor	Operation rules of MPEG ad-hoc groups
445	Nasse	Letter to Mr. Hidaka
446	Audio group	ISO 11172-3 compatible low bit rate multi-channel audio coding scheme
447	Video group	List of resolutions and remaining open issues in MPEG-2 video
448	Req. group	List of open issues for main profile at main level
449	Koster	Observations of the Hughes contribution to the Video Technical Report
450	Koster	Attempt for the definition of the new profile, with the HDTV and TV levels
451	Koster	SystemsVideo 'Relation' stream
452	Convenor	Report on informal meeting on IPR in MPEG-2
453	Hidaka	HDTV material selection
454	Teichner	Profile for hierarchical HDTV
455	Bramley	Decoder impact of 486 lines support
456	Savatier	To D or not to D
457	Editing commitee	Test Model 5 rev 1
458	Van de Kerkhof et al	Proposal for a revision of the document MPEG93/245
459	Tektronix	H.26X error resiliency based on data partitioning and concealment
460	Zdepski	Proposal for constraints of MPEG-2 systems transport demultiplexors for MP@ML operation
461	Systems group	List of conditional access requirements
462a	Req. group	Guide for the audio work
463	Audio group	New work item proposal for low bit-rate audio coding. Sydney revision.
464	Audio group	Draft requirements list for low bit-rate audio coding. Sydney revision
465	Fogg	Implementation impact of AC leaky prediction
466	Impl. group	List of open issues
467	Stevens	Information Technology (IT) profile
468	Fernando	Profile suitable for computer applications
469	Yano	Very low bitrate video coding demonstration
470	Liaison group	Information technology Vocabulary NP
471	Okubo	Guide for systems work
472	Okubo	Reply to open issues
473	Okubo	Profile architecture

474	Forshay	Letter to Prof. Noll
475	Kogure	Program of work of DSM CC
476	Bailey	An improved compatible and downloadable VLC code for MPEG-2
477	Teichner	Compatibility of chrominance formats
478	Deiss	Time accuracy for MPEG-2 Systems
479	Editorial group	First Working draft
480	Pan	Working draft of MPEG/Audio Technical Report V.2.0
481	MPEG/Req.	Liaison statement from MPEG to Radiocommunications TG11/4
482	MPEG/Req.	Considerations regarding the relationship of Program Layer and Transport Layer
483	Dunstan et al.	Multi-channel informatiuon carried by Systems Layer
484	MPEG/Req.	Resolution of 483 active line issue in 60 Hz standard

END

List of Tape Demonstrations
(5 April 1993, Melbourne)

No	Organization	Topics	Tape	Doc.
a	TRL, Monash University	Data partitioning and error resilience	D-50	AVC-472
b	Australian Defence Force Academy	Frequency scalability of interlaced source material	D-50	AVC-478
c	Sharp	Data partitioning (base layer picture)	D-60	AVC-457
d	Fujitsu	Ordinary leaky prediction	D-60	AVC-455
e	JVC	AC-leaky prediction	D-60	AVC-454
f	JVC	8x1 DCT	D-60	AVC-453
g	Hitachi	Leaky prediction (AC-leaky vs Adaptive DC quantization)	D-60	AVC-456
h	Hitachi	Data partitioning and error resilience	D-60	AVC-458
i	Toshiba	Quantization of intra-compatible macroblocks	D-60	AVC-460
j	Tektronix	Smart prediction	D-60	AVC-488
k	Tektronix	Data partitioning and error resilience	D-60	AVC-490

REPORT OF REGIONAL COORDINATING MEETING

1. Time : Sunday, March 28 from 16:00 to 18:00
2. Place: Holiday Inn Menzies Sydney
3. Participants

Aravind, R	USA
Biggar, M.	Australia
Eude, G.	France
Haskell, B.G.	USA
Hibi, K.	Japan
Koster, A.	Netherlands
Morrison, D.G.	UK
Okubo, S.	Chairman
Parke, I.	UK
Takishima, Y.	Japan
Ueno, H.	Japan

4. Purpose

To check if there are any contentious matters from TSS point of view toward the joint sessions. If there are, to clarify the situations first of all, and to find possible directions among regional coordinators.

