CCITT SGXV
Working Party XV/1
Experts Group for ATM Video Coding

Document AVC-106R
August 23, 1991

SOURCE : CHAIRMAN
TITLE : REPORT OF THE ~~SECOND~~ THIRD MEETING OF THE EXPERTS GROUP FOR ATM VIDEO CODING IN SANTA CLARA (August 14-23, 1991) - PART I
Purpose: Report

PART I - INDEPENDENT SESSIONS

1. General
2. Documentation
3. Tape demonstration
4. Discussion
5. Work plan and work method
6. Actions to other groups
7. Others

1. General

The third meeting of the Experts Group was held in Santa Clara (USA) at the kind invitation of AT&T, Bellcore, C-Cube Microsystems and CLI. The first part of the meeting, held during August 14-16, consisted of CCITT independent sessions, while the second part, held during August 14-23, consisted of joint sessions with ISO/IEC JTC1/SC2/WG11 (MPEG) and a closing session. The list of participants appears at the end of this report.

At the start of the meeting, Mr. Haskell made a welcome address on behalf of the hosting organizations.

At the closing session, Chairman thanked the hosting organizations for the meeting facilities provided and the excellent secretarial support.

2. Documentation (TD2)

For this meeting, 41 AVC-numbered documents and 11 temporary documents were available as listed in Annex 1.

3. Tape demonstration (TD4)

Several video tape demonstrations were given with D1 or U-matic to present experimental results as detailed in Annex 2.

4. Discussion

4.1 Reports of the meetings relevant to the Experts Group

4.1.1 Paris meeting of the Experts Group (AVC-65R, AVC-66)

The meeting reviewed the report of the closing session and the joint sessions at the Paris meeting. As to the discussion of the joint work method, see §6.3 of this report. Mr. Sandgrind called attention to Mr. Bjoentegaard's comment on the time schedule of the Santa Clara meeting of Video sub-group and necessary reduction of number of proposals to the Kurihama test.

4.1.2 CMTT/2 Special Rapporteur's meeting (AVC-67)

Mr. Carbiere gave on overview of the liaison statement which has been sent to CCITT SGXV and ISO/IEC JCT1/SC2/WG11. Annex of AVC-67 was consulted during the discussion of requirements to the H.26X codec.

Chairman's Note - During the review of AVC-67, there was a question whether 486 active lines per frame for CTV (525 line system) is correct or should read 480. According to CCIR Rep.624-3, blanking period for System M is defined as 19 to 21 lines which lead to 242.5+/-1 active lines per field. Rec. 723 source coding covers 248 lines per field.

4.1.3 SGXVIII meeting (AVC-68)

This liaison statement to this group contain study results on CLP issues, UPC issues and IVS baseline document. Each of which was discussed at the corresponding discussion item below.

4.2 Picture format

4.2.1 Number of formats (AVC-102,82; AVC-73,86; TD-4)

Mr. May clarified that "other formats" in "A future standard should leave the door open for use of other formats" mean such larger formats for 16:9 aspect ratio signals and HDTV signals.

Doc. AVC-82 provided pros and cons for interlaced and progressive formats.

Mr. Stevens clarified the Australian proposal in AVC-36 as well as AVC-73 that a maximum sized container is defined for each spatio-temporal resolution class, any formats are used as far as they are inside the container, and necessary conversions for the local display is carried out at the decoder. These conversions may be covered by the multi-scan capability or non-refreshing nature of the display. There was a question whether side information is transmitted to indicate the actual picture size in and mapping to the container or black bordered pictures filling the container are transmitted. There was also expressed concern about the difficulty of negotiation of the actual picture format size. Another question was whether this maximum container be 16:9 aspect ratio.

4.2.2 Conversion between CCIR601 and SCIF (AVC-80)

A work was presented to verify the feasibility of format conversion between 525 line CCIR601 signals and SCIF signals as in AVC-29, where converted pictures are evaluated in SNR as well as observation on interlace monitors. The following comments were given;

- Care should be paid to SNR evaluation, since simple line repetition may provide infinite value for interlace-progressive-interlace conversion. observing pictures are most important.

- If a progressive picture is made from a field, black and white stripe of maximum vertical resolution produces all white and all black alternating pictures.

- Observing on a progressive scan monitor is a method.

- If progressive scan signals are observed on interlaced monitors, moving slanted lines look stairstepped.

- A similar evaluation is ongoing for the 528 lines x 704 pels square pixel SCIF in Bellcore.

The meeting recognized that further study is necessary on the following combinations for the SCIF with parameters 576 lines, 59.94 frame/s, progressive;

Source		Transmission		Display
576/50 1:1 ---->				----> 576/50 1:1
576/50 2:1 ---->				----> 576/50 2:1
480/60 1:1 ---->	SCIF	---->	$SCIF^{-1}$	----> 480/60 1:1
480/60 2:1 ---->				----> 480/60 2:1
576/60 1:1 ---->				----> 576/60 1:1

4.2.3 Coding efficiency (AVC-79,83)

Two experimental results were presented which address coding loss due to the use of SCIF as coding format, one using a RM based algorithm while the other using a MPEG1 based algorithm. Some coding loss has been observed, but possibility of its reduction is also indicated.

Further work is requested for better understanding of the problem.

4.2.4 Progressive scan devices (AVC-81)

Document AVC-81 summarized the present situation for progressive camera products in Japan for information. There was a comment that camera availability only at this moment should not be argued for our decision on coding format, we should look at coming years. There was also some discussion on the sensitivity of progressive scan camera which is relevant to the brightness of displays in videoconferencing environments.

4.2.5 Conclusion (TD5,6)

After having further discussion on the following items;

- single coding format or multiple ones for higher quality video coding?
- possible parameter values? how related to CIF?
- extension to larger formats such as EDTV and HDTV?
- service integration aspects
- take the initiative to adopt the single format approach (if viable) to other groups?

Mr. Haskell undertook to coordinate a small group meeting in the evening of August 14 to sort out the problems, to identify possible solutions as well as future action points. Interim common understanding of the group and home work were itemized as in Annex 3, which also contains a table

elaborated by Mr. Schaphorst showing the framework for discussion of H.26X format.

Finally, the meeting agreed to reach an agreement on the picture format issue at the earliest occasion in 1992.

4.3 Framework for H.26X

4.3.1 Requirements

1) Current status (§4/AVC-96, §3.4/AVC-70)

Chairman reminded the group of the requirements on the H.26X codec which had been identified up to this meeting using relevant sections of the group's status report (AVC-96) and the Proposal Package Description document (AVC-70).

2) Application (AVC-78)

Australia pointed out "video surveillance" form an application category which is not covered by the existing list. Its impact on the video coding is also discussed. The meeting agreed to add this category in Table 1 of the status report and to use this as an input document for the joint sessions with MPEG.

3) Secondary distribution (AVC-67)

AVC-67 provided preliminary functional requirements for secondary distribution of digital TV and HDTV signals. It was pointed out during our meeting that "channel hopping" is required for receiving television programs and that the secondary distribution decoder may require H.261 compatibility in the light of common use of a terminal for different services. These points and H.26X requirements as in Annex 5 of this report are sent for action in a liaison statement to CMTT/2 Special Rapporteur's Group (see §6.2 of this report).

4) ATM network aspects (AVC-72,84,85,86; AVC-68)

AVC-72 proposed an additional list of requirements, and to include a complete list in the IVS Baseline Document. The meeting studied the content item by item, and agreed in principle to the proposal. Since picture format related matters are still under discussion, however, they are excluded for the moment. For the complete list, see 5) below of this report.

