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

Document AVC-553R
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Source: CHAIRMAN OF THE EXPERTS GROUP FOR ATM VIDEO CODING
Title: REPORT OF THE TWELFTH MEETING IN BOSTON AND NEW YORK (July 7-16, 1993) - Part I and Part II
Purpose: Report

Part I General
Part II Sole sessions in Boston
Part III Joint sessions in New York (see AVC-554R)

Part I General

The twelfth meeting of the Experts Group was held in the US as follows;

- ITU-TS sole sessions in Boston during 7-9 July at the kind invitation of PictureTel,
- Joint sessions with ISO/IEC JTC1/SC29/WG11 (MPEG) in New York during 12-16 July at the kind invitation of Columbia University.

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

Part II Sole Sessions

Contents

1. Introduction

The ITU-TS sole sessions were held at The Colonial Hilton and Resort during 7-9 July 1993 at the kind invitation of PictureTel. At the opening session, Dr. Norman Gaut, President & CEO, made a welcoming address on behalf of the hosting organization.

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

We had also a short closing session on 16 July at Columbia University to review both sole and joint sessions as well as to prepare for the Brussels meeting.

2. Documentation (TD-2)

For the sole sessions, 57 AVC-numbered documents and 12 Temporary Documents have been made available as listed in Annex 1.

3. Tape demonstration (TD-3)

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

4. Review of the previous meetings

4.1 Sydney/Melbourne meeting (AVC-496R)

Chairman briefly presented the outcome of the previous joint and sole sessions in Sydney and Melbourne and reported progress made after the meeting on the following outstanding issues (§ numbers refer to AVC-496R);

- VBV specifications (§6.2.2)
- WD informative text on error resilience (§6.3.5)
- Input of the clock recovery document to the Systems adhoc group meeting (§7.1.2)
- Relationship between MPEG-2 Systems and AAL/ATM (§7.2.2)

The following is yet to see more actions;

- Liaison with SG13 on UPC (§6.4.2)
- Framework for Recommendations (§8.2)

4.2 SG15 Rapporteur's meeting in Tokyo (AVC-498,499) <AVC-500,501>

Chairman reported on the following items which are relevant to the Experts Group activities;

- Consideration of MPEG-2 multimedia multiplex schemes for broadband applications
- Time schedule for system aspects Recommendations
- Protocols for desktop videoconferencing
- Video mixing for 4xQCIF

These have been elaborated in the current Experts Group meeting.

4.3 ITU-TS SG15 Chairman, Vice-Chairmen and proposed WP Chairmen

It was reported that Mr. M. Yamashita will continue to chair WP 1/15 and cover audiovisual matters including high quality audio coding.

4.4 Systems Adhoc group meetings in Atlanta and Amsterdam (AVC-502)

Ms. J. Vollbrecht summarized the progress made in the two adhoc group meetings of the MPEG Systems which led to the update of Working Draft, focusing on such items as source clock recovery, mapping of the TS packet on AAL.

4.4 CMTT/2 and its SRG

Mr. Zedler and Mr. Poncin gave some information on the current activities of the SRG and its relevance to the H.26X|MPEG-2 activities.

5. Video Source coding

5.1 Main Profile at Main Level (AVC-503,546) <AVC-539,540,541>

AVC-503 reported basic open loop performance of the MP@ML coding scheme for M=1 in statistics and picture quality. This is for conversational services, pending M=3 performance for distributive services to be demonstrated in New York.

AVC-546 pointed out some missing information and inconsistencies in TM5, MPEG2 Working Draft. Questions to clarify the MP@ML syntax and semantics were left to the consideration in New York.

During discussion, it was raised whether MP@ML decoders should handle bitstreams of higher Profile/Level bitstreams. Our conclusion was that the standard does not require it and that it is left to implementation.

5.2 Low delay mode

5.2.1 VBV specifications (TD-4; AVC-514,519)

The Experts Group produced a proposed revision for the VBV specifications (Annex C to the WD) through correspondence after the Sydney/Melbourne meeting as contained in Annex 3. Mr. Bjoentegaard coordinated this correspondence work. The remaining issues are handling of the 3:2 pulldown operation and the time stamps for "large picture" as addressed in AVC-519 and AVC-514, respectively.

After some discussion the meeting decided to put forward these proposals for consideration of the New York sessions to make a choice for **number_of_field_display** code between "last picture removed from the buffer" and "picture to be removed from the buffer". It also decided to propose to increment PTS and DTS by one picture time period if data is incomplete at the time it is to be removed from the buffer.

5.2.2 Concatenation of segments with different M values (AVC-520)

AVC-520 raised a question of how to maintain the low delay characteristics when coding segments with different M values are concatenated. We obtained a common understanding that use of the end of sequence or the AVC-520 method is an encoder option to prevent VBV violation.

The issue of low delay mode indication was revisited to facilitate maintaining the low delay operation for mixture of different M value segments. The meeting concluded that the low delay operation is to be managed by means of PTS rather than by flagging in the video stream.

5.2.3 Low delay possibility for M larger than 1 (AVC-523)

AVC-523 provided experimental results to achieve low delay by utilizing periodical nature of the VBR coded bit generation in IPB structures. The meeting decided to send a liaison to SG13 inviting comments on possible network overloading even if each traffic conforms to UPC as indicated in this contribution.

The meeting also confirmed the definition of field structure M=2 as illustrated on p. 2/AVC-523. As a result, the current TM5 description ruling out field structure M=2 for low delay should be revised (see also §6.2.2/AVC-496R).

5.3 Error resilience

5.3.1 Concealment (AVC-532,549)

AVC-532 provided information on characteristics of basic concealment techniques. It was clarified that in this experiment data after an error is discarded until a next start code. Mr. Haskell pointed out that error can be detected by the decoder only some time after errored data is input.

Impacts of loss of higher level header information such as picture type, f_code and quantizer matrices were experimented and discussed in AVC-548 and 549. Loss of the picture type and f_code is serious, while loss of the quantizer matrices slightly degrades quality. Mr. Uz stated

that redundant data is being proposed to be in the Systems TS packet. If H.32X terminals utilize PES, one possibility to convey these redundant data is to use private data.

5.3.2 AC-leaky prediction (AVC-515,530,531,537; TD-9)

AVC-531 and 537 provided experimental results on AC-leaky prediction presenting statistics and coded pictures, while AVC-536 proposed clean-up for syntax and semantics. During the questions and answers, it was clarified that limit cycle is not visible in the AC-leaky prediction, thus its fix is not necessary. It was also reminded that the current cell loss experiments are based on the lost cell being informed by the network to the decoder.

There were two input documents from Japan and Europe (AVC-515 and 530) stating that AC-leaky prediction is not necessary in the standards on the grounds that existing techniques can provide similar performance.

After having reviewed relevant papers and demonstration tapes, the meeting discussed what should be the position of the ITU-TS Experts Group on this matter. As part of this task, comparison between AC-leaky prediction and Intra Slice was tabulated with respect to the following items as in Annex 4;

- Coding efficiency/picture quality,
- Cell loss resilience,
- Channel hopping,
- Additional hardware complexity.

Since there were split views as to the inclusion of this technique in the standard, the meeting decided to await the review of other relevant inputs in New York and evaluation there.

5.3.3 Data partitioning (AVC-504)

Experimental results were reported for its error resilience improvements compared to the single layer coding scheme. It was clarified that H+L is constant while H/L varies in this experiment. Processed pictures were announced to be seen in New York.

5.3.4 WD informative text (AVC-511)

Mr. Biggar presented the current status of the error resilience informative text. Suggestions were made to include a general disclaimer for "D.3.1 Layered coding" taking into account the standardization work phase and to produce appropriate wording for the relationship between data partitioning and subband.

5.4 Scalability

5.4.1 Spatial scalability (AVC-505,518,529,533,534,539,540,541,542,543,544,545; TD-12)

1) Experimental results for coding efficiency/picture quality

AVC-518, 533, 542, 543, 544 and 545 provided experimental results for SIF/CIF and 601 scalable schemes. During the discussion, the following clarifications were made;

- In AVC-518, macroblock type decision is based on unweighted MSE, not biased to spatial compatible. AVC-545, however, is based on biased decision.
- BT is experimenting with macroblock type decision taking into account chroma components as well.
- AVC-533 suggests that H.261 compatibility should be achieved by "switchable" for point-to-point and by "transcoding" for multipoint.
- AVC-542 proposes that continuous weighting (coefficient downloading at macroblock level) be not included in the standard due to its hardware cost penalty .

- Experiments are encouraged to verify the approach to allow upsampling filter mismatch between encoder and decoder which is proposed in AVC-543. There was a comment that masking effects may be reducing the visual impairments if filter mismatch does not affect the performance.

Differed views have been expressed on adoption of the spatio-temporal weighting. There was no firm evidence to promote it or to drop it, partly because of different experimental set-up. The meeting concluded to provisionally retain it assuming that it requires no significant addition of hardware and that there is prospect of future improvements.

AVC-505 and 534 provided experimental results for CTV and HDTV scalable schemes; particularly spatio-temporal prediction is compared with pyramidal DCT in AVC-534. The following was clarified;

- Both layers are 4:3 in AVC-505, while they are 16:9 in AVC-534.
- Hardware consideration lead to M=1 for HDTV in the experiment of AVC-505.
- In AVC-534, 12 Mbit/s has been selected for the CTV base layer taking into account high quality digital satellite broadcasting. It is noted that the picture format is 16:9 and 4:2:2 here.

The meeting concluded that we can proceed with the current spatial scalability approach.

2) Clean-up of syntax and semantics

AVC-541 proposed clean-up of the picture layer syntax while AVC-518, 539, 540, 541 and 546 proposed that of the macroblock layer syntax addressing skipped macroblocks, VLC for macroblock type, prediction of motion vector, SNR scalability. During the discussion, the following was pointed out;

- Pel location relationship between the base layer and the upper layer pictures should be specified; co-located or shifted.
- Combination of Dual-Prime and averaging mode should be excluded from **macroblock_type** VLCs due to the memory bandwidth constraint.

There were some discrepancies in proposed solutions for the identified problems. Mr. Tabatabai attempted to sort them out in a small group. The outcome is contained in Annex 5.

3) Upconversion filters (AVC-541,543)

AVC-541 proposed specifications of spatial scalable upsampling based on the idea that complete matching of upsampling filter is not required as experimented in AVC-543. The meeting recognized that clarification is needed whether the encoder upsampling filter is specified as bilinear interpolation and leaving design freedom to the decoder upsampling filter or the other way around.