5. Discussion

We exchanged views on the following topics focusing on proposals from TSS members and items where differing experimental data are presented:

1) Low delay mode

- handling of skipped picture headers

2) Error resilience

- AC-leaky prediction
- Data partitioning

3) Scalability

- spatial scalable vs frequency scalable
- new profile
- scalability by PBP
- scalability by PBP and Main Profile
- integration of various features into a single syntax

4) MPEG multiplex and AAL/ATM

- overlapping functionalities

5) DSM control

- relevance TSS Recommendations

END

Source: REQUIREMENTS sub-group
Title: **Profile architecture**

This document reports the outcome of discussion at the Sydney meeting to define subsets of the MPEG-2 Video standard.

1. Structure

Level*

High	see skeleton	to be considered	see skeleton
Main		MP@ML see WD	
Low		to be considered	
	SIMPLE	MAIN	NEXT

Functionality

** Definition of Level is yet to be worked out. See MPEG93/339. Levels are not necessarily identical across profiles. Preliminary view on the high and low levels of the Main Profile is that they correspond to HDTV and SIF resolution, respectively.*

2. Documentation

Skeletons of NEXT and SIMPLE have been produced as attached.

3. Action points

- Specifications of each Profile at Level by elaborating skeletons
- Overall structure of Profile/Level
- See open issues listed in the NEXT skeleton.

Attachments

- Skeleton of NEXT Profile
- Skeleton of SIMPLE Profile

END

Attachment 1: Skeleton of NEXT Profile

We considered a profile called here NEXT as a first work of defining Profiles and Levels other than Main.

1. Purpose

To meet the requirements of major applications, such as outlined by CCIR (MPEG93/439) and the information technology industry, consisting of telecommunications, computer, and DSM groups (MPEG93/467), which are not fully addressed by Main Profile at Main Level.

2. Key functionalities

NEXT will support the following functionalities;

#	Functionality	NEXT	Main
1	Chroma format	Receive **4:2:2** Decode **4:2:2** or 4:2:0	4:2:0
2	Flexibility in bit rates (range of bit rates, CBR/VBR)	Control of bit rate on each layer is required.	yes
3	Random access / Channel hopping / Low Delay	yes; **much shorter channel hopping?**	yes, but not necessarily at every frame
4	Editability	yes as Main Profile	yes, but not necessarily at every frame
5	Resilience	**Graceful degradation** is required. Graceful degradation provides the ability for the progressive reduction of picture quality as the error rate in the bit stream increases. The reduction in picture quality may be continuous or in discrete stages, and may be achieved by mechanisms such as reduction in picture resolution or picture PSNR. Means of utilising transmission channels with the capability of unequal error protection is required. eg. B-ISDN ATM or Terrestrial Broadcasting.	yes
6	Video windowing (e.g. 4:3 from 16:9 pictures)	yes	yes
7	Low delay	yes; **much lower delay than Main?**	yes

8	Trick modes	Simple Fast Forward and Rewind are required. Data rate in FF/FR mode less than normal mode rate.	yes; those automatically supported by the basic syntax
9	Scalability (Hierarchical)	**Three resolution scales** are required. See section 3. It shall be possible to "not code" any scale, as required. Scalable technique with better efficiency than simulcast is required.	no
10	Compatibility	**Backward / forward** compatibility with H.261, MPEG1 and MPEG2 Main profile. **Downward / upward** compatibility is inherent in scalable requirement. Backward compatibility may not be an important consideration in some applications, particularly if it affects any other of the requirements. Forward compatibility with MPEG2 MP@ML is required for conformance at corresponding level. Other levels may not require this functionality. Forward compatibility with MPEG1 constrained parameter is required for conformance at this level. Other levels may not require this functionality.	yes, but only MPEG-1 forward compatibility
11	Quality	It should be possible to trade coding complexity with subjective picture quality on any scale.	
12	Flexibility in Implementation	Simple implementation is suggested. Target of software decoding for lowest scale of a lower level is foreseen for IT applications.	yes

NEXT will not support the following in the interest of "distribution" class quality;

- 4:4:4,
- 10 bits.