During the discussion, Mr. Verbiest pointed out that the definition of peak rate in Annex 2 to AVC-68 becomes ambiguous when NT2 multiplexes cells from multiple sources. Mr. Tabatabai also expressed his question on the network performance related to CLP bit as in Annex 2 to AVC-68. These points are sent to SGXVIII as questions (see §6.1 of this report).

AVC-84 proposed a specific action to the Kurihama test; submission of additional materials to demonstrate cell loss tolerance of proposed algorithms. Some members expressed their concern about additional work required before the deadline. After having considered this factor and importance of early consideration of cell loss for the joint development of a generic coding scheme, the meeting agreed to propose the modification of PPD document as in Annex 4.

During the discussion, it was felt necessary to establish appropriate method(s) for evaluating cell loss resilience in differing coding schemes (e.g. layered or not), particularly its visibility point of view for short test sequences. Cell loss ratio, distribution, decoding method, etc. should be specified. This matter needs further study of the Experts Group.

AVC-85 provided a discussion material for setting the coding/decoding delay objective to the H.26X codec. Various comments were given as follows:

- The system should not consume all the 400ms allowable end-to-end delay. A much smaller value should be set for the target.

- The current "less than about 150ms" target comes from the HRD definition (buffer size = 4 times CIF picture period).

- Delay is one of the performance items equally important as picture quality.

- Codec delay is highly dependent on implementation, thus it should be left to equipment provider's choice, which contributes to product differentiation.

- There might be a chance that propagation delay be negotiated as part of QOS?

- As to the impact of terrestrial and satellite transmission, local communication may use higher bit rate terrestrial transmission while long distance communications may use low bit rate satellite transmission due to the cost reason. The latter combination worsens the total system delay since low bit rate operation of the codec tends to induce longer delay.

- Delay in AAL is yet to be clarified.

Since the meeting felt it premature to make any decision at this moment, the current wording for the target is left as it is, with clarification of the background as described in the second hyphenated item above. At the same time, the meeting feels we should strive for smaller delay in H.26X at higher bit rates.

AVC-86 and AVC-87 attempted to extract specific requirements on H.26X from the service integration and multipoint points of view. The meeting welcomed this input as useful basis for further discussion. Members are requested to contribute to deriving more concrete impacts to the video coding which lead to a better architecture.

During the discussion related to the bandwidth flexibility of B-ISDN, it was queried how a particular bit rate for each call can be set up since the bit rates in B-ISDN are not quantized as in N-ISDN. Negotiations with both of the network and the remote terminal may be involved. This matter awaits further clarification.

5) Conclusion

Based on a number of requirements listed in those contributions, Mr. Brusewitz undertook to coordinate a small group meeting in the evening of August 15 with the task of summarizing these requirements on H.26X codec and H.32X terminal. The outcome is contained in Annex 5.

4.3.2 Architecture

1) ATM specific boundary conditions (AVC-71)

AVC-71 raised the question of whether source coding and transmission coding be separable or not in ATM environments. During the discussion, the following ATM specific considerations were pointed out;

- Source shaping by rate control is necessary in response to the UPC.
- Use of CLP impacts the source coding. If the cell loss rate is very low, simple error resilience measure in the source coding is sufficient. If it is very high, serious preventive measures are necessary in the source coding. Otherwise, cell loss can be prevented in the channel coding.
- Efforts to reduce redundancy in the source coding can be traded off with efforts of network utilization such as the use of different priority channels.
- Once the separation strategy is taken at the start, later inclusion of preventive measures at the source coding makes the total performance suboptimal if it be found necessary.

However, if cell loss ratio can be very low, and if the codecs for STM are considered as having VBR properties in number of bits per frame being changeable, another scenario may be also drawn where a traditional architecture is applied even in ATM environments. Considering that the network characteristics are not fully known, the meeting agreed to proceed having both strategies in scope for the moment.

2) Flexible layering (AVC-73,74; AVC-86; AVC-94,100,103)

AVC-73 gave further thoughts on the "flexible layering" introduced in AVC-35 at the Paris meeting, stressing the identification of service class boundaries. AVC-74 provided a supporting evidence. Interworking among different service classes are realized by switching off constituent layers as necessary.

There were some comments on the experimental data;

- Some concerns were expressed concerning layer 1 prediction loop drift (between encoder and decoder) under the influence of low priority channel cell loss. In this implementation (AVC-74), method of controlling the impact of this drift effect must be studied.
- Rate-distortion curve should better be evaluated using a two-dimensional VLC for DCT coefficients. Significant difference in INTRA mode between the single layer and two layer schemes needs clarification.

As general comments, it was pointed out that coding efficiency and hardware complexity be carefully studied and that mixture of frame rates in the two layers (e.g. 30 Hz of H.261 in the first layer, 25 Hz of CCIR-601 in the second layer) may affect coding efficiency.

4.4 VBR vs CBR

4.4.1 Characteristics

1) Delay estimation (AVC-90)

AVC-89 provided a simplified model to analyze the delay in VBR modes. From comparison with AVC-56 presented at the Paris meeting, Mr. Haskell commented that this is an alternative approach to AVC-56, that implications are high speed operation and large capacity of memory in the decoder and that coder operation time "T" can be smaller in practice.

It was also pointed out that if the window size of network Swin is small, coding delay becomes large because of necessary smoothing of peaks in the terminal, that the leaky bucket will produce similar results.

2) Required window size for average rate monitoring in the network (AVC-89)

Experimental results were presented for a particular rate control system, indicating the window size of several seconds can improve VBR mode picture quality.

After some questions and answers on such items as visibility of coding-stopped macroblocks, the meeting recalled the importance of the window size of the network for average monitoring. The decision of this parameter should be based on interaction between this group and SGXVIII, perhaps with iteration. Mr. Verbiest stated that the Belgian experimental system uses a more sophisticated policing with multiple leaky buckets where not only peak and 100 sec average rates but also higher order moments are also monitored.

4.4.2 Statistics (AVC-99)

Mr. Verbiest offered measured statistics on VBR operation which are stored in a floppy disk. This can be used freely as far as the purpose is research and reference is given to RTT Belgium.

It was recognized that similar data are missing when motion compensation is included. Members are encouraged to provide such data.

4.4.3 Network loading model (AVC-75,97; Annex 5 to AVC-96)

Improvements to the first network model were discussed. As pointed out at the Paris meeting (see §4.4.3/AVC-65R), the current model provides saturation probability Psat. The meeting agreed to use the following equation for calculation of cell loss ratio CLR;

$$CLR = \int L(R) * p(R) dR \; / \; \int R * p(R) dR$$

where L(R) is loss function that can be approximated as Eq.(1) in AVC-75.

The meeting also agreed to modify the network loading model as in Annex 5 to AVC-96, assuming that its CLR is derived according to the above equation.

There were some discussion on the relation between this network modeling and the mechanism according to which the network accommodates calls. AVC-97 argued that its model is reflecting a likely mechanism in the network, but possibility of using peak, mean and variance was also expressed by others.

It was also discussed that call acceptance mechanism and exact modeling of the source and network should be separated, important thing be to obtain better understanding and deeper insight to the statistical multiplexing problem. The meeting agreed to this view by noting in the network loading

model description that we need more accurate model(s) for the precise study of VBR vs CBR issue. Suitable models for this purpose need continued study.

4.4.4 Guidelines for further work

The meeting confirmed that the guidelines established at the Paris meeting for VBR vs CBR issue still stands. Further study according to these guidelines are awaited, particularly experimental evidence for VBR advantage in reconstructed pictures under UPC.