4) Necessary resources for supporting spatio-temporal weighting (AVC-529)

Spatio-temporal weighting requires higher memory bandwidth, but if B frames are incorporated, the resource for that purpose can also be used for spatio-temporal weighting in I and P pictures. It should be noted, however, that hardware does not increase only if the higher layer has B pictures.

5.4.2 Frequency scalability (AVC-510)

AVC-510 provided experimental results for the use of Frequency Scalability to achieve FF/FR functionality. It has been noted that the use of base layer for FF/FR can be common to fscalable, sscalable and data partitioning.

5.4.3 General (AVC-517,527)

AVC-527 provided information on software decoding. The intention of submission was clarified as being a rebuttal to the argument that frequency scalability is suited for software decoding by use of small size IDCTs. It was also pointed out that the IDCT in the attached paper uses short-cut and is not conforming to the IDCT specifications in the standards and that fscalable with small size IDCTs may not give good picture quality either.

Examples of scalability applications were discussed in AVC-517. The following comments were given during the discussion;

- Different colorimetries in HDTV and CTV will affect coding efficiency of the sscalable scheme. It may be more difficult to cope with this in the fscalable scheme.
- 4:2:2 extension in fscalable is not clear.

5.5 VBR and its delay (AVC-522)

AVC-522 provided experimental results for the two methods to give upper bound for the octet interleaving delay for the VBR coded video; to keep a minimum bitrate and to set a time-out for flushing the interleaver matrix. It has been shown that some strict UPC methods can assure a certain maximum delay for VBR coding even if interleaving is involved. There was a comment that a method to turn on/off interleaving according to the bit rate may help though its practicality is to be checked.

5.6 Specific video techniques

5.6.1 Object oriented coding/decoding (AVC-509)

A proposal was made to allow encoding/decoding objects separately each of which consists of slices with identical identification. The meeting supported the idea of including **slice_id**, leaving the syntax representation to further consideration.

5.6.2 Video mixing for continuous presence multipoint systems (AVC-500,501)

This discussion is in response to the request of the Tokyo Rapporteur's meeting. We briefly reviewed the input documents and obtained the following comments;

- Technical feasibility should be examined in the light of overall system configuration. Existing terminals should be accommodated without modification as far as possible.
- Comparison should be made against transcoding MCU in terms of picture quality, delay and other factors as listed in AVC-501.

The meeting decided to continue the study toward the next meeting and the SG15 meeting (both in September) through correspondence. Mr. Schinkel undertook to coordinate this work with participation of Bellcore, BT Labs, CNET, NTT Labs; other members are also welcome. The task is to draft a reply to WP15/1 with respect to video coding techniques which are necessary for terminals and MCU to constitute the video mixing multipoint system.

5.7 Profiles other than Main (AVC-516,525,526,528)

Requirements for the profiles from audiovisual communication applications were discussed in the four input documents. The following comments and clarifications were made during the discussion;

- An opposing view was expressed to AVC-516 that H.26X/H.261 compatibility can be covered by switchable terminal and transcoding MCU, thus spatial scalability is not required for this purpose (the same view is also in AVC-533), and that cell loss resilience can be provided by data partitioning with less complex hardware.
- Cell loss resilience may better be provided by FEC if 10% increase in bit rate is justified.
- The question is what profile of H.26X we specify for the H.32X terminal.

- Some of the telecommunication requirements listed in AVC-525 should be covered by H.32X, not by H.26X. The worst case CLR of 10^{-2} mentioned in this document corresponds to the Australian study (see AVC-296 submitted to the New Jersey meeting).
- SCIF listed in AVC-526 is for illustrating high quality videoconferencing.
- AVC-528 provides high level scenarios whose implications should be studied for designing the system components such as MCU.

The meeting concluded that the discussions here are to be reflected in the Requirements sub-group work in New York.

6. Network aspects

6.1 B-ISDN characteristics (AVC-508)

Mr. Dunstan gave an overview of B-ISDN to form a common basis among the participants. AVC-508 was intended for presentation at the Systems meeting in the joint sessions.

6.2 AAL Type 1 (AVC-521,538; TD-10)

AVC-521 and 538 addressed error correction in AAL. The backgrounds are that SG13's response on support of H.320 terminals in B-ISDN indicated necessity of cell loss correction (see AVC-447) and that requirements from CMTT/3 on high quality sound transmission indicate the same solution for cell loss (see Annex to AVC-538). Another factor is that we need some bit error correction mechanism as well in video signal transport through ATM networks.

There was a comment that error resilience evaluation is needed between
- loading the network with pure video, and
- use of FEC resulting in 10% more network loading, thus higher cell loss probability

assuming the same pure video bit rate.

Both AVC-521 and 538 propose solutions for the cell loss correction with low delay. Mr. Asai and Mr. Eude collaborated to compare the two methods. The outcome is contained in Annex 6 which is a summary of the discussion with an accompanying liaison statement to SG13. The liaison statement was sent to Geneva where SG13 was meeting concurrently with our group.

Joint meeting with SG13 experts on AAL Type 1 and Type 2 for audiovisual communications has been suggested by Mr. Yamazaki, Rapporteur for AAL Type 1/2 in SG13. The meeting supported this idea, awaiting detailed arrangements to be settled between the two groups.

6.3 Multimedia multiplex and AAL/ATM (AVC-498,499,506,507,524,547,550; TD-6,8)

6.3.1 Relationship between MPEG Systems and AAL/ATM

AVC-507 listed functionalities for supporting the audiovisual communication services to answer a question of what are required for video support AAL without considering MPEG Systems. The following was listed as a conclusion of the discussion;

- Transfer of variable length data units. Interval between data units may be fixed or variable.
- Multiplexing and synchronization of elementary streams
- Capability to synchronize source and receiver clocks
- Error detection capability

AVC-498, 499 and 506 discussed use of all or part of MPEG Systems as a possible multimedia multiplex method for audiovisual communication applications. Alignment between ITU-TS Recommendation and ISO/IEC standard is also an issue.

The meeting concluded that technical solutions should first be established and the alignment should be clarified based on the technical solutions.

AVC-507, 524, 547 and 550 discussed interaction between MPEG Systems and AAL/ATM listing possible scenarios to find optimum solutions both for H.22X in the H.32X terminal and for transfer of TS packets over B-ISDN.

After general review of these contributions, Mr. Dunstan coordinated a night session for detailed analysis. The outcome is contained in Annex 7. Contributions are requested toward making a choice out of the listed alternatives.

6.3.2 Independent clock sources and their recovery at the decoding end (TD-7)

There can be several independent clock sources in the audiovisual terminal. They should be identified and the recovery method for each source should be clarified. This is yet to be worked out for the H.32X terminal.

6.4 Audiovisual protocols for LAN (AVC-498,512,513)

AVC-498 and 512 discussed features of audiovisual communication systems over LAN, while AVC-513 discussed necessary functionalities of multimedia multiplexing in particular.

Several participants expressed prompt interests in standardization of this area. The meeting concluded that this Experts Group should draft necessary Recommendations and that time frame should be set for this work, seeking advice of WP15/1 as well.

Contributions are solicited.

7. Intellectual property (AVC-551)

AVC-551 proposed the following regarding the H.26X related patents;

- Disclosure of patent information relevant to technical proposals
- Adoption of waiving patent rights (at least for ITU applications)

As to the second point addressing the ITU applications, a view was expressed that different policies should not be taken between telecommunication and information technology standardization bodies.

The meeting concluded that "disclosure of patent information" should immediately be followed to conform to the ITU-TS code of practice and that the second point should be advised to and consulted with patent experts in each participating organization.

8. Work plan (AVC-499; TD-5)

We confirmed that the Tokyo Rapporteur's meeting had supported to set a target of early 1995 for "minimum system" Rec. to deter from prior divergence; also to show "committee draft" on the plan (May 1994?) to focus attention on preparation of first solid draft. Here "minimum system" is meant to be a minimum total audiovisual communication system (H.32X) consisting of video/audio coding, multimedia multiplex, communication procedures, etc.

Chairman reminded members of hardware verification trials which should take place in the final stage of standardization work to secure our Recommendations. Since video coding/decoding specifications will be verified mostly through the bitstream exchange currently ongoing, our task is to test the above mentioned minimum system between two or more independently designed equipment. The date could be sometime during 1995. Interested organizations are requested to express willingness of participation and to contribute to materializing the plan. This topic will be part of the agenda at the next meeting in Brussels.

9. Joint sessions with MPEG in New York

9.1 Documents

The Experts Group submitted TD-4 (Annex 3 to this report, MPEG93/699), TD-8 (Annex 7, MPEG93/698) and TD-9 (Annex 4, MPEG93/700) as outcome of the sole sessions. Other individual inputs are indicated with MPEG document numbers in Annex 1.

9.2 Representatives

The following members acted as representatives of the ITU-TS Experts Group to reflect the group's concern and report the outcome of the joint sessions.

ITU-TS EG	S. Okubo
Requirements	B. Haskell
Video	G. Bjoentegaard
Systems	S. Dunstan
Implementation	G. Morrison

10. Others

10.1 Future meetings

Meeting	Date	Sole sessions	Joint sessions with MPEG
13th	September 1993	September 2-3 in Brussels	September 6-10 in Brussels
14th	November 1993	October 27-29 in Daejeon (See AVC-535)	November 1-5 in Seoul

10.2 Miscellaneous

In order to compensate the discussion time shortage at meetings, Chairman encouraged the members to review the already available AVC-numbered documents when they produce new contributions, indicating AVC-number, source, title and date of referred documents at the end of each contribution.

Collection of TD-2 of the previous meetings will be distributed as an electronic file for this purpose.