3. Performance

Example figures for three layer resolution;

1) At HDTV Level

Layer	Resolution	Aspect ratio	Bit rate
Upper (HDTV)	1920x1152x25, 1920x1035x30 1440x1152x25, 1440x1035x30; 1440x960x29.97	16:9	<~100? Mbit/s
Middle (EDTV/ SDTV)	960x576x25, 960x486x29.97 720x576x25, 720x486x29.97	16:9, 4:3	<~25? Mbit/s
Low (LDTV)	480x288x25, 480x243x29.97 360x288x25, 360x243x29.97	16:9, 4:3	<~4? Mbit/s

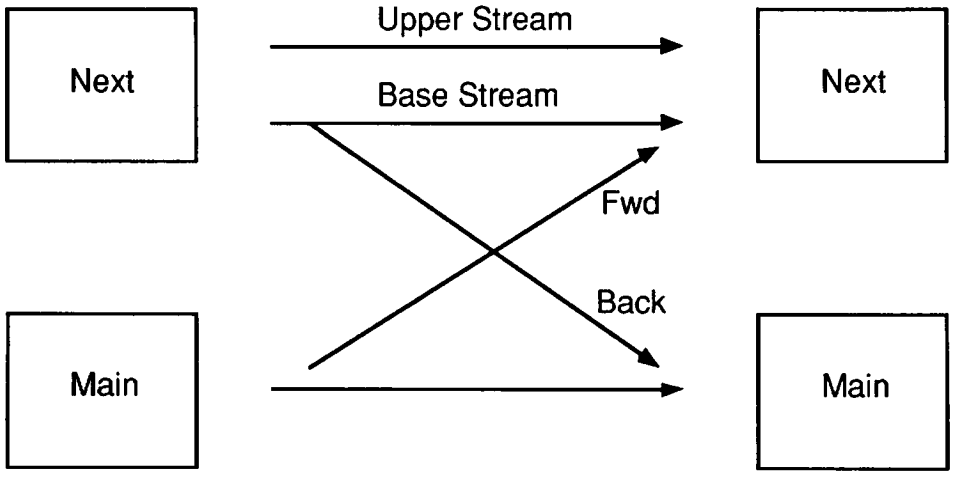
2) At Information Technology (IT) Level

Layer	Resolution	Aspect ratio	Bit rate
Middle (SDTV)	720x576x25, 720x496(480)x29.97	4:3	<~4? Mbit/s
Low (SIF)	360x288x25, 360x248(240)x29.97	4:3	<~2? Mbit/s
Very Low (QSIF)	180x144x25, 180x124(120)x29.97	4:3	<~1? Mbit/s

4. Some clarification

4.1 Compatibility

1) Definition of backward/forward compatibility



Example of compatibility between profiles. The Next profile is scalable, the Main is not. Clearly the Next decoder decodes the Main bitstream. Backward compatibility implies that a subset (or section) of the scalable is a legal Maim profile bitstream.

Figure 1 Definition of forward/backward compatibility

2) Interworking

There are several interworking combinations between scalable and non-scalable systems. Figure 2 illustrates pictures which are reproduced by the MP@ML decoder.