4.5 Video coding algorithms

4.5.1 Layered coding (AVC-94,100,103)

Three layered coding simulation results were presented, all of which can work in non-compatible mode by switching off the base layer. They do not exactly follow the structure in Figure 1/AV-65R in which the second layer codes the difference between the first layer coded picture and the original input. The following points were clarified through questions and answers.

AVC-94

- Five motion vectors are calculated for a 32x16 macroblock of 601 resolution, one for the inner loop, four for the outer loop.

AVC-100

- Delay due to "upconversion" can be minimal since it need not be subjected to encoder and decoder buffer delay.
- This structure allows 16:9 aspect ratio in the MPEG-2 coding.

AVC-103

- This result shows that there is some coding loss due to the use of two layers, but not so big as anticipated. Whether the layering can compete with "simulcast" in coding efficiency needs further study.
- Flicker is not observed even if SNR differs by 4 dB between odd and even fields.

4.5.2 New elements (AVC-88,104)

Two study results were presented for information on coding efficiency of a subband coding and improvements on forward prediction. There was a question whether "CBP" is effective also for high resolution video coding.

4.6 Multimedia multiplexing (AVC-76,91,92)

The meeting adopted the proposal in AVC-76 that we request of SGXVIII to develop appropriate signalling and control for bounded cross media delay.

AVC-91 provided a discussion material for realizing H.32X terminal interworking with H.320 terminal focusing on multimedia multiplexing methods. It is argued that user multiplex be a solution. Mr. Morrison pointed out that not only H.320 terminals but also MPEG standard sources may require the same consideration. Further study is requested.

AVC-96 provided a discussion material on the virtual layer approach to define multimedia multiplexing. The meeting welcomed this useful input and

requested of the members further development of the idea. Mr. Stevens suggested the naming would be more suitable if it is "media control layer" or "media convergence layer" instead of "MUX layer".

4.7 AAL Type 1 and Type 2

4.7.1 Current status (AVC-68)

Chairman gave a brief summary of the AAL study in SGXVIII referring to Annex 2 to AVC-68.

4.7.2 Required elements for audiovisual communication systems (AVC-77)

The meeting supported the considerations in AVC-77 that AAL Type 2 be commonly used for VBR and CBR audiovisual communications, and recognized the urgency of study on the definition of AAL Type 2 by the Experts Group. The meeting also agreed to place relevant questions to SGXVIII in the liaison statement to SGXVIII (see §6.1 of this report).

4.7.3 Error and cell loss protections (AVC-98,69)

AVC-98 provided information on bit error and cell loss performance required for video services assuming a certain duration of error free time for each service. Preventive measures are exemplified in AVC-69. There were some concerns whether simple error free time calculation help us because visibility of the bit error and cell loss much differs among coding schemes; e.g. according to being layered or not.

Since the preventive measures against bit errors and cell losses have crucial impacts to the structure of audiovisual terminals for B-ISDN, the meeting agreed to expand the content in relevant parts of the IVS Baseline Document (p.20 and p.22 of AVC-68) covering the above concerns by notes as a step in the ongoing iterative process.

There was discussion on where necessary error correction and cell loss protection be carried out, at SAR, CS or user layer depending on the network performance. The following factors should be considered in this study:

- Interworking with N-ISDN terminals should also be considered where bit errors are taken care of at the user layer.
- It should be noted that scrambling in ATM layer causes correlated errors in SAR-PDU.
- Order of scrambling, error correction and encryption should be carefully considered.
- If video is layered, different layers may take advantage of different levels of bit error and cell loss performance.

4.7.4 Comments on AAL Type 1 (AVC-93)

The meeting agreed to include the requirements to the AAL Type 1 functions raised by AVC-93, with necessary modifications, in the liaison statement to SGXVIII (see §6.1 of this report).

There was a question whether audiovisual terminals use Type 1 as well if both VBR and CBR are covered by Type 2 as in AVC-77. One of the cases identified was interworking between B-ISDN and N-ISDN, which was discussed in more details (AVC-91, TD-7). The meeting felt ambiguous about whether

Type 1 for interworking be required in H.32X terminal, or it may be covered by the interworking unit in the network. It was also pointed out that the existing N-ISDN terminals are quite susceptible to cell loss if it occurs in the circuit emulation mode. These points need advice of SGXVIII.

4.8 IVS Baseline Document (AVC-68,101; AVC-72,98)

It was agreed to adopt the proposal in AVC-101 as input for upgrading the IVS Baseline Document, which are sent to SGXVIII with other points identified during the meeting (see §6.1 of this report).

5. Work plan and work method

5.1 Harmonization with other groups (AVC-95)

The meeting had opportunity to have attendance of Mr. Yasuda who is acting as Convenor of ISO/IEC JTC1/SC2/WG8. He presented the current organization under his responsibility, focusing on the recent establishment of new SC29 where all the audiovisual and hypermedia coding groups are assembled, and requested continuous cooperation between these ISO groups and relevant CCITT groups.

5.2 Collaboration work with MPEG

The meeting had a free discussion session on possible improvements of the joint work method with MPEG. This session was continuation of the relevant part of the Paris meeting closing session as recorded in §6.3/Part I of AVC-65R.

The following voices were heard on the current situation as needing improvements;

- MPEG is still spending much time for MPEG-1.
- From practical point of view, CCITT sole sessions spend 3 days without sufficient time for discussion, while joint sessions continue 5 days for topics of our less concern. This lacks balance. Closing session should be held at an earlier occasion so that attendance to the joint sessions become more flexible.
- MPEG meetings are too frequent, thus close coupling of our meetings with them may cause travel budget problems in some organizations, and furthermore shorter interval between meetings may decrease high quality contributions.
- Meeting place of sole sessions should be more carefully chosen. For example, this meeting in Santa Clara could have been in the East coast where better support of the meeting becomes available. It is not always necessary to meet at the same place with that of joint sessions.
- Document managements need improvement.
- Use of liaison representatives may solve these problems. (Chairman noted that appointed representatives to respective sub-groups are not meant to this "liaison representatives" but should function as co-chair with that of MPEG.)

- That method of collaboration may end up with MPEG's sole responsibility of joint development of the generic coding. Furthermore, CMTT which adopts this way of work is less influential to MPEG. It is noted that broadcasters have become more influential in MPEG-2 through more participants from this field compared to MPEG-1.

- Agreements obtained through discussion are not clear enough. Decision process looks different among sub-groups, depending on the character of the person in charge.

- Change of terms of reference needed more time for discussion because the item was new to recently joined CCITT members.

- Due to the large number of participants, single persons have difficulty to make his voice heard, and to identify how decisions were made.

- We should start from knowing each other, we may need some time to achieve this, working together toward a common objective may increase this possibility. Sharing a common Test Model for collaborative work plays an essential role for this purpose. Enhanced presence of the CCITT Experts Group should be sought through good technical works.

- Having a technical session on communication aspects such as ATM may help mutual understanding among members ready for joint development.

- Efforts of penetrating the joint development spirit through the management may help us. Mr. Yasuda undertook to reflect this point as part of organizing the new SC29.

- One difference in attitude between ISO and CCITT is that ISO is more oriented to the definition of bit stream while CCITT also addresses terminal and overall service matters. This difference may be causing some mismatches between their approaches.

The meeting confirmed to review this matter on a continuous basis, taking into account the facts that we will experience our sole sessions after the joint sessions at the next meeting in November and that the Kurihama sessions will involve presentation of proposed algorithms which are of our great concern.

At the closing session on August 22, Chairman presented Mr. Chiariglione's letter to him in response to these voices which had been raised at the MPEG Chairmen meeting on August 18, containing record of discussion at the MPEG Chairmen meeting and some other comments. The meeting welcomed this message for our mutual understanding.