END

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Annexes

Annex 1	Documentation
Annex 2	List of tape demonstrations
Annex 3	Proposed text for WD Annex C - Video Buffer Verifier
Annex 4	Summary of the discussion on AC-leaky prediction
Annex 5	Report of the small group work to sort out the discrepancies in proposed solutions for the spatial scalable syntax
Annex 6	Cell loss correction method for AAL Type 1 to support H.320 terminals in B-ISDN
Annex 7	Report of discussion on ATM/AAL and MPEG-2 Systems

Participants of the twelfth meeting of Experts Group for ATM Video Coding 7-16 July 1993 in Boston and New York

			B	N	
FRG	Mr. B. Hammer	Siemens	X	X	
	Mr. K. Illgner	Aachen University of Technology	X	X	
	Mr. I. Sebestyen	Siemens	X	X	
	Mr. G. Zedler	DBP TELEKOM	X	X	CM
Australia	Mr. M. Biggar	Telecom Australia	X	X	CM
	Mr. S. Dunstan	Siemens	X	X	
	Mr. T. Sikora	Monash University	X	X	
Belgium	Mr. O. Poncin	Belgacom	X	X	CM
Korea	Mr. J-Y. Nam	ETRI	X	X	CM
USA	Mr. M. Balakrishnan	Philips Labs	X	X	
	Mr. R. Baker	PictureTel	X	-	
	Mr. C-T. Chen	Bellcore	-	X	
	Mr. H. Compter	RG Associates / Omniphone Technology	X	-	
	Mr. R. Greenblatt	RG Associates / Omniphone Technology Phone	X	-	
	Mr. R. Grinnell	PictureTel	X	-	
	Mr. B.G. Haskell	AT&T Bell Labs	X	X	
	Mr. D. Hein	VTEL	X	-	
	Mr. D. Klenke	CLI	X	-	
	Mr. J. Liu	Sun Microsystems	X	-	
	Mr. A. Loui	Bellcore	X	-	
	Ms. A. Reibman	AT&T Bell Labs	X	-	
	Mr. R. Schaphorst	DIS	X	X	CM
	Mr. G. Sullivan	PictureTel	X	-	
	Mr. A. Tabatabai	Tektronix	X	X	CM
	Mr. M. Uz	David Sarnoff	X	X	
	Ms. J. Vollbrecht	Hughes Aircraft	X	X	
	Ms. M. Yong	Motorola Codex	X	-	
	Mr. Z. Yuan	PictureTel	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. Asai	Mitsubishi	X	X	
	Mr. S. Nogaki	NEC	X	X	
	Mr. S. Okubo	NTT	X	X	Chairman
	Mr. T. Tanaka	NTT	X		CM
	Mr. H. Ueno	Toshiba	X	X	
Netherlands	Mr. A. Koster	PTT Research	-	X	
	Mr. K. Rijkse	PTT Research	X	-	
	Mr. D. Schinkel	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	
Sweden	Ms. C. Verreth	Telia Research	X	X	CM

CM: Coordinating Member
(CM): Substitute for CM

Documents for the Boston/New York meeting (7-16 July 1993)

Normal Documents

AVC number	MPEG 93/...	Pur-pose	Title (source)
AVC-491b	N400	R	Test Model 5 (Test Model Editing Committee)
AVC-496R		R	Report of the eleventh meeting in Sydney and Melbourne - March 27 - April 7, 1993 (Chairman)
AVC-497	???	R	MPEG-2 Working Draft - Video Part - Version 4 (Working Draft Editing Committee)
AVC-498	-	D	Work plan for broadband audiovisual systems Recommendations (S. Okubo)
AVC-499	-	R	Report of ITU-TS SG 15 Rapporteru's meeting in Tokyo (N D Kenyon)
AVC-500	-	P	Multipoint 4 QCIF to CIF video mixing (Bellcore)
AVC-501	-	I	Simulation studies of 4 QCIF to CIF video mixing (Bellcore)
AVC-502		R	MPEG 2 Ssytems Working Draft (Systems Committee Adhoc Group)
AVC-503	493	I	Performance of the Mian Profile @ Main Level - distributive and interactive services (BELGACOM, UCL)
AVC-504	494	I	MPEG-2|H.26X error resilience based on data partitioning (BELGACOM, UCL)
AVC-505	495	I	New results on spatial scalability ((BELGACOM, UCL)
AVC-506		P	Concern regarding MPEG-2 Systems and ATM/AAL functionality (Australia)
AVC-507	567	D	H.32X terminal and MPEG-2 Systems (Aus. UVC)
AVC-508	568	D	B-ISDN & Video Services Tutorial (S. Dunstan, Siemens)
AVC-509	516	P	Flexible Object Oriented Decoding Using Slice Identification (Aus. UVC)
AVC-510	517	I	FF & FR using Frequency Scalability layered coding (Aus. UVC)
AVC-511	528	I/P	Report of Ad-hoc Group on ATM Cell Loss and Error Resilience (M. Biggar, chair)
AVC-512	-	P	Design of H.32z terminals for LANs (Aus. UVC)
AVC-513	-	P	H.22z protocol for LANs (Aus. UVC)
AVC-514	546	P	Time stamp for a large picture (Japan)
AVC-515	547	P	Considerations on AC-leaky Prediction (Japan)
AVC-516	548	D	Considerations on the next profile (Japan)
AVC-517	549	D	Practical examples of Hierarchical coding (Japan)
AVC-518	550	P	Syntax modification for compatibility/spatial scalability (Japan)
AVC-519	551	P	VBV operarion in 3:2 pulldown (Japan)
AVC-520	552	D	Some considerations on the coding segments (Japan)
AVC-521	599	P	Correction method for cell loss and bit error in AAL Type 1 (Japan)
AVC-522	-	I	VBR coding and octet interleave (Japan)
AVC-523	-	I	Low delay IPB mode transmisssion using VBR (Japan)
AVC-524	553	D	Relation between MPEG-2 transport mux and ATM/ALL and possible candidates for AAL (Japan)
AVC-525	514	P	Telecommunication requirements for the Next profile (NL,I,UK,N,FRG)
AVC-526		D	Telecommunication levels for the Next profile (NL,I,UK,N,FRG)
AVC-527	545	I	Software decoding of video streams (PTT Research)
AVC-528	543	I	Inter working between wide screen SCIF and SCIF video conferencing systems (PTT Research)
AVC-529	561	I	On the B-frame design complexity of spatio-temporal weighting (PTT Research)
AVC-530		P	European stance on leaky prediction (F,FRG,B,N,I,NL,UK)
AVC-531	639	I	Simulation results on AC-leaky prediction (France)
AVC-532	638	I	Cell loss resilience : simulation results on concealment techniques (France)
AVC-533	636	I	Experiment on spatial/temporal H.261/H.26x compatibility (France)
AVC-534	569	I	Comparison of CTV/HDTV compatible coding schemes (ETRI)
AVC-535	-	I	Invitation to the 14th ATM Video Coding Meeting (ETRI)
AVC-536	620	P	Cleanup of AC-Leak Syntax and Specification (AT&T)
AVC-537	686	I	Comparison of the Cell-Loss Resilience of MPEG-2 Main Profile and AC-leaky prediction (AT&T)

AVC-538	-	P	Method for the correction of cell losses for low bit-rate signals transport with the AAL Type 1 (France)
AVC-539	631	P	Semantics for skipped macroblocks in spatial scalability (BT)
AVC-540	632	P	Semantics for prediction of motion vector in spatial scalability (BT)
AVC-541	633	P	Syntax and semantic extensions for spatial scalability (BT)
AVC-542	634	I/P	Spatio-temporal weighting experiments (BT)
AVC-543	635	I/P	Accuracy requirements of upsampling (BT)
AVC-544	641	I/P	Frequency adapted spatio-temporal weighting (BT)
AVC-545		I	Results on spatial scalability Core Expt. TM5 G.6.6 (Tektronix)
AVC-546	614	D	Missing information and inconsistencies in TM2, MPEG2 Working Draft (Tektronix)
AVC-547	645	D/P	Preliminary studies into ATM mapping of MPEG-2 Transport Layer Packets (BT)
AVC-548	678	I/P	Experiments on the effect of losses of picture-type or f-code in picture headers (David Sarnoff)
AVC-549	679	I/P	Experiments on the effect of loss of quantizer matrices in picture headers (David Sarnoff)
AVC-550	637	D/P	About the transfer of MPEG transport packets in ATM (CNET)
AVC-551	-	P	ITU-TS patent policy and MPEG-2 follow up (Siemens)
AVC-552	N0491	R	Test Model 6 (Test Model Editing Committee)

Abstracts

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

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

AVC-496R Report of the eleventh meeting in Sydney and Melbourne - March 27 - April 7, 1993 (Chairman)

This document records the outcome of the sole and joint sessions held in March-April 1993.

AVC-497 MPEG-2 Working Draft - Video Part - Version 4 (Working Draft Editing Committee)

This document provides agreed syntax and other texts for the video part which were edited after the Sydney meeting.

AVC-498 Work plan for broadband audiovisual systems Recommendations (S. Okubo)

This document is reproduction of a contribution to SG15 Rapporteur's meeting held in May 1993 which raised the following for discussion;

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

AVC-499 Report of ITU-TS SG 15 Rapporteur's meeting in Tokyo (N D Kenyon)

This is a report of the three day SG15 Rapporteur's meeting held in May 1993, covering H.KEY, AV.420, JPEG profile and protocols for AV Recommendations, channel aggregation, data transmission in H.320-based systems, and workplan for broadband audiovisual communications.

AVC-500 Multipoint 4 QCIF to CIF video mixing (Bellcore)

System control aspects are discussed for achieving continuous presence multipoint videoconferencing using 4 QCIF to CIF video mixing. This document is reproduction of a contribution to SG15 Rapporteur's meeting held in May 1993.

AVC-501 Simulation studies of 4 QCIF to CIF video mixing (Bellcore)

Video coding aspects of 4 QCIF to CIF video mixing are discussed evaluating end-to-end delay, picture quality, buffer sizes and system complexity. Experimental results are also reported, indicating that intra slice method is effective in reducing delay. This document is reproduction of a contribution to SG15 Rapporteur's meeting held in May 1993.

AVC-502 MPEG 2 Ssytems Working Draft (Systems Committee Adhoc Group)

This was generated a the Amdsterdam meeting of the Systems Adhoc Group in June 1993.

AVC-503 Performance of the Main Profile @ Main Level - distributive and interactive services (BELGACOM, UCL)

Coded results for a fixed step size are presented with bit generation statistics and processed pictures. Original PAL sources of videoconferencing like sequence and TV programs are encoded with (M=1, N=50) and (M=3, N=50???), respectively.

AVC-504 MPEG-2 / H.26X error resilience based on data partitioning (BELGACOM, UCL)

Coded results for 2-layer data partitioning are presented where the bitstream generated is packetized at the slice level into two priorities with the low priority layer suffering 10^{-3} CLR. Coded pictures for two sequences and two different sets of PBP values are demonstrated.

AVC-505 New results on spatial scalability (BELGACOM, UCL)

Experimental results are reported on comparison of simulcast vs spatial scalable coding for TV and HDTV. SNR data and processed pictures are presented for total of 20 and 25 Mbit/s where 6 Mbit/s is assigned to the TV coding. Spatial scalable shows 0.5 dB SNR increase compared to simulcast.

AVC-506 Concern regarding MPEG-2 Systems and ATM/AAL functionality (Australia)

Concern is expressed that ITU-TS SG15's indication of desire to use MPEG-2 Systems specifications for audiovisual communications is premature. It is concluded that the definition of AAL Type 2 is a matter of urgency which this Experts Group should undertake at the earliest possible time, and that the objectives should include recommendations to SG13 for functionality for a generic AAL Type 2 that allows full exploitation of the network functionality while still working with MPEG-2 Systems in a simple, efficient manner.