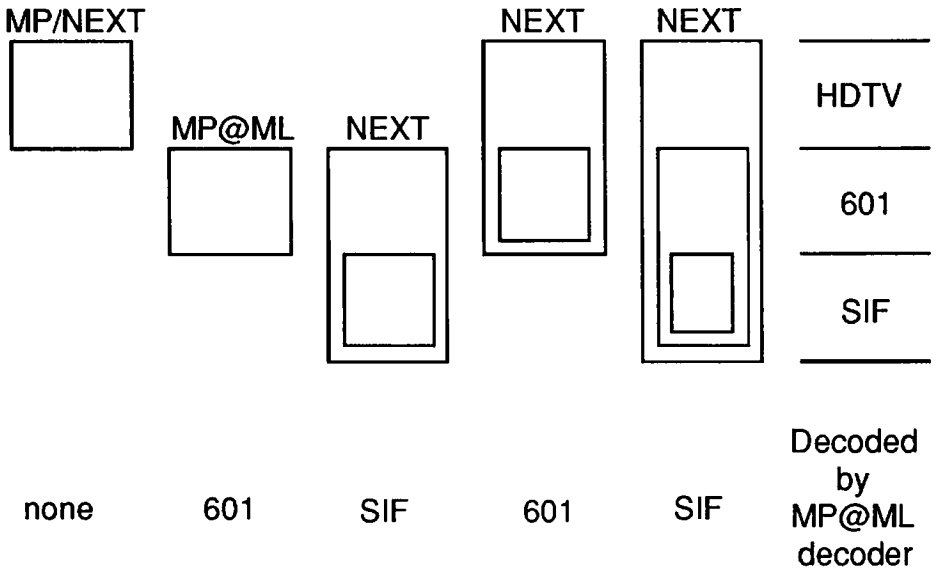


Figure 2 Pictures decoded by the MP@ML decoder

3) Configuration

Figure 3 illustrates a configuration for the backward/forward compatible scheme.

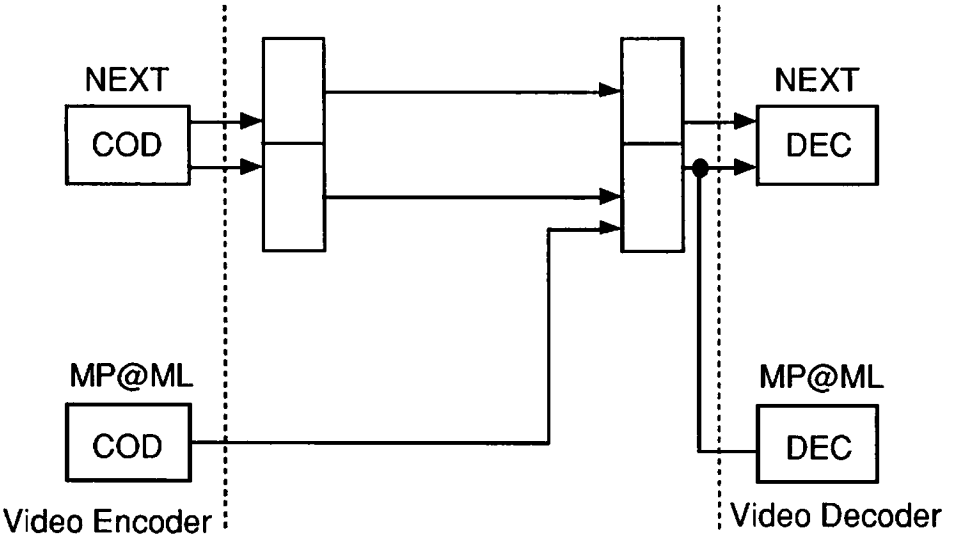


Figure 3 Configuration of a forward/backward compatible scheme

5. Open issues (to be studied by the next meeting)

- further clarification of compatibility
- hierarchy with respect to interlace/progressive
- target value for "very low delay"
- target value for "very fast channel hopping"
- inherent difficulty in compatibility (relation between layers)

* number of pels per line
* number of lines
* aspect ratio
* chroma format (see a possible solution in Annex)
* error resilience
* bit rate ratio

- trade off between different functionalities (implication of constraints).
- interrelationship between multiple profile/levels.
- additional levels in NEXT profile.
- further profiles other than Main, NEXT.

END

Attachment 2: Skeleton of SIMPLE Profile

1. Purpose

To define a profile that is able to operate with less memory and lower speed memory relative to the Main Profile, while at the same time maintaining a moderately high coding efficiency.

2. Definition

The feature set of the Simple Profile includes all those of the Main Profile, except B-frames and Dual Prime prediction.

Discussion of this Profile included application to two levels, namely the Main level and HDTV level.

END

VBV operation to take care of skipped pictures

Note - This is a draft revision to TD-10 subject to changes according to the review by members through correspondence (see §6.2.2 of this report).

Annex C to WD **Video buffering verifier**
(This annex forms an integral part of this Recommendation | International Standard)

Constant rate coded video bit streams shall meet constraints imposed through a Video Buffering Verifier (VBV) defined in Clause C.1.