Chairman concluded this discussion by confirming that we will continue our efforts toward the success of joint work through grass roots activities as well as top-down actions.

5.3 Collaboration work with CMTT/2 SRG

The Experts Group invites increased level of participation of CMTT/2 SRG at all meeting in a liaison statement (see §6.2 below of this report).

6. Actions to other groups

6.1 SGXVIII (TD-9)

Mr. Tanaka drafted a liaison statement containing the following items found during the meeting;

- further questions on the network characteristics
- request for multimedia support
- requirements on the network characteristics from the video coding
- comments on AAL Type 1 and Type 2
- improvements of the IVS baseline document

The meeting approved this draft with some amendments as in Annex 6.

6.2 CMTT/2 (TD-10)

Two liaison statements are sent to CMTT/2 SRG for action as in Annex 7; one contains comments on their preliminary functional requirements, the other contains invitation to the joint work.

6.3 MPEG

1) The list of H.26X requirements (Annex 5) and the proposal of additional submission material concerning cell loss (Annex 4) are input to the joint sessions.

2) The meeting appointed representatives to MPEG subgroups (Video, System, Requirements, Test, Implementation) as follows;

MPEG-VIDEO (Didier LeGall)	J. Guichard
MPEG-SYSTEM (Sandy MacInnis)	B.G. Haskell
MPEG-REQUIREMENTS (Sakae Okubo)	S. Okubo
MPEG-TESTS (Tsuneyoshi Hidaka)	S. Okubo
MPEG-IMPLEMENTATION (Geoff Morrison)	G. Morrison

3) The meeting selected the following input documents to the joint sessions from the Experts Group;

Proposal : TD-7, TD-8, AVC-78 (change source to Experts Group and add "QCIF" to "Resolution")
Information : AVC-71,73,74,88,94,96,100,103,104

4) Discussion results in §5.2 of this report should be reflected through the management for and discussion in joint sessions.

7. Others

7.1 Status report (AVC-96,105)

Updating by appointed editors is continued. Editors are requested to send new texts to Chairman by September 15, 1991.

7.2 Future meetings

- 4th meeting

  Joint sessions with MPEG: November 18-26 in Kurihama hosted by JVC
  Sole sessions : November 27-29 in Yokosuka hosted by Japan

- 5th meeting joint with MPEG Video

  January 7-8, 1992 in Singapore hosted by Asia Matsushita Electric

END

Annexes to AVC-106R

Annex 1 Documents for the third meeting of the Experts Group
Annex 2 List of tape demonstrations
Annex 3 Agreements and action points for the picture format issue
Annex 4 Additional submission materials for the "Kurihama Tests"
Annex 5 H.26X requirements
Annex 6 Liaison statement to SGXVIII
Annex 7 Liaison statements to CMTT/2 SRG

List of Participants of the third meeting
of the Experts Group for ATM Video Coding

(14 -23 August 1991, Santa Clara)

FRG	Mr. F. May	Daimler-Benz Research	CM
	Mr. G. Zedler	DBP Telecom	CM
Australia	Mr. G. Smith	AUSSAT	
	Mr. P. Stevens	Siemens	
Belgium	Mr. O. Poncin	RTT	
	Mr. W. Verbiest	Alcatel Bell Telephone	CM
Canada	Mr. D. Lemay	BNR	CM
USA	Mr. M.M. Anderson	Bellcore	LR-ISO
	Mr. B.G. Haskell	AT&T Bell Labs	
	Mr. M. Liou	Bellcore	
	Mr. R.P. Rao	Compression Labs	
	Mr. R.A. Schaphorst	Delta Information Systems	CM
	Mr. A.J. Tabatabai	Bellcore	CM
	Mr. X. Yuam	PictureTel	
	Mr. J. Zdepski	David Sarnoff	
France	Mr. G. Eude	France Telecom	
	Mr. J. Guichard	France Telecom	CM
Italy	Ms. L. Conte	CSELT	(CM)
Japan	Mr. Y. Kato	Mitsubishi Electric	
	Mr. T. Odaka	Toshiba	
	Mr. S. Okubo	NTT	Chairman
	Mr. T. Soejima	Fujitsu America	
	Mr. T. Tanaka	NTT	CM
	Mr. Y. Takishima	KDD	(CM)
	Mr. H. Yasuda	NTT	
	Mr. T. Yukitake	Matsushita Communication	
Norway	Mr. H. Sandgrind	Norwegian Telecom	CM
Netherlands	Mr. H. Carbiere	PTT Research	LR-CMTT
	Mr. A. Koster	PTT Research	(CM)
UK	Mr. I. Parke	BT	
	Mr. D.G. Morrison	BT	CM
Sweden	Mr. H. Brusewitz	Swedish Telecom	CM

CM: Coordinating Member
(CM): Substitute for CM
LR: Liaison Representative

Documents for the third meeting of the Experts Group
14-23 August 1991, Santa Clara

Normal Documents

AVC-65R REPORT OF THE SECOND MEETING OF THE EXPERTS GROUP FOR ATM VIDEO CODING IN PARIS (CHAIRMAN)

Achievements and action points obtained at the second meeting are recorded to facilitate our discussion at this meeting.

AVC-66 REPORT OF THE 14TH MPEG MEETING IN PARIS (MPEG)

This document contains the recommendations of the Paris meeting and detailed meeting reports.

AVC-67 LIAISON STATEMENTS AND MEETING NOTICE (SPECIAL RAPPORTEUR OF TG CMTT/2)

Functional requirements for the secondary distribution of digital CTV, EDTV and HDTV signals to consumers are given on the following aspects;

- real-time coding/decoding
- minimum coding/decoding delay
- automatic optimization to the picture content, network performance, etc.
- picture formats covering CTV interlaced, EDTV/HDTV interlaced and progressive
- quality objectives - no impairments in principle
- graceful degradation for unusual significant level of errors
- quality of normal real time delivery be not compromised for features
- compatibilities among CTV, EDTV and HDTV
- worthwhile commonality with other standards

AVC-68 LIAISON STATEMENTS AND IVS BASELINE DOCUMENT (SGXVIII)

Outcome of the June meeting which is relevant to our work is contained; status of discussion on CLP issues, status of agreements on UPC issues, and updated IVS Baseline Document.

AVC-69 CLR AND BER PROTECTION FOR ENHANCED END-TO-END USERS QOS (RTT BELGIUM)

An example of AAL Type 2 implementation is presented, which protects against bit errors and cell losses to obtain at least 2 hours errors free transmission for a bit rate range of 2 to 140 Mbit/s for BER=1E-6, CLR=1E-6. Bit error protection is with forward single error correction, while cell loss protection is with 4 bit Sequence Number and one parity cell added to the 31 service cells. Three critical cases are also analyzed which require slightly smaller CLR.

AVC-70 UPDATED DRAFT PROPOSAL PACKAGE DESCRIPTION FOR MPEG PHASE 2 (CHAIR OF MPEG REQUIREMENTS SUB-GROUP)

This is an update of the Paris meeting outcome based on the comments received from the collaborators.

AVC-71 THE IMPACT OF THE NETWORK ON VIDEO CODING (AUSTRALIA)

It is claimed that optimum performance of ATM video coding can not be obtained if source coding and channel coding are considered separately, and that the following ATM network characteristics should be taken into account for development of the ATM video coding;

- cell loss resilience
- effective use of cell loss priority
- variable bit rate coding
- flexible bandwidth allocation

AVC-72 REQUIREMENTS FOR ATM VIDEO CODECS (AUSTRALIA)

The following additions to the list of requirements on the ATM video codecs are proposed;

1) functional requirements
   - audio/video relative delay (portion assigned to codec)
   - support of continuous presence multipoint
2) compatibility / interworking requirements
   - capability of handling multiple coder input/output formats
   - backward/forward compatibilities with H.261
   - interworking among systems with different spatial and temporal resolutions
3) network related requirements
   - rate control for VBR
   - control for two priority channels
   - error performance assessment under cell loss

It is concluded that the full list of requirements be input to the IVS Baseline Document.