AVC-507 H.32X terminal and MPEG-2 Systems (Aus. UVC)

This document presents an overview of H.32X terminal, AAL functionality for an audiovisual terminal, illustration of data flow in the H.32X terminal, MPEG-2 Systems functionality, and some scenarios for coping with the overlap between MPEG-2 Systems and AAL/ATM. AAL Type 2 proposal is attached which consists of SAR (ST/SN/HEC/47 Bytes SAR-PDU payload) and CS (CMI/TS/variable size CS-PDU payload/PAD/LI/CRC). As a conclusion, importance is stressed for establishing required AAL modes of operation before suitable mechanisms to support them are determined.

AVC-508 B-ISDN & Video Services Tutorial (S. Dunstan, Siemens)

This document gives an overview of B-ISDN as described in the ITU-TS Recommendations, covering B-ISDN services, Protocol Reference Model, ATM layer, switching and network functions, AAL layer and signalling. The aim is to assist in a common understanding of B-ISDN principles and terminology.

AVC-509 Flexible Object Oriented Decoding Using Slice Identification (Aus. UVC)

An idea is presented to allow separately encoding objects which consist of slices with identical identification, thus to allow separate and complete decoding of each object individually. Each object may have fixed/variable shape and fixed/variable position from one frame to another. For this purpose, a new syntax element **slice_id** (4 bits) is proposed for inclusion in the slice header.

AVC-510 FF & FR using Frequency Scalability layered coding (Aus. UVC)

Experimental results are reported for use of Frequency Scalability to achieve FF/FR functionality. Speed up factor of 3 and 12 have been simulated for a 3-layer scheme with the lowest layer containing at maximum 2x2 DCT coefficients.

AVC-511 Report of Ad-hoc Group on ATM Cell Loss and Error Resilience (M. Biggar, chair)

This is a report of the adhoc group activities after the Sydney meeting in March - April 1993. Some discussions are described and error resilience description is offered for inclusion in the Working Draft.

AVC-512 Design of H.32z terminals for LANs (Aus. UVC)

Two options for the design of LAN-attached desktop multimedia terminals (H.32z terrminals) are discussed; one is to retain H.221 framing and to place one or more H.221 frames into packets for transmission across the LAN, the other is to packetize each data stream (video, audio, signalling, etc.) and to transmit them separately across the LAN using a different LAN packet.

AVC-513 H.22z protocol for LANs (Aus. UVC)

This document describes an H.22z protocol for transporting real-time audiovisual/multimedia information over packet switched local area computer networks. The required functions are identified; packetization, multiplexing, error handling and timing recovery. Then a corresponding packet structure is proposed.

AVC-514 Time stamp for a large picture (Japan)

A proposal is made to the definition of Presentation Time Stamp for "large pictures", which is followed by skipped pictures, and to the handling of such PTS at the decoder. The solution is similar in approach to the one for VBV; if the buffer does not contain complete data at the time indicated by PTS, no action is taken and checking the buffer proceeds to the next timing.

AVC-515 Considerations on AC-leaky Prediction (Japan)

After having reviewed previously obtained study results, preference is given to that AC-leaky prediction should be outside Next Profile since existing Intra Slice and Short Slice methods provide similar effects.

AVC-516 Considerations on the next profile (Japan)

This document lists syntactic elements which may be included in the Next Profile and provides four possible solutions, out of which Solution C (to define a single Next Profile with selected mandatory elements) is concluded preferable. Then requirements from the audiovisual communication applications are discussed to conclude that Spatial Scalable Extension should be included as a minimum for H.261 backward compatibility and error resilience.

AVC-517 Practical examples of Hierarchical coding (Japan)

This document lists practical examples of hierarchical coding, indicating picture and syntax of each hierarchy. Some questions are raised toward definition of the Next Profile.

AVC-518 Syntax modification for compatibility/spatial scalability (Japan)

A modified syntax is proposed to remove redundancy in motion vectors for spatial only prediction and in **prediction_weight_code** for full spatial prediction macroblocks. Experimental results are presented to verify the effectiveness of this modification.

AVC-519 VBV operarion in 3:2 pulldown (Japan)

Based on a review of the 3:2 pulldown related coding operation, the following is proposed;

- Period t of the VBV operation should be calculated on the parameters contained in the last picture removed from the buffer.
- Coding should be carefully controlled for 3:2 pulldown so that VBV specification is not violated due to the change of field_count sequence between the source order and the coding order.
- Picture skipping must not take place in the 3:2 pulldown mode.

AVC-520 Some considerations on the coding segments(Japan)

Coding-decoding delay is analyzed for concatenation of M=3 and M=1 segments. It is pointed out that some care should be paid in coding control to maintain low buffering delay and to avoid VBV violation.

AVC-521 Correction method for cell loss and bit error in AAL Type 1 (Japan)

A cell interleaving method for AAL Type 1 is proposed which applies RS(48,44) to a block of 12 cells. This FEC code has capability of correcting a single cell loss in the block with encoding-decoding delay of 24 ms at 384 kbit/s. This document also discusses separation between SAR and CS, protection

against successive cell losses, hardware complexity and extension to other AAL. Items requiring SG13 advice are pointed out; partitioning SAR and CS, use of CSI bits.

AVC-522 VBR coding and octet interleave (Japan)

Experimental results are reported for the two methods to give upperbound for the octet interleaving delay; to keep a minimum bitrate, and to set a time-out for flushing the interleaver matrix. It is shown that both methods are effective in reducing the delay and increase of the step size is small, particularly if there is more strict UPC.

AVC-523 Low delay IPB mode transmisssion using VBR (Japan)

Experimental results are reported to achieve low delay by the utilizaion of periodical nature of the VBR coded bit generation in IPB structures. Two mehtods are studied; use of special relationship bwteen the GOP size and UPC window size, and declaration of a higher average bitrate.

AVC-524 Relation between MPEG-2 transport mux and ATM/ALL and possible candidates for AAL (Japan)

Based on review of the MPEG-2 Systems and the I.363 AAL, relationship between them is discussed for designing audiovisual communication terminals. It is concluded that use of PES packets may be preferable for video service integration, but use of TS packets may be redundant. A notion of H.32X transport packet is offered for discussion which segments the PES packet and have such features as variable length to support different QoS, software implementation. Appropriate AALs to transfer the H.32X transport packets are also discussed; Type 5 and Type 4 SAR modified.

AVC-525 Telecommunication requirements for the Next profile (NL,I,UK,N,FRG)

The following requirements from telecommunication applications are listed as mandatory; H.320 interworking (including video, audio, multiplexing, call control, etc.), H.261 compatibility, MPEG-1 compatibility (including video, audio, systems), low end-to-end delay (less than 150ms), cell loss resiliency (up to 10^{-2} CLR), bitrate range from 64 kbit/s to several tens of Mbit/s.

AVC-526 Telecommunication levels for the Next profile (NL,I,UK,N,FRG)

Two specific levels in the Next Profile is discussed for telecommunication applications; Main level, (wide screen) SCIF level. Selection of syntactic elements for the Next Profile is also discussed by marking the TM5 syntax.

AVC-527 Software decoding of video streams (PTT Research)

Information is provided on the design and implementation of a software decoder for MPEG-1 video streams (paper by K. Patel et al). It is shown that memory bandwidth is the primary limitation in performance of the decoder, not the computational complexity of IDCT.

AVC-528 Inter working between wide screen SCIF and SCIF video conferencing systems (PTT Research)

The following three interworking situations are depicted which are covered by the MPEG-2 syntax;

- interworking between the H.32X B-ISDN normal screen terminal operating at SCIF and the H.320 N-ISDN terminal operating at CIF,
- interworking between the 16:9 wide screen SCIF terminal and the 4:3 normal screen SCIF terminal by means of side panel,
- interworking among the three stated above.

AVC-529 On the B-frame design complexity of spatio-temporal weighting (NL)

This document examines hardware complexity for supporting B frames and spatio-temporal weighting, obtaining the following conclusion;

- Spatio-temporal weighting gives a gain in SNR performance which may further increase by the future techniques.
- It requires higher memory bandwidth, but if B frames are incorporated, the resource can also be used for spatio-temporal weighting in I and P pictures.
- For M=1 coding, support of spatio-temporal weighting requires additional memory bandwidth.

AVC-530 European stance on leaky prediction (F,FRG,B,N,I,NL,UK)

The inclusion of the AC-leaky prediction is not supported, for error concealment purpose, in the NEXT or the SIMPLE profile on the grounds that it does not outperform other existing solutions.

AVC-531 Simulation results on AC-leaky prediction (F)

This paper follows the main guidelines of Core Experiment F4 on AC-leaky prediction. The following aspects are tested : coding performances without loss and cell loss concealment capability.

AVC-532 Cell loss resilience: simulation results on concealment techniques (F)

This paper provides some results on the concealment techniques proposed in TM5 : Substitution from previous frame with and without motion compensation , Intra MV. Simulations are done in M=1 context.

AVC-533 Experiment on spatial/temporal H.261/H.26x compatibility (F)

This paper presents the results of a (core) experiment about H.261/H.26x compatibility by using the two layered prediction scheme. We used the **prediction_weight_code** table proposed in TM5 , which includes a half compatible/half temporal prediction. Simulation results and our point of view concerning the need of this latter prediction mode are given.

AVC-534 Comparison of CTV/HDTV compatible coding schemes (ETRI)

Coding performance (SNR) is reported for the following two CTV/HDTV compatible coding schemes at 12+13.5 Mbit/s; pyramidal DCT, and spatio-temporal predictive coding. Both of the base layer and upper layer use TM5. Two up/down conversion filters of CMTT and MPEG are also compared. It is concluded that the spatio-temporal prediction method gives a little superior performance and that the TM5 filters give better performance in the spatio-temporal scheme.

AVC-535 Invitation to the 14th ATM Video Coding Meeting (ETRI)

This document provides information on the meeting in Daejon

AVC-536 Cleanup of AC-Leak Syntax and Specification (AT&T)

AC-leak syntax is proposed to be a separate extension with its own unique identifier. Semantics for the AC-leak are also clarified.

AVC-537 Comparison of the Cell-Loss Resilience of MPEG-2 Main Profile and AC-leaky prediction (AT&T)

Experimental results are reported for the AC-leak method comparing with the Main Profile (N=15); quality when there is no error, cell loss resilience, and channel hopping speed. It is concluded that;

- quality for M=1 with D=6 and N=15 is nearly identical,
- the AC-leak gives visually less objectionable pictures against cell losses, particularly with D=6,
- in the worst case a very clear image is available after 12 frames with D=6, but the picture is very recognizable after 6 frames.