The VBV is a hypothetical decoder which is conceptually connected to the output of an encoder. Coded data is placed in the buffer at the constant bit rate that is being used. Coded data is removed from the buffer as defined in Clause C.1.4, below. It is a requirement of the encoder (or editor) that the bit stream it produces will not cause the VBV to either overflow or underflow. Encoders may wish to realize low buffering delay by allowing pictures to be dropped occasionally. As a result of this it may happen that at some time when a picture is expected to be removed from the VBV buffer there will not be sufficient data in the buffer to remove a complete picture. This situation is allowed to occur only if both the picture about to be coded and the previously decoded picture are I or P.

1 The VBV and the video encoder have the same clock frequency as well as the same picture rate, and are operated synchronously.

2 The VBV has a receiving buffer of size B, where B is given in the **vbv_buffer_size** field in the sequence header.

3 The VBV is initially empty. It is filled from the bit stream for the time specified by the **vbv_delay** field in the video bit stream.

4 All of the data for the picture which has been in the buffer longest is instantaneously removed. Then after a period of time, t, specified by the **picture_rate** in the sequence header and the **picture_structure** and the **number_of_field_displayed_code** in the picture header of the last picture decoded, the buffer is inspected. If both the picture about to be coded and the previously decoded picture are I or P and there is not sufficient data in the buffer, no data is read out of the buffer and the previous decoded pictures are displayed again. Otherwise all of the data for the picture which (at that time) has been in the buffer longest is instantaneously removed. The period of time, t, is defined as follows:

$$t = \frac{1}{\text{fields\_per\_picture} * P} * \text{field\_count}$$

Where

fields_per_picture = 2 when **picture_structure** equals 11 (frame structure).
or fields_per_picture = 1 when **picture_structure** takes any other value (field structure)
P = Number of pictures per second calculated from the **picture_rate** field.
field_count is the number of displayed fields calculated from the **number_of_field_displayed_code** in the picture header of the picture about to be decoded

Sequence header and group of picture layer data elements which immediately precede a picture are removed at the same time as that picture. The VBV is examined immediately before removing any data (sequence header data, group of picture layer or picture) and immediately after each picture is removed. Each time the VBV is examined its occupancy shall lie between zero bits and B bits where B is the size of the VBV buffer indicated by **vbv_buffer_size** in the sequence header.

Support Aspects Required for "Layered" Video Coding Algorithms

The term "layered" is intended here to cover data partitioning, frequency scalability and spatial scalability schemes in which the coded representation comprises more than one bit stream. They are logically and physically separated for storage/transmission to provide features such as error resilience (priority treatment of more important bit stream) and scalability (intentional discarding of some of the bit stream).

IDENTIFICATIONS

- Video decoder needs to know which layering scheme the encoder has used.
- Video decoder needs to know which data is for which layer.

The MPEG System is an appropriate way to convey both of these, as proposed in Document AVC-495.

ALIGNMENT

Decoder needs information to align the layers. Both spatial and temporal "addressing" are required for every "layer". Spatial can be accomplished with macroblock address, slice header, etc. At least two methods are possible for the temporal aspect.

- PTS present for every layer to absolutely time each one.
- Use Temporal References to align layers relative to each other. Insert/use PTS in one (bottom layer?) to determine absolute timing of all decoded layers.

ERROR RESILIENCE

- Need to ensure that mechanism in data partitioning for "switching" between "transmission layers" to concatenate data is not totally dependent on error free situation. (Otherwise error resilience of partitioning is compromised.)
- Need to ensure that alignment information and decoder techniques are sufficient for adequately rapid re-establishment of alignment after errors (cell losses). It may be commonly assumed that higher layers are lost until end of slice and that normal quality decoder can restart with next slice. This may not be true if extent of lost data is comparable to one frame because there is uncertainty about which picture a slice belongs to if the picture header has been lost.

ERROR FLAGGING

In general there is potential benefit if the video decoder can be informed of the presence and location of errors/cell losses. For fully integrated terminals, mechanisms to pass such information need not be standardised. However, in the case of concatenated networks, a standardised method for carrying information about errors in a prior network would be useful. (The second "network" may actually be a storage device.)

PARTLY FILLED CELLS

Issues of stuffing or partly filled cells may become more important with multi-layer (multi-stream) because bit rate per stream becomes lower.

PACKET RATE LIMITATION

For multi-stream cases the packet rate may need to be higher. The MPEG-1 limit of 300 packets per second is probably too low even for main profile main level.