AVC-73 ARCHITECTURE FOR VIDEO SERVICE PROVISION (AUSTRALIA)

Flexible layering scheme is supported for the ATM video coding architecture, where signals are coded in multiple layers but lower layers may be switched off as necessary, thus providing the compatibility with existing coding schemes in the short term while allowing the coding scheme optimized for the B-ISDN. A three layer system with pyramidal decomposition of the input signals is given as example implementation. The importance of reaching a decision on the coder input formats defining layer boundaries is stressed by listing issues which impact on the decision; spatial resolution and frame rates, interlace or progressive scanning and pel aspect ratio.

AVC-74 THE EFFICIENCY OF A LAYERED PYRAMID CODER (AUSTRALIA)

Coding results are provided for a layered Laplacian Pyramid scheme, where the input CIF signal is decomposed into a QCIF base layer and an enhancement layer. Coding efficiency is compared between the single layer scheme and the Laplacian Pyramid scheme in terms of rate-distortion, where rate is counted as entropy of non-zero coefficients. It is concluded that

the Laplacian Pyramid scheme is potentially as efficient as the single layer coder.

AVC-75 SOURCE/NETWORK MODEL (AUSTRALIA)

To improve accuracy of the network loading model, use of cell loss ratio CLR given in Eq.(2) instead of saturation probability Psat is proposed. Number of channels and statistical multiplex gain (SMG) are exemplified assuming a network model where all the cells exceeding network capacity are lost and a source model of Gaussian distribution, concluding that the Group's first network loading model provides conservative estimation of SMG. It is also stressed that understanding of the impact of the network characteristics on the coder will require a model of the cell loss burst behavior.

AVC-76 VIRTUAL PATH SUPPORT OF MULTIMEDIA MULTIPLEXED (AUSTRALIA)

The Virtual Path approach for ensuring cross media synchronization is concluded as not appropriate because of its semipermanent nature and mixed QOS requirements corresponding to respective media. It is proposed to make a request for the network to provide necessary signalling and control for bounded cross media delay by ensuring all media components follow a common physical path. This should be liaised to SGXVIII for action.

AVC-77 THE SAR SUBLAYER OF AAL2 FOR VIDEO SERVICE SUPPORT (AUSTRALIA)

Functionalities of SN, IT, LI and CRC in the current I.363 are reviewed from the VBR video service provision point of view, indicating that they may not be matched to the needs of video services, or even not required at all and suggesting that AAL Type 2 with minimum functionality may offer the flexibility to accommodate a wide and diverse range of video services. It is proposed that this matter be a priority issue of the Experts Group and that consideration should be given to a single SAR sublayer for both VBR and CBR with a liaison to SGXVIII advising our thought.

AVC-78 REMOTE VIDEO SURVEILLANCE AS A B-ISDN SERVICE (AUSTRALIA)

It is proposed that remote surveillance be added to the list of relevant applications being considered by the Experts Group (Table 1 of Status Report), as its characteristics are not entirely covered by other services. It is noted that the remote surveillance has such distinct characteristics as importance of ensuring a high coding quality for each frame for archiving and later retrieval, rapid removal of transmission error artifacts, wide variety of frame rates, frequent use of on-line panning, tilting, zooming, etc.

AVC-79 LOSS OF CODING EFFICIENCY BY USING SCIF (JAPAN)

Simulation results are reported for comparison of rate-distortion between coding the original 525/60 interlaced signals and coding the converted signals into progressive scan SCIF as in AVC-29. The loss of coding efficiency is found to be 25-30% for INTER and 35-30% for INTRA of "Flower GArden". It is concluded that further study is required, including the use of suitable VLC and/or better format conversion filters.

AVC-80 CONVERSION SIMULATION BETWEEN 525 LINE INTERLACED FORMAT AND SCIF (JAPAN)

Simulation results are reported on conversion from 525 line interlaced picture to 576 line progressive scan picture and back to the original interlaced picture. Used filters have 16 taps for interlace/progressive scan conversion and 31 taps for 480/576 line conversion. It is concluded that SNR and subjective investigation show satisfactory re-converted pictures but that further study is required on coding efficiency and additional hardware for adopting the SCIF approach.

AVC-81 PROGRESSIVE SCANNING CAMERA (JAPAN)

Present status for the development of progressive scan cameras in Japan is described as being still in an infant stage.

AVC-82 MERITS AND DEMERITS OF THE PROGRESSIVE AND INTERLACED FORMATS (JAPAN)

Two possible scanning systems for SCIF, interlace and progressive, are compared on the following items;

- ease of layered coding
- matching with current camera/display devices
- coding efficiency
- field parity identification

AVC-83 COMPARISON OF PICTURE QUALITY AND ENCODING EFFICIENCY BETWEEN SCIF - SUPER CIF - AND INTERLACED FORMAT USING MPEG ENCODING (JAPAN)

Simulation results are shown which compare the coding efficiency between the progressive (SCIF) and interlaced (ILF) formats by applying MPEG encoding separately to each original field. It is reported that though the SCF requires considerably more bits for a common step size (thus obtaining higher SNR) than ILF, both provide almost the same SNR for a common bit rate 4 mbit/s. A possible interpretation is also given.

AVC-84 . ADDITIONAL SUBMISSION MATERIALS FOR 'KURIHAMA TEST' (JAPAN)

Considering that cell loss and its effect on video coding in the B-ISDN ATM environments, it is proposed that the following additional materials be submitted for the Kurihama test;

- what will happen if cell loss occurs during transmission, description of cell loss protection, if any
- additional delay due to the above cell loss protection
- presentation of decoded pictures when cell loss occurred

The first two should be mandatory, and the third be desirable.

AVC-85 CONSIDERATION ON ACCEPTABLE PROCESSING DELAY IN THE VIDEO CODEC (JAPAN)

Starting from the G.114 specifying that one way propagation time should be less than 400ms for "acceptable" audio quality, and considering that the acceptable delay for videophone is not different from telephone, acceptable

codec delay is derived for three cases of transmission: optical, satellite and their combination with assumption of 50ms delay due to the ATM processing in the network portion.

AVC-86 REQUIREMENTS FOR THE VIDEO CODING STANDARD H.26X (JAPAN)

Expected terminals functions in the B-ISDN are first discussed from service integration, namely H.32X intercommunication with another H.32X, MCU, secondary distribution center and network database, as well as multipoint communications point of view. Then the following requirements are derived from them necessary functions to effectively utilize the B-ISDN;

1) H.26X video coding should incorporate H.261 for intercommunication.
2) It is sufficient in the terminal that only the decoder can cope with required service characteristics except for the case of conversational services.
3) Decoders may have full set of capabilities to fulfill the entire functionalities corresponding to respective services, but coders may implement limited set of functionalities specific to the application.
4) Embedded bit stream structure is a desirable coding architecture.
5) Realization of "Flexible Layering" can be a solution for these requirements.
6) Several received video streams may desirably be processed with simultaneous decoding (time-sliced decoding) at the decoder for continuous presence.

AVC-87 CONSIDERATION ON MULTI-POINT COMMUNICATION IN B-ISDN (JAPAN)

Three configurations for the continuous presence multipoint system are considered, out of which the following two cases need particular attention for the video coding;

- A decoder receives multiple bit streams multiplexed from multiple sources and reconstruct respective pictures and provide them to separate displays (time sliced decoding).
- A decoder receives a bit stream which contain a picture composed by an MCU from multiple sources. Coded bit streams should be edited without decoding and recoding at the MCU.