AVC-538 Method for the correction of cell losses for low bit-rate signals transport with the AAL Type 1 (France)

This documents intends to respond to the liaison from TG CMTT/3 which is requiring a cell loss correction method adapted to high quality sound transmission with low delay at low bitrates. The method uses diagonal octet interleaving for 16 cells and FEC (RS codes). As a conclusion, a common cell loss correction method is proposed for all real-time low bit-rate services using AAL type 1.

AVC-539 Semantics for skipped macroblocks in spatial scalability (BT)

This document proposes clarification and addition to WD for skipped macroblocks taking spatial scalability into account.

AVC-540 Semantics for prediction of motion vector in spatial scalability (BT)

This document proposes clarification and addition to WD for prediction of motion vector to include spatial scalability. VLCs for **macroblock_type** are also proposed.

AVC-541 Syntax and semantic extensions for spatial scalability (BT)

This document proposes a picture layer syntax for spatial scalability as well as a macroblock layer syntax for snr scalability.

AVC-542 Spatio-temporal weighting experiments (BT)

Experimental results are reported for coding efficiency and picture quality of the three methods of spatio-temporal prediction; simple switching, simple switching plus averaging, optimum continuous weights. It is concluded that the third method which requires downloadable weights is not worth the cost, and that the second average mode method gives a little gain, while increasing the complexity a little, thus is proposed to be in the standard.

AVC-543 Accuracy requirements of upsampling (BT)

Experimental results are reported for comparison between 4 different upsampling filters in the decoder in the spatial scalable scheme where an encoder upsampling filter is used It is concluded that the upsampling process need not be performed exactly the same in the encoder and decoder to get the same subjective picture quality at the encoder and decoder and that the simplest interpolation is sufficient. The pel repetition, however, gives poor quality.

AVC-544 Frequency adapted spatio-temporal weighting (BT)

Experimental results are reported for frequency adapted spatio-temporal prediction where the spatio-temporal prediction signal is derived by averaging the two horizontally low passed components (spatial one and temporal one) and adding the temporal high pass component. It is concluded that this technique gives a small but noticeable gain, thus a core experiment is proposed for its optimization.

AVC-545 Results on spatial scalability Core Expt. TM5 G.6.6 (Tektronix)

Experimental results are reported for comparison of coding efficiency (SNR) between simulcast, spatial scalability with weighted prediction and spatial scalability with binary selection. It is concluded that there is an SNR gain from using either of spatial scalability and that spatial scalability with binary selection performs better than spatial scalability with weighted prediction. It is also stated that spatio-temporal weighting adds hardware complexity.

AVC-546 Missing information and inconsistencies in TM5, MPEG2 Working Draft (Tektronix)

Some items needing correction or new definition are pointed out for the specifications of WD (MP@ML) and TM5 (spatial scalability).

AVC-547 Preliminary studies into ATM mapping of MPEG-2 Transport Layer Packets (BT)
AVC-550 About the transfer of MPEG transport packets in ATM (CNET)

Methods for transmitting MPEG-2 TS packets over ATM networks are discussed referring to the Bellcore contribution to the Atlanta Systems group meeting. Assuming that transmission efficiency and cell loss resilience are of prime importance, the following scenario is proposed as the best compromise; use of AAL Type 1, no padding octets by use if "alignment" mapping and packet length of nx47 octets.

AVC-548 Experiments on the effect of losses of picture-type or f-code in picture headers (David Sarnoff)

Experimental results are reported on the impacts of picture header information loss causing serious damage in decoded pictures. It is proposed to allow redundant transmission of very sensitive data within the picture headers to improve the noise channel performance.

AVC-549 Experiments on the effect of loss of quantizer matrices in picture headers (David Sarnoff)

Experimental results are reported on the impacts of quantizer matrix information loss. It is concluded that quantizer matrix changes slightly degrade the quality of decoded pictures, thus redundant transmission of this information is not required.

AVC-551 ITU-TS patent policy and MPEG-2 follow up (Siemens)

The ITU-TS policy is reminded and it is proposed that the AVC Rapporteur Group starts collecting patent information and that the Group declares its desire to follow the waiving approach.

AVC-552 Test Model 6 (Test Model Editing Committee)

This document describes experiments on optimization of upconversion filter for spatial scalability, optimization of macroblock type tables and verification of temporal scalability.

Temporary Documents

TD-1	Chairman	Agenda for the sole sessions in Boston
TD-2	Chairman	Available documents for the Boston/New York meeting
TD-3	Chairman	List of tape demonstrations
TD-4	G. Bjoentegaard	Proposed text for WD Annex C
TD-5	Chairman	List of open issues - April 1993
TD-6	Chairman	Fields in Protocol Data Unit and their functions
TD-7	Chairman	Independent clocks and their recovery methods
TD-8	S. Dunstan	Results of meeting to discuss ATM/AAL and MPEG-2 Systems
TD-9	Chairman	Summary of the discussion on AC-leaky prediction
TD-10	S. Okubo, K. Asai	Cell loss correction method for AAL Type 1 to support H.320 terminals in B-ISDN
TD-11	Chairman	Agreements and actions (substitute of the meeting report)
TD-12	A. Tabatabai	Report of the small group work to sort out the discrepancies in proposed solutions for the spatial scalable syntax

END

List of Tape Demonstrations
(8 July 1993, Boston)

No	Organization	Topics	Tape	Doc.
a	BELGACOM	MP@ML performance	D-50	AVC-503
b	BT Labs	Spatio-temporal weighting	D-50	AVC-542
c	BT Labs	Spatial scalability upsampling filters	D-50	AVC-543
d	BT Labs	Spatio-temporal weighting	D-50	AVC-544
e	Monash University	Object oriented decoding	D-50	AVC-509
f	Monash University	FF/FR using frequency scalability	D-50	AVC-510
g	CNET	AC-leaky prediction	D-50	AVC-531
h	CNET	H.261 compatibility	D-50	AVC-533
i	CNET	Concealment techniques	D-50	AVC-532
j	AT&T Bell Labs	AC-leaky prediction	D-60	AVC-537
k	David Sarnoff	Error resilience - loss of picture_type, f_code	D-60	AVC-548
l	David Sarnoff	Error resilience - loss of quantizer matrices	D-60	AVC-549
m	NEC	Overlapped MC	D-60	(LBC)

ISO/IEC
JTC1/SC29/WG11
MPEG93/699
July 1993

Source: **Experts Group for ATM Video Coding.**
Subject: **Proposed text for WD Annex C - Video Buffer Verifier.**
Purpose: **Proposal.**

The TSS Experts Group for ATM Video Coding discussed the item of VBV operation to take care of picture skipping at the last meeting. It was agreed that a new text to replace Annex C in the WD was needed. I hereby send the agreed outcome from the group. First some background for our proposal:

1. VBV specifications of MPEG-1 are based on the following;

a) Use of a virtual buffer with size B which never underflows nor overflows
b) Removal of coded data for a complete picture
c) Data removal at every picture period

2. If we allow occasional picture skipping, b) or c) should be extended. The current VBV specifications in Annex C to WD is extending b) by introducing "removal of partial coded data", but maintaining c). This method, however, allows an infinite number of bits for a picture unless we specify a certain upper bound in addition to a).

3. The other possibility is to extend c) but maintaining b). We propose to adopt this method by making the data removal conditional; to remove a complete picture if it is available at a picture period, otherwise the coded data remains in the buffer. This method does not need additional specification of the upper bound for the number of bits per picture, because a) automatically guarantees this.

4. An important clarification is to specify to allow picture skipping only in local IPPP... situations. This seems to be a common understanding obtained in Sydney as expressed in Section 2.3.1/TM5.2 "skipped frames are only allowed for M=1". The problem is, however, that there is no way to convey M value, thus our interpretation is "local IPPP... situations" where no B picture is involved.

5. Another improvement of our proposal is to integrate the two cases in the current text distinguishing between all pictures being coded and some pictures being skipped. We think the above extension does not need this distinction.

<u>Proposal for new text for Annex C:</u>

Annex C 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 this Annex

Background.

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.3 below. Sequence header and group of picture layer data elements which immediately precede a picture are removed at the same time as that picture. 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. This is a requirement on the video bitstream including coded picture data, user data and all stuffing.

Encoders may wish to assign a large number of bits to a particular picture to cope with a scene change or for other purposes. If all of the subsequent pictures are to be coded, a large (but constant) delay is incurred. Hence some of the subsequent pictures can be skipped to realize low delay in the steady state. As a result of this it may happen that 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 neither the picture to be removed nor the previously removed picture is B type.

Definitions.

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

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

- To "Inspect the VBV" means to check if the occupancy of the VBV lies between zero bits and B bits and to report VBV violation if the requirement is not fulfilled.

- The period of time, t, is 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 picture about to be decoded. The definition of t is 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.

Procedure for VBV examination

1 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.

2 Inspect the VBV.

3 If the buffer contains complete data for one picture, all of the data for the picture which has been in the buffer longest is instantaneously removed from the VBV.

4 If the buffer does not contain complete data for one picture, either of two actions are taken: If the picture to be removed or the previously removed picture is B type, then report VBV violation. Otherwise proceed without further action to clause 5.

5 After a period of time, t, go back to Clause 2.

END

ISO/IEC
JTC1/SC29/WG11
MPEG93/700
JULY 1993

SOURCE : EXPERTS GROUP FOR ATM VIDEO CODING IN ITU-TS SG 15
TITLE : SUMMARY OF THE DISCUSSION ON AC-LEAKY PREDICTION
Relevant Sub-group: Video

Input materials

AVC-515 (MPEG93/547)	Considerations on AC-leaky Prediction (Japan)
AVC-530	European stance on leaky prediction (F,UK,B,I,N,G,NL)
AVC-531 (MPEG93/599)	Cell loss resilience : simulation results on concealment techniques (France)
AVC-536 (MPEG93/620)	Cleanup of AC-Leak Syntax and Specification (AT&T)
AVC-537 (MPEG93/686)	Comparison of the Cell-Loss Resilience of MPEG-2 Main Profile and AC-leaky prediction (AT&T)

Comparison

<table>
<tr><th>Items</th><th>AC-leaky prediction
d=6</th><th>Intra slice
N=12</th></tr>
<tr><td>Coding efficiency / picture quality</td><td colspan="2">Almost comparable (Note 1)

Note 1- False contouring is slightly visible in the sky part of 525 line Flower-garden for AC-leaky pictures (demonstration associated with AVC-537).</td></tr>
<tr><td>Cell loss resilience</td><td colspan="2">One view: With concealment techniques where error locations are known, d=6 is visually equivalent to N<12 (AVC-537). If error locations are unknown, concealment cannot be used.