Comparison table for spatial scalability and frequency scalability

Note - This comparison table is provisional with a purpose of stimulating further work of the members.

Comparison Item	Frequency Scalability[1]	Spatial Scalability	Simulcast
Interworking Capabilities			
1. Scalability			
resolution:	+	++[2]	++
bit rate:	+	++[3]	++
SNR:	+	+	+
2. Flexibility to drop all layers and code single layer:	+	+	+
3. Ability to code in interlaced-interlaced mode:	+	+	+
4. Ability to code in interlaced-progressive mode:	+	++	++
5. Ability to code in progressive-progressive mode:	+	+	+
Coding Performance			
1. Better than simulcast efficiency:	+	+	
2. Approaching single layer efficiency:	++[4]	+[5,6]	
Network Issues			
1. Can provide robustness against cell loss:	+	+	-[7]
2. Ability to provide constant bitrate on all layers:	+	++	++
Compatibility with existing standards			
1. Compatibility with H.261 or MPEG1 on lower layer possible:	-	+	+
2. Compatibility with MPEG2 on lower layer possible:	?	++	++
Hardware Complexity			
1. Low additional encoder cost/complexity:	++[8]	+[9]	+
2. Low additional decoder cost/complexity (highest layer):	++[10]	+[11]	+
3. Low additional decoder cost/complexity (lowest layer):	++[12]	+	+
4. Lowest layer bit stream software decodable:	+[13]	-	+[14]
Functionality			
1. Short encoding delay possible on all layers:	+	+[15]	++
2. Short decoding delay possible on all layers:	+	+	++
3. Panning	+	++	++
4. Flexibility to have complexity/quality tradeoff at encoder and decoder:	++[16]	+[17]	+
Applications			
1. Suitable for desktop video-conferencing:	+	+	+
2. Suitable for HDTV-TV interworking:	+	+	+
3. Possiblity to incorporate future services:	+	++	++

1 also includes Data Partitioning
2 more flexible
3 more flexible
4 at the expense of lower picture quality at lower layer
5 seems to be dependent on sequence
6 will depend on the bit rate in the lower layer
7 similar performance can be achieved with higher complexity hardware
8 0-25% additional memory space for two layer scheme compared to single layer encoder dependent on implementation
9 25 % additional memory space needed for two layer encoding scheme
10 no additional memory space needed compared to single layer decoder
11 25 % additional memory space needed for two layer scheme
12 underlying assumtion is the DCT size which makes decoders less complex
13 DCT size, see above
14 Simulcast may provide software decodable capability if 2x2 DCT size is used
15 This may not be possible with H.261 compatibility on the lowest layer
16 Frequency Scalability schemes can be implemented using one or two loops at the encoder to achieve complexity/quality tradeoffs
17 Also Spatial Scalability schemes may be able to trade off comlexity with quality using simple fixed upsampling filters

General Comments

The meeting also noted a Sydney MPEG contribution (MPEG'93/250) presented by HHI where the coding performance of both Spatial Scalability and Frequency Scalability schemes for SNR scalability was given. Accordingly the result for both schemes were very similar. "In fact, Frequency Scalability shows some advantages for the EDTV layer and Spatial Scalability for SDTV and HDTV". Further studies are needed to verify these results.

Figure 1 shows the application dependency of either Spatial or Frequency Scalability schemes. For ease of interoperability, it is, however, desired to identify overlapping application areas which may be represented by one single application profile.