AVC-88 THE EVALUATION OF SUBBAND CODING EFFICIENCY (JAPAN)

Coding results are presented in rate-distortion curves and processed pictures which compare a two layered subband coding and a non-layered coding. The following observations are given;

- The quantizer step size for N layered subband coding should be SQRT(N) times smaller than the step size of non-layered coding to provide the same SN.
- Adjustment of MC size, MC precision and number of interpolation filter taps improves the subband coding efficiency.
- The single layered coding performs better in rate-distortion characteristics, but the reconstructed pictures look almost the same.

AVC-89 CONSIDERATIONS ON THE WINDOW SIZE OF TRAFFIC DESCRIPTOR (JAPAN)

VBR coding simulation results are given when a particular long term average control scheme is applied to the coder. It is reported that several seconds are required in this coding control scheme for the window size of the

traffic descriptor in the network to absorb the changes of of video sequences due to zooming of two seconds.

AVC-90 CONSIDERATION ON DELAY WITH VBR CODING (JAPAN)

Coding/decoding delay is analyzed for a VBR system with some assumptions of simplification. The size of the encoder output buffer is given as Sbuf(bits)=Ave(bit/T)*Swin(T) where Ave is average bit rate per frame period T and Swin is window size of the network UPC measured in frame time period T. Average bit rate is policed with moving window of size Swin here. Maximum delay is given as L=(Ave/Peak)*Swin where Peak is peak bit rate per frame period T. Some comparison with the discussion in AVC-56 is also given.

AVC-91 MULTIMEDIA MULTIPLEX METHOD (JAPAN)

Multimedia multiplex methods are discussed in the light of interworking between an H.32X terminal connected to B-ISDN and an H.320 terminal connected to N-ISDN. Some problems of using the VCI method for such interworking are first listed; low bit rate for each medium in H.320, speed of configuration change, provision of multimedia multiplex conversion in the gateway. Then user multiplex is suggested for such purpose, but pointing out the need of study on how to achieve VCI based multimedia multiplex with the interworking feature. Notion of "switchable" and "embedded" is illustrated for multimedia multiplex.

AVC-92 VIRTUAL LAYER APPROACH FOR MULTIMEDIA MULTIPLEX FUNCTION (JAPAN)

The virtual MUX layer approach is further discussed where the MUX layer is placed between codecs and the network (AAL) for logical multimedia multiplexing functions as presented in AVC-53. Necessary functions of this MUX layer are listed; such as packetization in variable length of each media information, recovery of end-to-end synchronization of each media information, handling of AAL-SDU for lost and errored cell, etc. Mapping of these MUX layer functions to AAL functions are also given.

AVC-93 REQUIREMENTS TO THE FUNCTION OF AAL TYPE 1 (JAPAN)

Requirements to the CS layer functions of AAL Type 1 are proposed for liaison to SGXVIII in the light of video transmission and its impact to AAL Type 2.

- error correction: interleaving should be optional, cell loss notification is indispensable for the video decoder.
- 8 kHz timing is necessary for interworking with existing terminals
- clock: inquiry should be made whether submultiples of 155.52 MHz are available, recovery of video signal clock may be required.

AVC-94 COMPATIBLE CODING OF CCIR 601 IMAGES: PREDICT THE PREDICTION ERROR (PTT RESEARCH - THE NETHERLANDS)

Modifications to the multi purpose coding scheme, which has upward and downward compatibility with H.261 or MPEG1 and was presented in AVC-33, are provided with D1 tape demonstrations for both of full CCIR 601 resolutions and SIF resolution results. A second DPCM loop operating on CCIR 601 resolution is added so that two prediction errors are computed: one based on a SIF prediction and one based on the full resolution, the SIF quantized prediction error signal being used for prediction for the full resolution

prediction error signal. By switching off the first loop, this system can operate in a non-compatible mode as well.

AVC-95 ESTABLISHMENT OF NEW SC29 (CONVENOR OF ISO/IEC JTC1/SC2/WG8)

It is announced that SC29 has been established which covers audio, visual and multimedia coding fields.

AVC-96 STATUS REPORT ON ATM VIDEO CODING STANDARDIZATION (EXPERTS GROUP)

Study results as well as further study items are summarized for common understanding among members of the the group and publicity of the group's activities. This is a version updated according to the Paris meeting outcome.

AVC-97 COMPARISON OF NETWORK LOADING MODELS FOR TWO LAYER VARIABLE BIT RATE CODING (UK)

It is concluded that the Large Deviation model adopted in the Group's first network loading model is more appropriate than other ones in that it is a safe conservative model independent of the source modeling and that the practical network resource management is more correctly reflected, by giving an equation for the cell loss ratio CLR instead of the probability of saturation Psat. A comparison of number of accommodated channels is given between estimates based on CLR and Psat, indicating that the use of Psat is practically sufficient when about 1000 channels are multiplexed.

AVC-98 REQUIREMENTS ANALYSIS FOR VIDEO SERVICES (RTT BELGIUM)

Impacts of video service requirements on ATM network parameters and required error handling are discussed for possible upgrading of the IVS Baseline Document. Based on the necessary error free time for each service, bit error handling is first investigated with the ATM payload scrambling taken into account. It is concluded that some bit error protection is mandatory for video services even in case of BER=1E-8, and that the payload scrambling weaken the error correction capability of existing codes such as BCH(511,493) of H.261. Then cell loss handling is investigated, concluding that at least its detection is essential, and that a single cell loss correction is required for the most demanding TV distribution services even for CLR=1E-8. Comments are also given to possible interaction between bit error correction and cell loss correction, bursty cell loss correction and cell loss concealment.

AVC-99 VBR VIDEO STATISTICS (RTT BELGIUM)

The number of 112 bit subpackets per frame are recorded for the four different type of video services: video telephony, videoconferencing, normal quality broadcast video, high quality broadcast video. An adaptive DPCM codec is used for this measurement which adaptively selects intrafield prediction, interframe prediction and conditional replenishment. This paper is accompanied by a floppy disk containing the recorded data.

AVC-100 LAYERED CODING FOR COMPATIBILITY (UK)

Coded results are presented for a "pel split" layered coding scheme which uses the MPEG-1 coded pictures as a prediction for the MPEG-2 pictures and has three possible prediction modes for each field: MPEG-1, previous field and previous frame. MPEG-1 bit stream is embedded in the composite bit stream. By switching off the MPEG-1 prediction mode, this scheme becomes a MPEG-2 single layered scheme.

AVC-101 COMMENTS ON THE IVS BASELINE DOCUMENT AVC-25 (BELGIUM, FRANCE, FRG, NORWAY, THE NETHERLANDS, SWEDEN, UK)

Comments on the following items are proposed for upgrading the IVS Baseline Document:

- work plan: consideration of video service requirements such as in AVC-98 when defining service dependent CS
- service bit rates: concern with CLP bit change by the network
- QOS provided by the ATM layer: clarification needed
- general: stress on multimedia system aspects required

AVC-102 COMMENTS ON PICTURE FORMAT - ANNEX 3 TO DOC. AVC-65R (BELGIUM, FRANCE, FRG, NORWAY, THE NETHERLANDS, SWEDEN, UK)

It is proposed that one additional format is required beside QCIF and CIF for communication services, whose parameter values are as in AVC-29, awaiting firm supporting evidence concerning quality degradation loss of coding efficiency due to scan conversion by the beginning of 1992. It is also proposed that a future standard should leave the door open for use of other formats.