Another view: With concealment techniques(Note 2), d=6 and N=6 are comparable in demonstration, while d=6 and N=12 are comparable in SNR (AVC-532).

Note 2 - Use of other existing techniques such as Intra motion vector concealment, use of short slice may improve this performance for both d=6 and N=12.</td></tr>
<tr><td>Channel hopping</td><td>After 6 frames, reasonable representation of image is available. After 12-15 frames, almost complete image (within 1 dB) is available.</td><td>In most cases, complete image is available after 12 frames. In theory, the worst case requires 24 frames for obtaining complete image.</td></tr>
<tr><td>Additional hardware complexity</td><td>One view: trivial in the total system and in the codec chip.

Another view: not trivial in the video codec chip.</td><td>-</td></tr>
</table>

Conclusion

There has been no unanimous view on inclusion of the AC-leaky prediction in the standard.

Report of the small group work to sort out the discrepancies in proposed solutions for the spatial scalable syntax
(by Mr. Ali Tabatabai)

In our small group meeting, we addressed the following two issues:

1) Dummy motion vector

Two solutions were suggested to deal with dummy motion vector.

First solution is by Japan (AVC-518). In this solution, a new entry in **frame_motion_type** Table is defined with assigned code word of "00". This code was previously identified as "reserved" code. We feel the use of this code word may increase the potential of **start_code** word emulation.

The proposal outlined in BT contribution (AVC-540) is based on **macroblock_ype** VLC Table expansion. This solution may have an impact on hardware complexity, because of using longer VLC code words.

2) Full-spatial compatibility for B pictures

We recognized the need to add two new entries into the **macroblock_type** Table for B pictures to show "full-spatial" compatibility. The VLC codes corresponding to these entries are listed in Doc. AVC-518, Annex 1.

END

Source: Experts Group for ATM Video Coding in SG15
Title: Cell loss correction method for AAL Type 1 to support H.320 terminals in B-ISDN

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At the twelfth meeting of the SG15 Experts Group for ATM Video Coding held during 7-9 July in Boston, we reviewed the following two contributions regarding the subject matter;

AVC-521 Correction method for cell loss and bit error in AAL Type 1 (Japan)
AVC-538 Method for the correction of cell losses for low bit-rate signals transport with the AAL Type 1 (France)

Our fundamental position is that a sufficient level of network performance (cell loss ratio) should be available to allow simple terminal implementation. Before deciding adoption of the cell loss correction technique under discussion, we would like to confirm that this additional functionality of AAL Type 1 is really necessary

The attached material is summary of the discussion, comparing the following two methods in delay, cell loss correction capability and some other aspects;

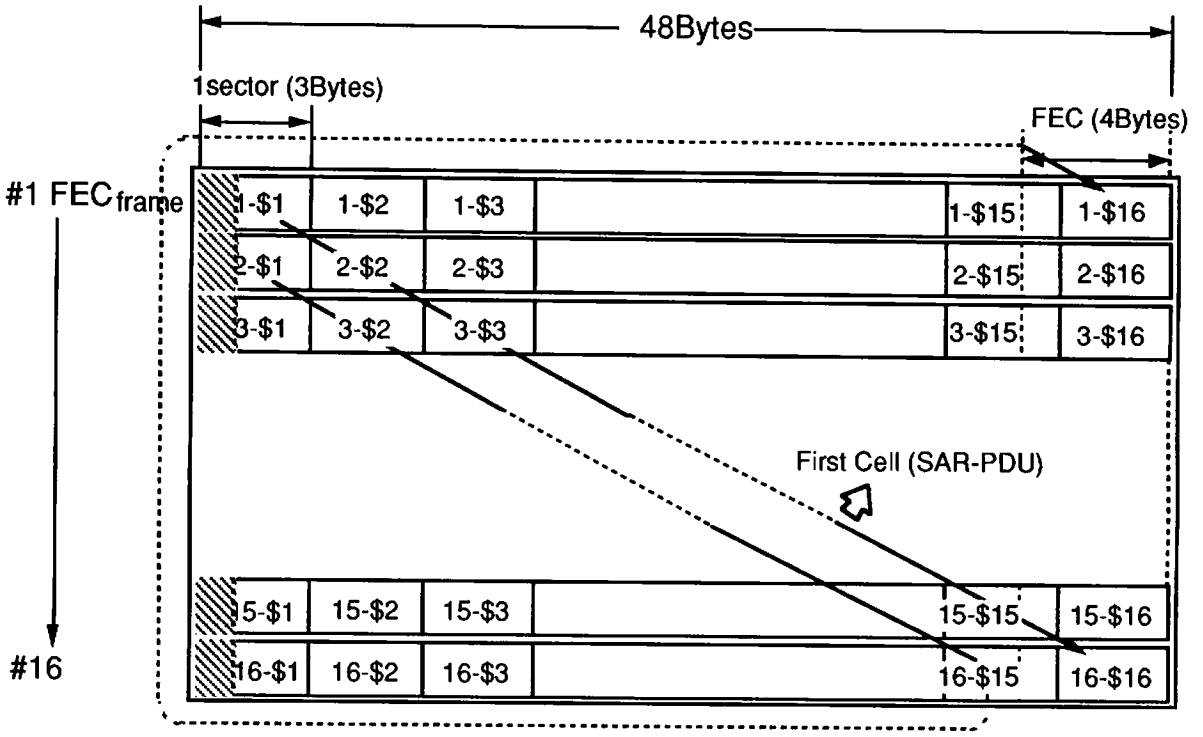
- separable FEC interleaving matrix as contained in AVC-521,
- its modification to the non-separable matrix as proposed in AVC-538.

We welcome any comments of SG13 on this comparison. We also seek advice on the method of synchronizing the interleaver matrices between the transmitting and receiving AALs as discussed in §4 of AVC-521, particularly on what combination of SRTS and SDT should be considered for supporting H.320 terminals on B-ISDN, including the B-N interworking situations.

Document AVC-521 is attached for your consideration (Note: AVC-538 has already been input to SG13 from France).

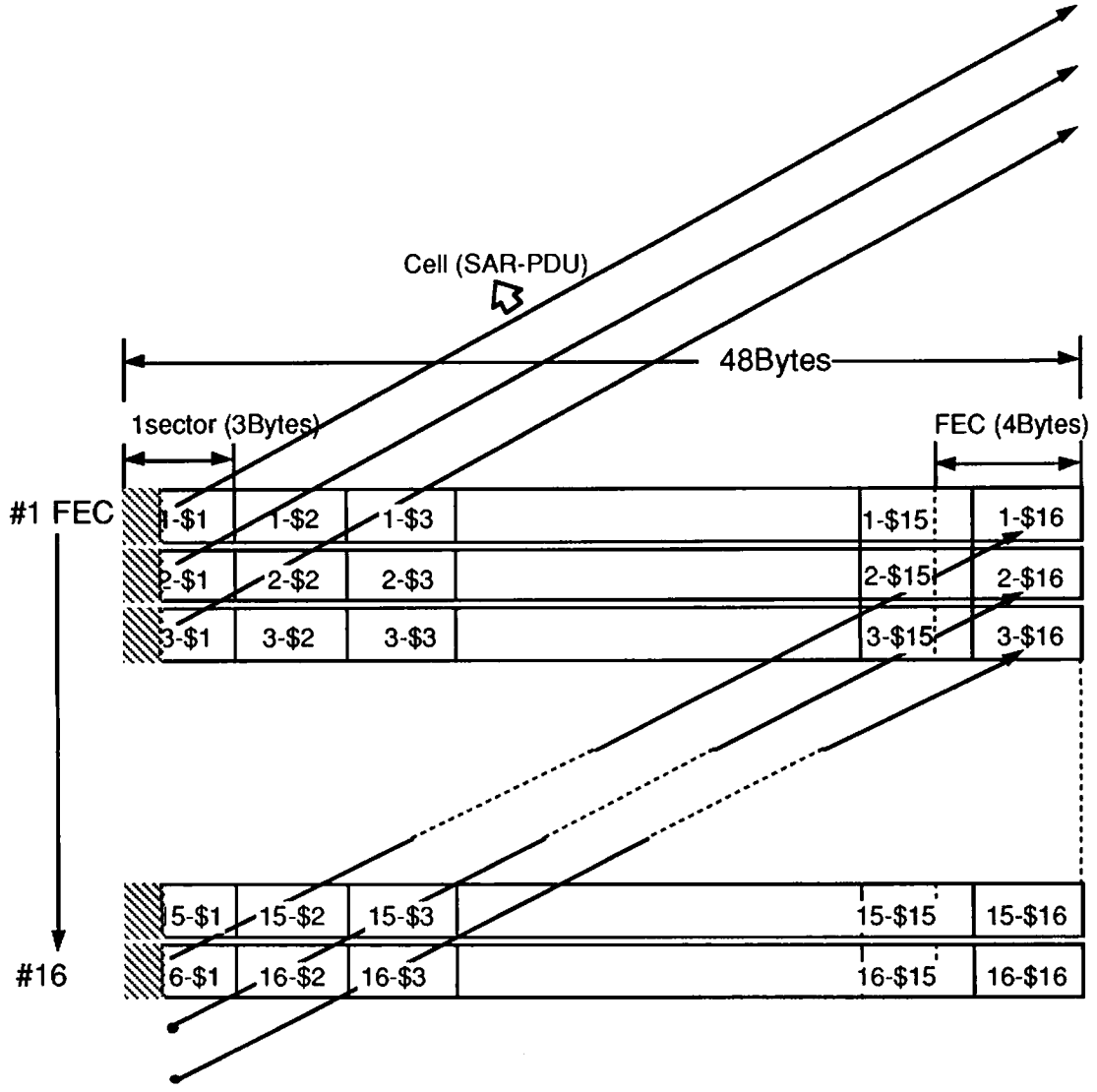
END

* SEPARABLE MATRIX: AVC-459(521)



RS(4844)FEC frame x 16 <=> 16 cells
(Closed form of Error Correction Matrix)
- Each cell Contains only one sector of each FEC frame.
- First sector of each FEC frame is also first sector of each cell.

* NON-SEPARABLE MATRIX : AVC-459(521)+AVC-538



RS(48,44) FEC frame x 16 ~16cells
(Open form of Error Correction Matrix)

* COMPARISON

- Correction Capability

RS(48,44) corrects { 1 cell/16 cells (cell loss) or 2 Bytes/48 Bytes (random error)

In both cases....
One sector from each FEC frame is in one cell.
----------> correction capability is the same.