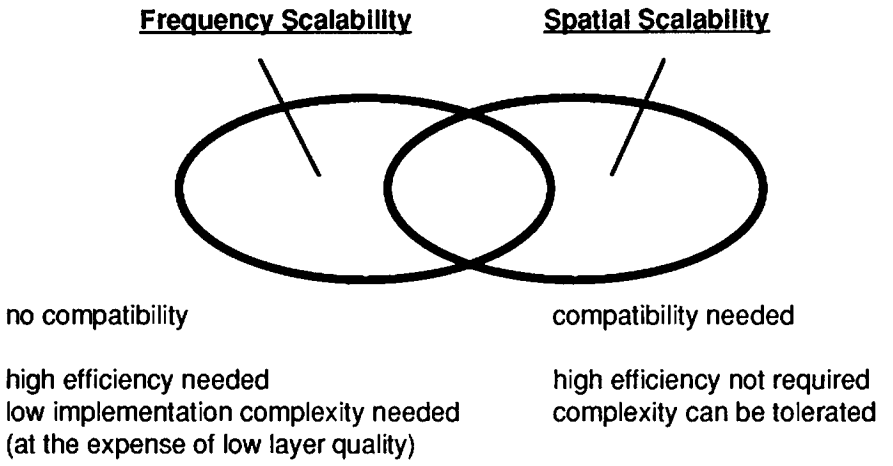


Figure 1: Virtual Applications Areas for Frequency Scalability and Spatial Scalability Coding Schemes

END

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.

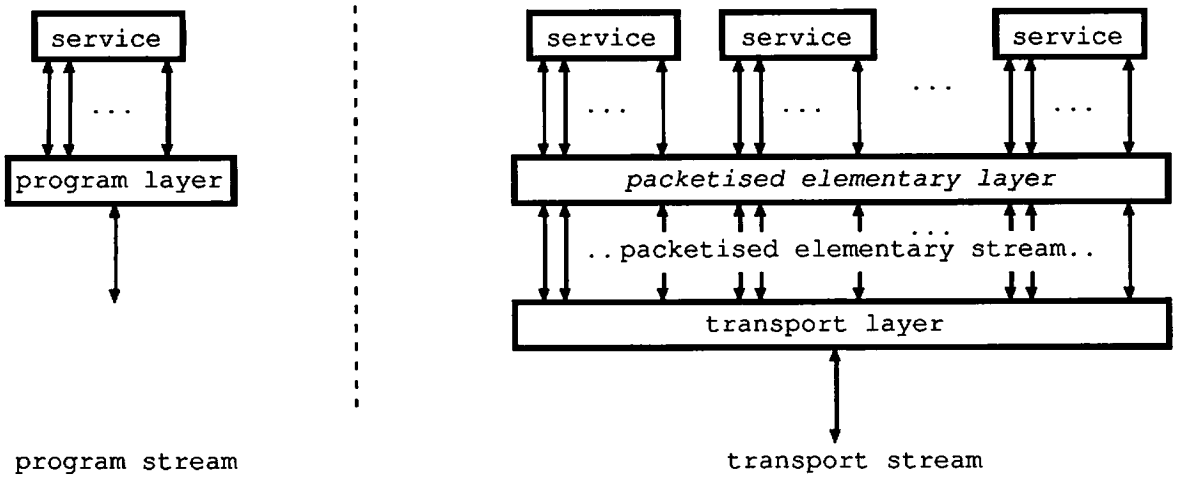


Figure 1. Relationship between MPEG 2 system program stream and transport stream.

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.

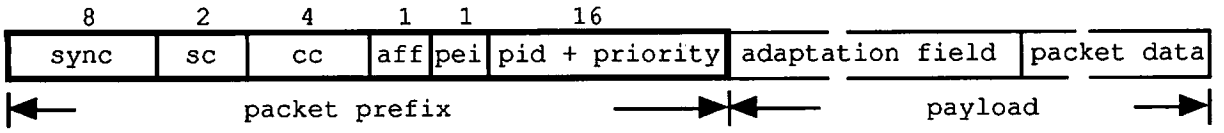
The transport stream is designed for use on lossy transmissions mediums. The transport stream consists of packets with payloads which are relatively short, compared to an MPEG 1 system packet. Elementary streams belonging to one program, or service, are identified by a mulitplex map, which lists programs 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.

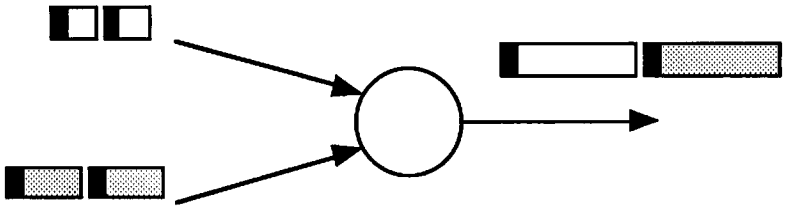


Figure 3. General requirement of a transport layer multiplexer.