AVC-103 SIMULATION RESULTS ON A PEL SPLIT COMPATIBLE ALGORITHM (CNET - FRANCE TELECOM)

Coded results are presented for a "pel split" scheme as summarized above (AVC-100). Numerical data and processed pictures are given for MPEG-1 coding, MPEG-2 compatible coding and MPEG-2 non compatible coding.

AVC-104 SUMMARY DESCRIPTION OF VADIS/COST ALGORITHM GROUP 2 FORWARD PREDICTION METHOD (NORWAY)

Two factors contributing to the good subjective quality demonstrated at the Paris meeting (AVC-30) are described are described:

- multiple two-dimensional VLC's for DCT coefficient coding which have EOB of 1-3 bits and are switched adaptively for each coefficient without side information

- dual frame prediction which uses only forward prediction with two preceding frames

This scheme is characterized by low delay and simple architecture.

AVC-105 TERMINOLOGY CHAPTER FOR THE STATUS REPORT (DIS, NCS)

Definitions of relevant terms are provided for inclusion in §2 of the status report.

Temporary Documents

TD-1 Agenda for the third meeting in Santa Clara (Chairman)
TD-2 Available documents (Chairman)
TD-3 List of tape demonstrations (Chairman)
TD-4 List of picture formats (Chairman)
TD-5 Agreements and action points for the picture format issue (Small group on picture format)
TD-6 Framework for discussion of H.26X format(Small group on picture format)
TD-7 Additional submission materials for the "Kurihama Tests" (Experts Group) and a diagram illustrating N-ISDN and B-ISDN interworking (Chairman)
TD-8 H.26X requirements (Small group on requirements)
TD-9 Liaison statement to SGXVIII (Small group on SGXVIII liaison)
TD-10 Liaison to TG CMTT/2 SRG (Liaison representative)
TD-11 Draft report of the third meeting of the Experts Group for ATM Video Coding in Santa Clara (Chairman)

END

List of Tape Demonstrations
(14 and August 1991, Santa Clara)

No	Organization	Topics	Tape	Doc.
a.	KDD	Picture format conversion between 525 interlaced format and SCIF	D	AVC-80
b.	Fujitsu	Cell loss concealment	U	AVC-84
c.	Matsushita Comm.	Sub-band coding efficiency	D	AVC-88
d.	PTT Research	DCT-split compatible coding	D	AVC-94
e.	BT Labs	Pel-split layered coding for compatibility	D	AVC-100
f.	CNET	Pel-split layered coding for compatibility	D	AVC-103

AGREEMENTS AND ACTION POINTS FOR THE PICTURE FORMAT ISSUE

INTERIM COMMON VIEW OF THE EXPERTS GROUP

1. No standardization of format conversion.
2. Can specify a maximum resolution for the "601" class of services
   a) 59.94Hz frame rate
   b) Progressive
   c) 576 lines
   d) 7xx pels/line
   e) 4:3 aspect ratio
3. Support CIF Pel Aspect Ratio
4. Above applies to the decoder.

QUESTIONS

1. Impact of square pels?
2. Next class is HDTV or EDTV?
3. Are Max and SCIF the same?
4. Which subsets are allowed?

SINGLE FIXED SCIF

PROS	CONS
1. Fixed decoder 2. MCU easier 3. Windows easier 4. Equal burden 5. Display with only one conversion	1. Limits picture size and shape 2. Intra-regional is more expensive and poorer performance. 3. Two conversions instead of one.

MAXIMUM SERVICE CLASS

PROS	CONS
1. Unforeseen services 2. Allows for multi-format displays	(Some pros for SINGLE FIXED SCIF may be reworded here?)

HOMEWORK

1. Performance of SCIF conversions ; delay, quality, etc.
2. Coding efficiency
3. Conversion requirements
4. Address all "con" issues.
5. Applications of H.26x codec

FRAMEWORK FOR DISCUSSION OF H.26X FORMAT: see the attached table

FRAMEWORK FOR DISCUSSION OF H.26X FORMAT

CCITT RECOMMEND.	BIT RATE	RESOLUTION CLASS	PARAMETER	MAX VALUE	NEGOTIABLE VALUES
H.261	N-ISDN	A (Low)	BIT RATE	2.048 MBPS	B,2B · · · ,2048
			LINES	288	144 288
			PIXELS/LINE	352	176 * QCIF 352 CIF
			MAXIMUM FRAME RATE	29.97	29.97/1 /2 /3 /4
H.26X	1-10 MBPS	B (601)	LINES	576	576 528,512, 480,
			PIXELS/LINE	768	720 ? 768,704, 512,
			MAXIMUM FRAME RATE	59.94	59.94 30,15,10, 50,25,12.5,
			PEL ASPECT RATIO		625 * SCIF SQUARE 525
		C (ENHANCED)	LINES	576	S76
			PIXELS/LINE	960 ?	960 * ? EDTV
			MAXIMUM FRAME RATE		
		D (HIGH) HDTV	LINES		
			PIXELS/LINE		
			MAXIMUM FRAME RATE		

* MANDATORY

ADDITIONAL SUBMISSION MATERIALS FOR THE "KURIHAMA TESTS"

Source : CCITT Experts Group for ATM Video Coding
Title : Additional Submission Materials for the "Kurihama Tests"
Date : August 16, 1991
Purpose: Proposal

One of the important objectives for the joint development of high quality video coding among MPEG, CCITT Experts Group and CMTT/2 Special Rapporteur's Group is to standardize a generic coding algorithm with bit rates up to 10 Mbit/s, including communications service as one of the essential applications. Such transmission bit rates are provided by ATM based B-ISDN.

User information is transported with cells in the ATM network, and some cells are inevitably lost due to network congestion or other reasons. If one cell is lost, the decoder loses 384 (or slightly less) user bits consecutively.

Since this large number of lost bits affect significantly the decoder operation and subsequent reconstructed pictures, and since we have better chance to optimize the coding performance by integrating the source coding and the transmission coding, the CCITT Experts Group request that the cell loss resilience be considered by all the coding algorithm proposers from the start.

From this standpoint, the CCITT Experts Group proposes the following additions to the PPD document;

[1] §6.2.1 3) i.

Any claims for additional features <u>(such as cell loss resilience)</u> should be supported by demonstrations.

[2] §6.2.1 4) c. the last hyphenated item

- any other functionalities if claimed <u>(Note)</u>

<u>Note To demonstrate cell loss resilience, it is recommended to simulate 10^{-3} cell loss ratio, e.g. by replacing 384 coded bits every 0.1 sec with '0', decoding the resultant bit stream and reconstructing pictures. Exact method of simulation should be described.</u>

END

H.26X REQUIREMENTS

Status notation

(A) Agreed
(P) Preferable
(M) Mandatory
(T) Target
(FS) Implementation method is for further study

1. BIT RATE

up to several 10s Mbit/s	(A)

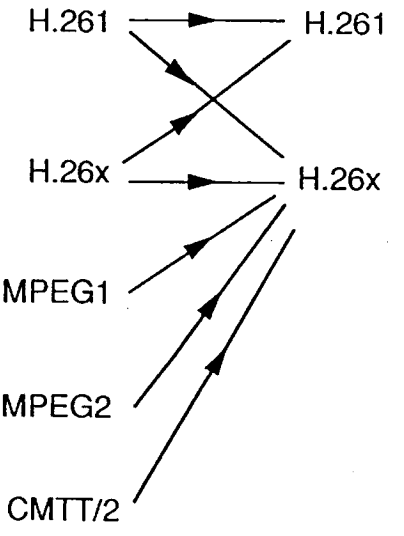
2. CODEC SOURCE FORMAT

QCIF/CIF	(A)
"601" class (see Annex 3 of this report)	(FS)
EDTV	(?)
HDTV	(?)