- Processing Delay (Case of 384Kbps)

Separable Matrix
48(Bytes) x 8(bits) x 16(cells) x 2(sites)/384 x 10^3=32(msec)

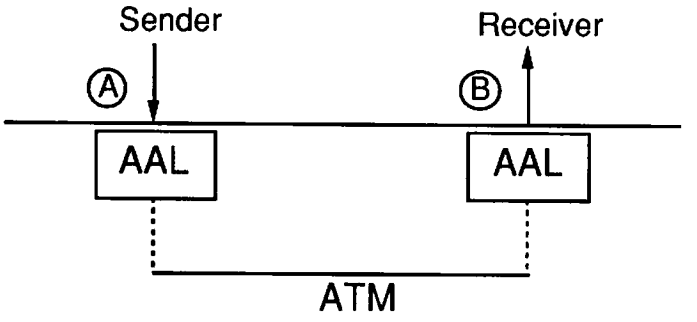
Non-separable Matrix
136(sectors) x 3(Bytes) x 8(bits) x 2(sites)/384$10^3$=17(msec)

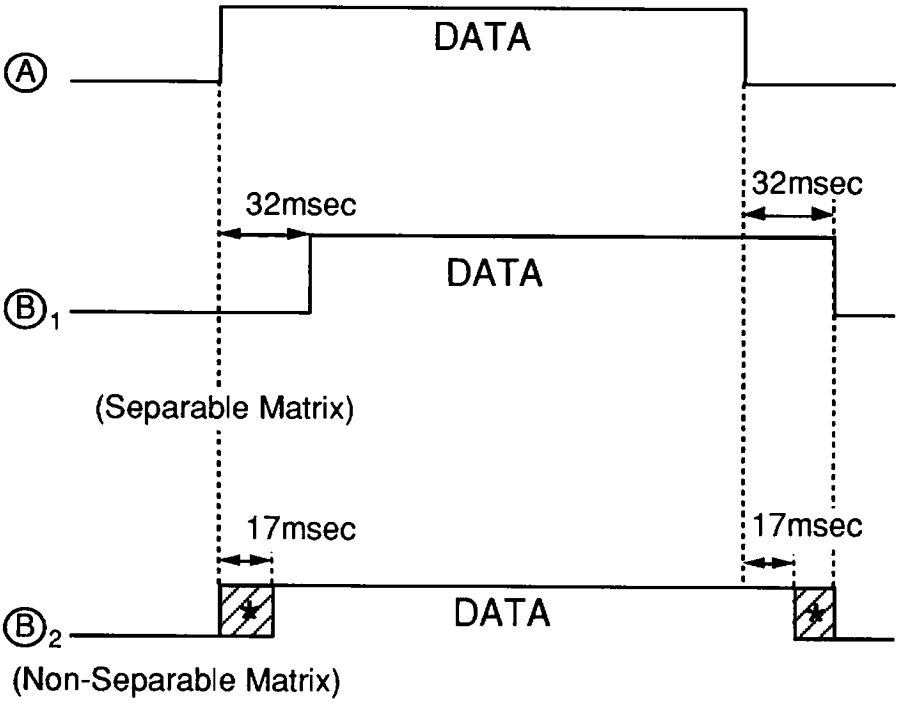
- Applicability

Separable Matrix
Applicable for multiplexing in unit of 16 cells
Applicable for VBR
Applicable at users level as well

Non-Separable Matrix
Applicable for non-multiplexing, CBR
Needs special treatment at Start and End (see next page)

* DATA TRANSPORT (Case of 384 kbps) ALL Type 1





* Shaded areas mean garbage data.

ISO/IEC JTC1/SC29/WG11
MPEG 93/698
July 12, 1993

SOURCE : ITU-TS SG15 Experts Group on ATM Video Coding

TITLE : Report of discussion on ATM/AAL and MPEG-2 Systems

0. INTRODUCTION

The relationship of ATM/AAL and MPEG-2 Systems was addressed in two distinct parts, as follows,

- system functionality required for the H.32X terminal
- adaptation of MPEG-2 Systems Transport Stream to ATM.

1. H.32X TERMINAL

1.1. Functions required between elementary streams and ATM layer

System functions required to transport a number of elementary streams in the H.32X terminal, to a receive H.32X terminal were identified as follows,

- transfer of variable length data units. Interval between data units may be fixed or variable.
- multiplexing and synchronisation of elementary streams
- capability to synchronise source and receiver clocks
- error detection capability

In the H.32X terminal these functions are to be distributed between

- H.22X - nominally MPEG-2 Systems
- I.363 - the ATM Adaptation Layer

It is noted that MPEG-2 Systems may have some of the functions of a generic AAL type 2 i.e. source and receiver synchronisation.

1.1. Error strategy

Some error detection capabilities are required. Possibilities to deal with errored data units include,

- discard of whole data unit
- delivery of errored data units, with indication of error position

The former strategy enables simpler error detection procedures, but causes error multiplication. The latter allows parts of the data unit already received to be used by the decoder. Examples of both strategies are discussed in a following section.

1.2. Alignment between elementary stream structure and packet boundary

Alignment between some structure in the elementary stream may not be mandatory, but H.22X and I.363 functionality should not prohibit it. For example alignment of the start of the video slice to the start of a cell payload has been shown to provide good spatial error localisation.

1.3. H.22X and ATM/AAL alternatives

Three options regarding distribution of functionality between H.22X and ATM/AAL were considered. In all cases the MPEG-2 Systems PES stream was nominated for inclusion in H.22X.

The PES layer is assumed to include the following functions

- multiplex - 8 bit stream_id field is considered adequate capacity
- receiver clock synchronisation - ESCR field
- elementary stream synchronisation - PTS and DTS

The following issues are raised in relation to the PES syntax

- packet_length field occurs at start of PES packet, and causes segmentation of the PES packet to be delayed until the complete PES packet has been assembled.

Proposal - make PES packet length field optional, and don't use in H.32X. Equivalent error detection can be provided by SAR sublayer.

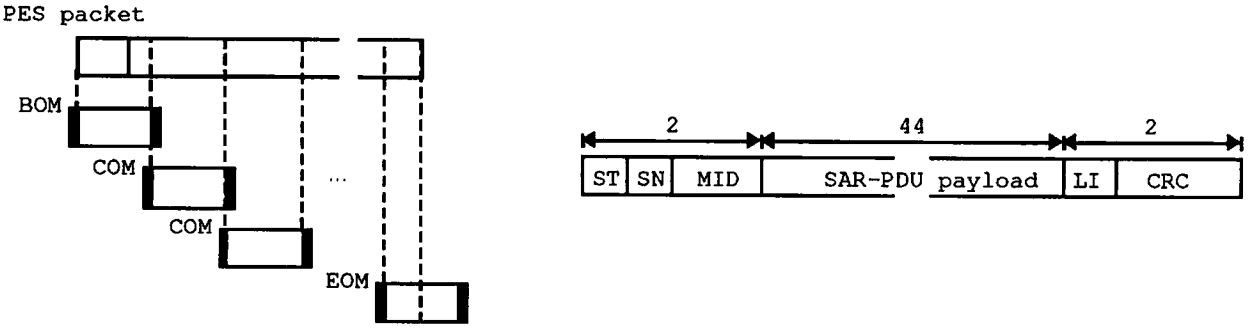
- packet_start_code_prefix is redundant.

  Proposal - code it, but ignore it in H.32X. This framing function can be provided by SAR sublayer.

- in the cases where multiplexing is done at the PES level, PES packet length must be constrained so as to limit multiplex delay

In the following sections reference to existing AALs indicates possible use of the respective mechanisms in AAL type 2, which is the appropriate AAL for the H.32X terminal.

1.3.1. Case A: PES packet + modified AAL type 4 SAR



a) PES and SAR relationship b) SAR-PDU structure

Figure 1. Case A: PES packet + modified AAL type 4 SAR sublayer.

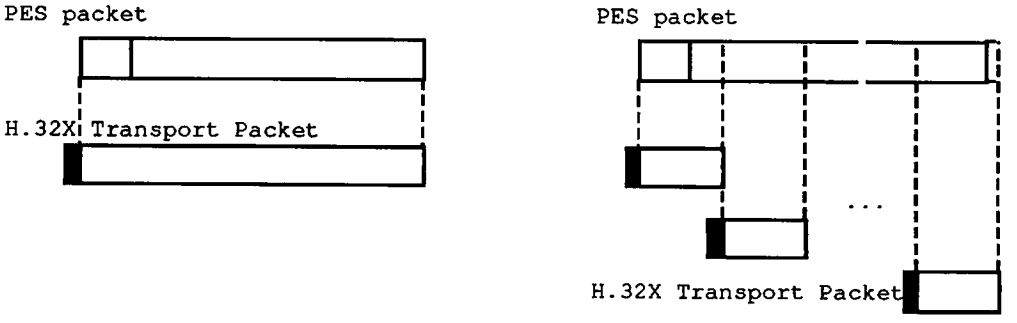
Features

- can detect cell loss location. Hence errored PES packets, with error location information coded as side information or as embedded error codes, can be delivered to decoders
- low delay - multiplexing and error are done on a segment basis
- has bit error detection

Problems

- less efficient than other methods

1.3.2. PES packet + modified Transport Stream packet + AAL type 5 CPCS/SAR



a) Error free b) Error prone

Figure 2. Case B: PES packet + modified Transport Stream packet + AAL type 5 CPCS/SAR

H.32X Transport Stream packet is modified MPEG-2 Systems Transport Stream syntax. H.32X Transport Stream packet length should be variable, and able to be selected on a call by call basis.

Scenario: H.32X terminal communicating with video data base. PES packet on data base may be long. H.32X Transport packet needs to be chosen according to error parameters for a particular call i.e.

- high quality link - map one PES packet to one Transport Stream packet

- low quality link - map one PES packet to a number of smaller Transport Stream packets

Features

- efficient

Problems

- cannot determine location of error in case of cell loss. Cell loss causes whole Transport Stream packet to be discarded

1.3.3. PES packet plus + AAL type 5 CPCS/SAR

Features

- efficient

Problems

- cell loss causes whole PES packet to be discarded.
- PES packet size is dependent upon multiplexing delay constraint.

1.3.3. Discussion

Of all these cases case A provides the shortest delay as well as the most robust performance. The other cases are more efficient but cause the whole data unit to be discarded.
AAL type 1 mechanisms were also considered but no clear solution could be found.