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

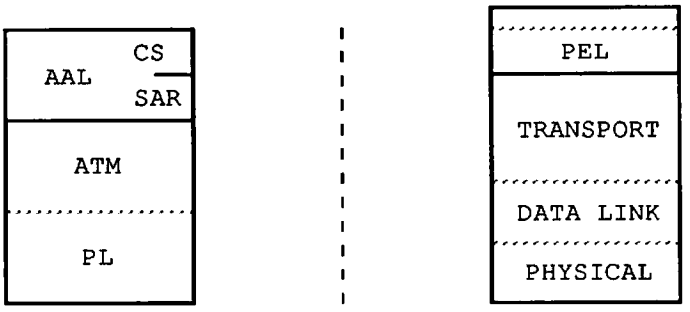
In the MPEG 2 transport model no multiplexing is performed at the packetised elementary layer. All multiplexing is done at the transport layer. This supports simple drop and insert capabilities in the transport stream. Currently the packetised elementary stream does not contain pack headers i.e.

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.

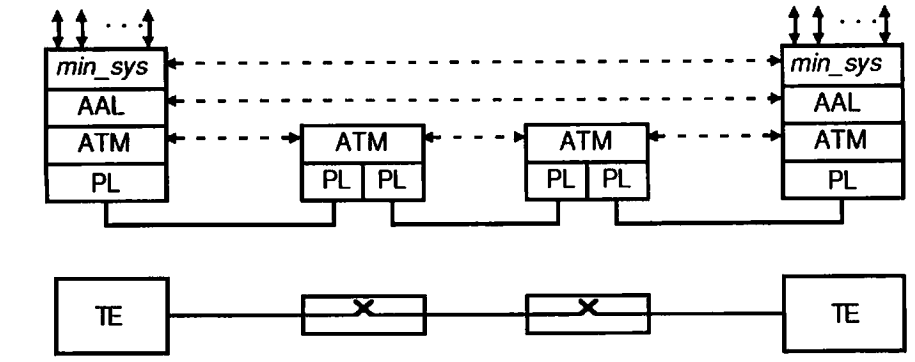
5. MPEG 2 system and B-ISDN interaction

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.

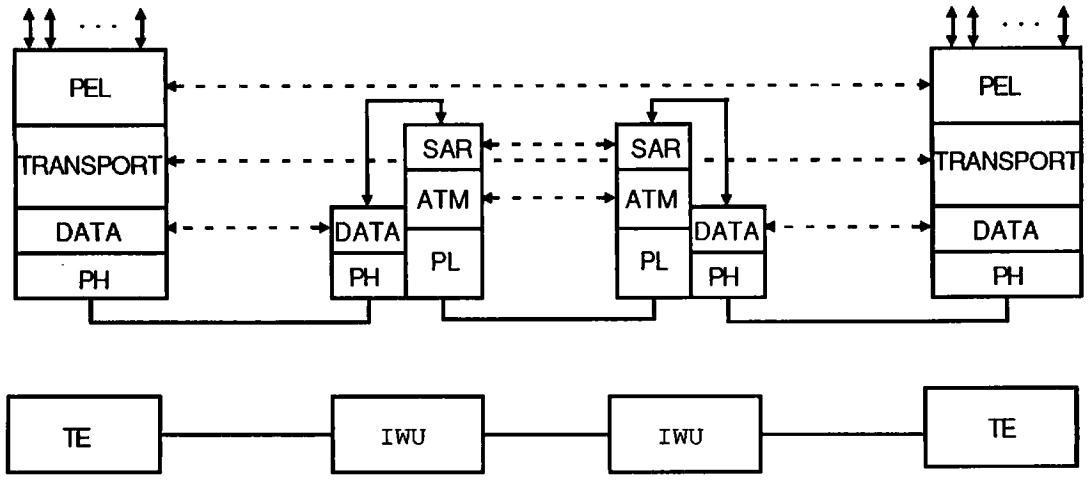
MPEG 2 transport stream connected to B-ISDN for service delivery to B-ISDN terminal - in this case the MPEG 2 transport stream may need to be terminated at an interworking unit, such that one of the reference points described above is available.

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.

END