1.4. H.32X and time base

Only one time base is required in the H.32X terminal. Hence the H.32X terminal corresponds to one program.

2. TRANSPORT STREAM AND B-ISDN

Given that it is required to deliver a Transport Stream across a number of systems, one part of which may be ATM/B-ISDN, what is the best way to adapt Transport Stream packets to the ATM/B-ISDN part of the link?
For the B-ISDN connection

- some error detection capability is required
- it is believed that SAR/CS mechanisms common to other AALs should be used if possible.

Consideration is given to the use of AAL type 1 and AAL type 5 mechanisms.
A suitable error correcting code for the length of Transport Packet under consideration is a shortened RS(255,251) code. This is able to correct 2 bytes. This code, and CRC32, is referred to in the following figures.
Figure 3 shows the Transport Stream packet and AAL type 1. Sequence numbers are available in SAR-PDU headers. In the case of cell loss the unerrored part of the Transport Stream may be forwarded to the decoder when the shortened RS(255,251) is used. The Transport Stream packet should have a length of 184 bytes. A length of 232 bytes may also be suitable.

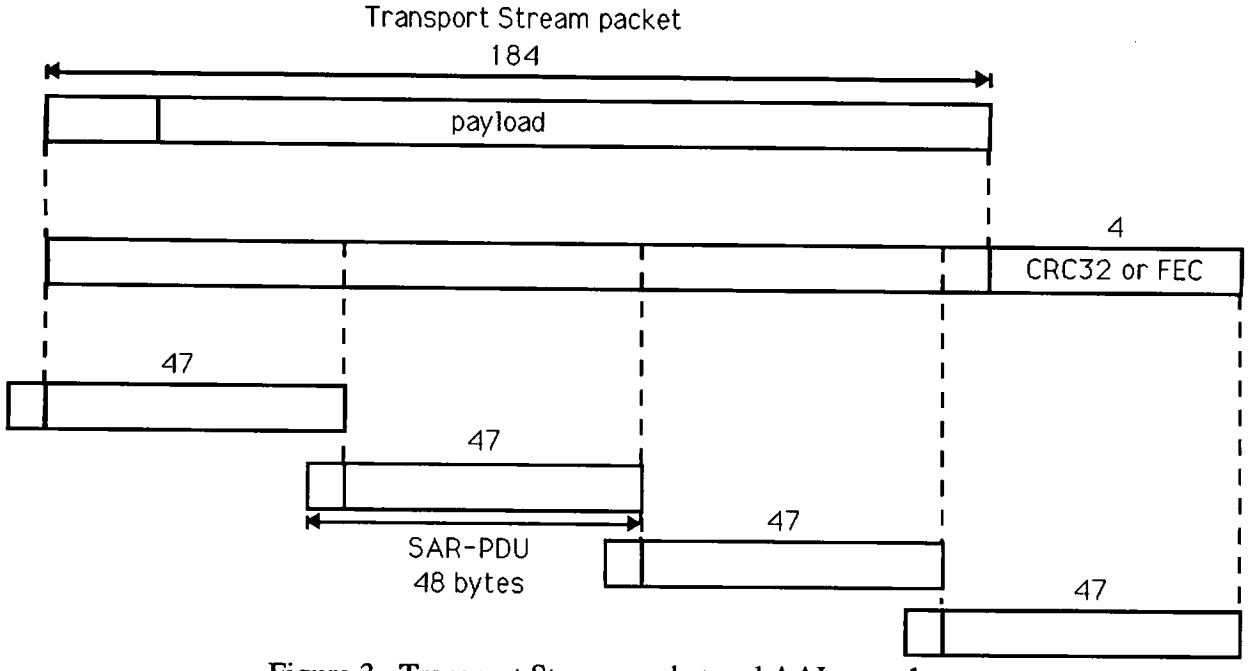


Figure 3. Transport Stream packet and AAL type 1.

Figure 4 shows the Transport Stream packet and AAL type 5. The Transport Stream packet length is n x 48 - 8, which is 184 or 232 for n=3 and 4 respectively. In the case of cell loss the whole Transport Stream packet is discarded.

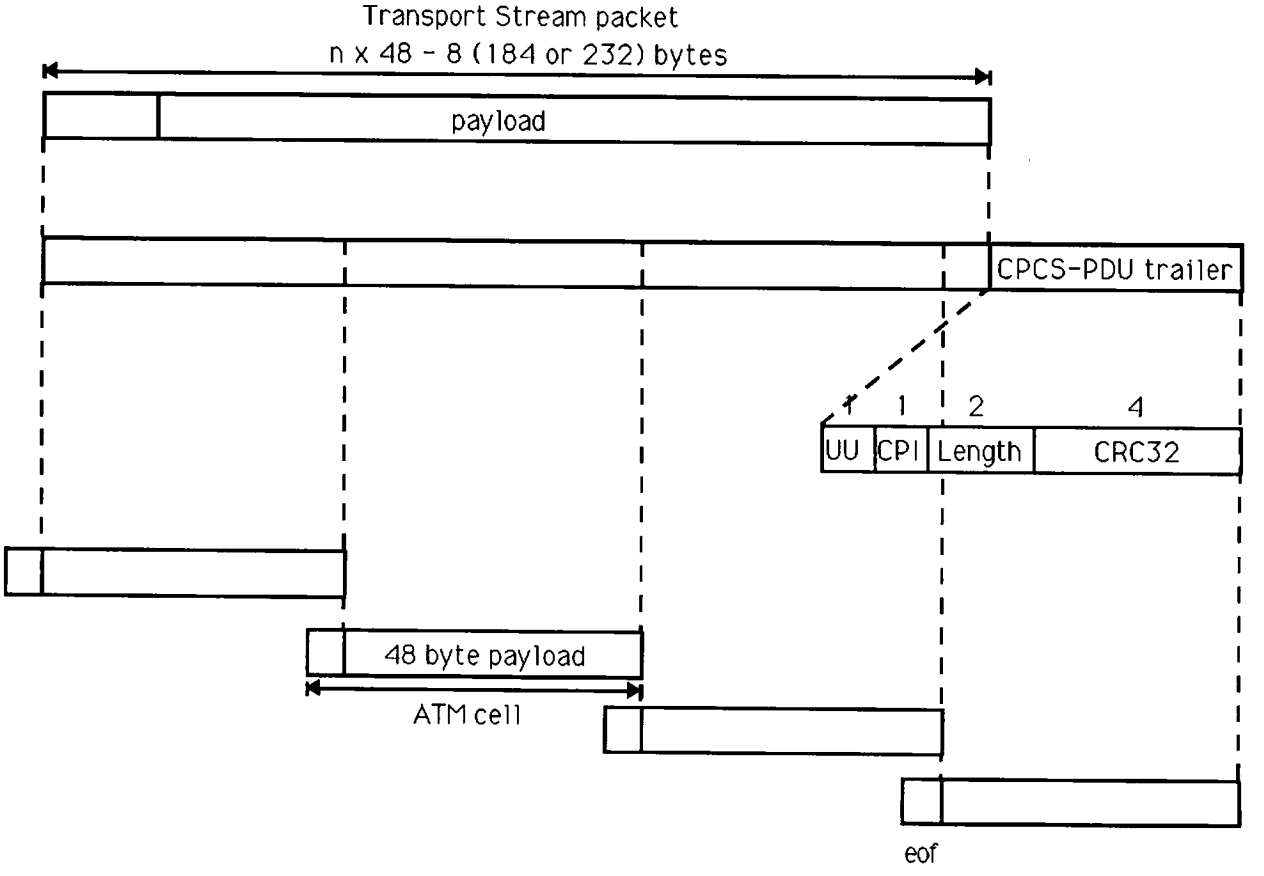


Figure 4. Transport Stream packet and AAL type 5

Figure 5 shows the Transport Stream packet and use of an AAL type 5 structure, but which uses only error detection/correction.

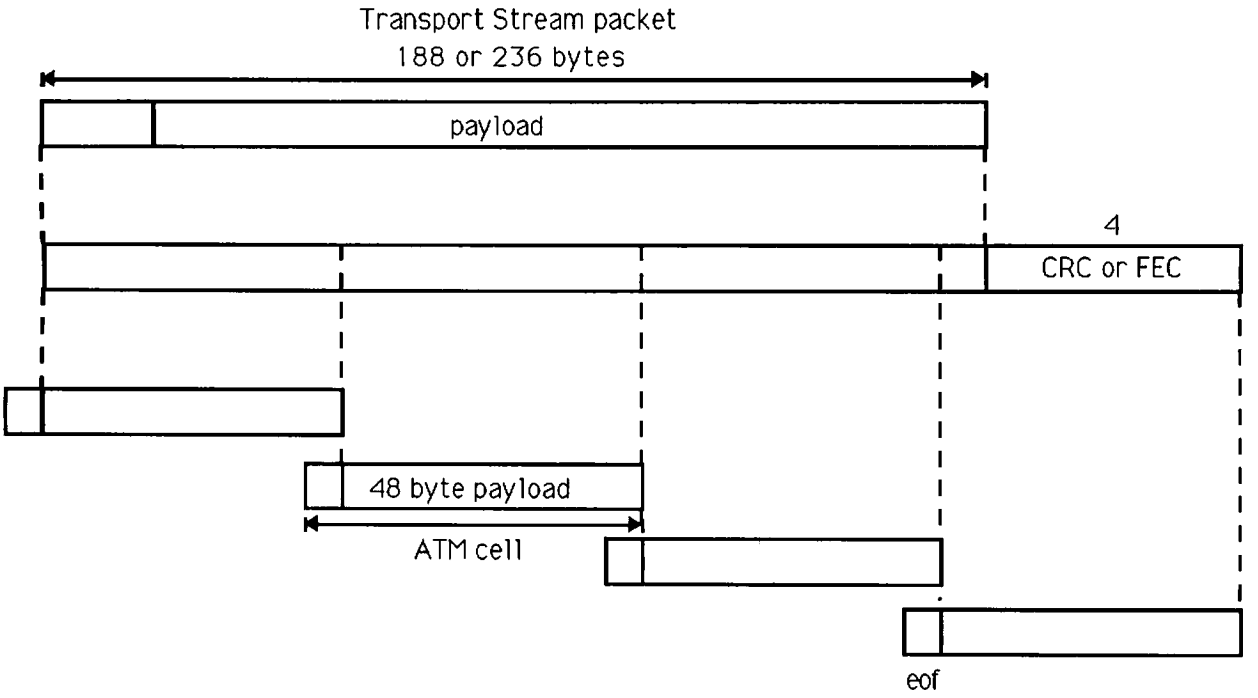


Figure xx. Transport Stream packet and new AAL.

- end -