3. COMPATIBILITY

encoder	decoder		
H.320 --->	H.32X	(terminal)	(A,M)
H.32X --->	H.320	(terminal)	(A,M)
H.261 --->	H.26X		(P,FS)
H.26X --->	H.261		(P,FS)
MPEG1 --->	H.26X		(P,FS)
MPEG2 --->	H.26X		(P,FS)
*"CMTT/2"--->	H.26X		(P,FS)

* Secondary distribution, which may include classes above "601"

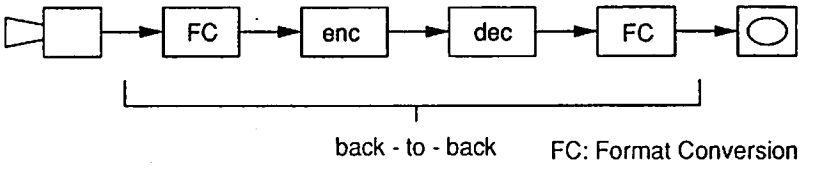


4. PICTURE QUALITY

"PAL/NTSC" at 3-5 Mbit/s and delay=? (T,FS)
"Rec. 601" at 8-10 Mbit/s and delay=? (T,FS)

5. DELAY

less than about 150 ms at bit rate > 2 Mbit/s (FS)



6. CODEC COMPLEXITY

complex/high performance
vs
simple/low performance
ex. pure intra-codec

7. APPLICATIONS

CTV, ENG, IPC, ISM, NDB, SSM, STV, TTV
(same as the PPD document, p.3 of AVC-70)
RVS (Remote Video Surveillance)

7. ATM

VBR and CBR (A,M)
Cell loss resilience (M,FS)
Bit error resilience (M,FS)
High/low priority cell utilization (P,FS)
High/low priority cell independent rate control (P,FS)
Usage Parameter Control (M,FS)

8. MULTIPOINT

Continuous presence possible (P,FS)
Time-sliced decoding
Editing without decoding-recoding
Mix of H.320 and H.32X (M,FS)

9. H.32X TERMINAL

Interwork with

H.320 terminal (A,FS)
Network database (P,FS)
Distributive service (P,FS)
Multipoint (A,FS)
Stored bitstream (P,FS)

Multimedia multiplexing (M,FS)
Audio quality > ? (FS)
Relative audio/video delay < ? (FS)
Video clock recovery (FS)
Encryption/scrambling (FS)

LIAISON STATEMENT TO SGXVIII

Questions: 3,4/XV; 2,13,22/XVIII

SOURCE : EXPERTS GROUP FOR ATM VIDEO CODING IN SGXV
TITLE : LIAISON STATEMENT TO SGXVIII
PURPOSE: FOR ACTION

1.Introduction

The third meeting of the CCITT SGXV Experts group for ATM Video Coding Experts was held in Santa Clara, 14-23 August 1991, to progress studies on video coding for services on the B-ISDN.

The Experts Group sent some comments to SGXVIII to evaluate the Integrated Video Services (IVS) Baseline Document after our second meeting. We are glad to know that these comments have been adopted in IVS. To achieve the best video service in B-ISDN we wish to send some additional comments detailed in §2 below.

The Experts Group also wishes to send some additional questions and requirements which are detailed below in §3.

2. Comments on IVS Baseline Document

2.1 Cell loss ratio (page 16, 2nd paragraph, 2nd and 3rd sentences)

Please revise the sentences as follows:

Current sentences;

"For example, a high quality videoconference connection... This may be..."

New sentences;

"Table 1 (reproduction of Annex 1 to AVC-96 with two bottom rows deleted) provides some network performance requirements obtained from some example service quality figures. The table concentrates on bit error and cell loss error correction techniques. Layered coding concealment techniques are however under consideration and lead to different figures."

Additional note to Table 1;

* These values are calculated under the assumption that cell losses are isolated. If cell losses tend to occur successively, another cell loss ratio and another cell loss correction technique may be required.

* We assumed that one cell loss always causes a picture degradation. The visual perception of the picture, however, may be acceptable even if cell loss concealment technique is not used. Therefore there is a possibility that these requirements will be relaxed.

2.2 A2.6 Service bitrate (page 11, 2nd paragraph)

Usage parameter control and network parameter control, CLP bit.

"When the cell tagging option is exercised, non compliant CLP=0 cells may be overwritten to CLP=1".

We are concerned that the network can modify the CLP bit. Some layered coding techniques intend to use CLP bit for layer indicator. For such a case, changing the CLP bit may cause more problems than discarding the cell.

This fact has already been mentioned in the last liaison statement from SGXV;

Use of CLP bit (page 16)

"The CLP bit is seen as a useful mechanism to provide protection against cell loss by controlling that information which might be lost. It is crucial that, after a cell is labeled 'high priority' by a terminal device, this is not changed by the network."

2.3 QOS related to Cell Loss Priority (bottom of page 12)

QOS related to Cell Loss Priority

"The CLP indicator in the cell header may be set by the user or the service provider. In the case of video services, the CLP bit is set by the layered coding provider..."

The wording should be clarified; e.g. who is "the layered coding provider"? Is he a user?

2.4 List of H.26X requirements

We have identified such functional requirements as attached for the high quality video coding standard H.26X, which we propose to be included in the IVS Baseline Document.

3. Questions and requirements

3.1 Cell loss ratio

If cell loss ratio is rather low, we believe that the channel coding alone, either at AAL or higher layer, can cope with low cell loss ratio based on acceptable delay requirement. However if the cell loss ratio is extremely high, some technique for cell loss resilience is required also for video source coding.

On the other hand, we intend to select a video source coding algorithm at the beginning of 1992. Therefore after that day, it becomes difficult to implement additional cell loss resilience technique for source coding algorithm.

Therefore we are eager to know the likely value of cell loss ratio as soon as possible. For this purpose we sent the liaison two times. However, the answer from SGXVIII is not clear yet. IVS Baseline Document only says that

the requirement from SGXV is that value and does not mention whether this requirement is achievable or not from a network standpoint of view.

3.2 CLP bit

3.2.1 Negotiation for two priority flows

The liaison statement from SGXVIII at Geneva meeting, 11-28 June 1991 (annex 2, last paragraph) said as follows;

"There will be negotiation for both priority flows."

It is clear for CBR. However the following two types of negotiation can be considered (Figure 1);

Case 1: Negotiations are done for both flow separately.

In this case low priority flow cannot use the erosion area of high priority flow.

Case 2 : Negotiations are done for high priority flow and sum of both priority flows.

In this case low priority flow is not restricted as Case 1 and can use the erosion area of high priority flow.

The question is which is the likely solution.

3.2.2 Merit of using CLP bit

The question is what is the merit of using CLP bit. Layered coding is a suitable technique to use both priority classes. However whether we adopt this technique or not depends on its expected merit. What degree of network resource saving can be obtained by using low priority cells?

This question is also related to the selection of video source coding technique. Therefore quick response is required.

3.3 Usage Parameter Control for peak cell rate

The liaison statement from SGXVIII at Geneva meeting, 11-28 June 1991 annex 2 said as follows;

"A maximum Cell Delay Variation will be allocated to the Customer Equipment (CEQ) between the ATM SAP and the interface at the T Reference Point.

Please show us the meaning of "a maximum cell delay variation". When we assume a system configuration as in Figure 2, the minimum inter-arrival time will change because of multiplex of multiple VCs at terminal adapter and NT2 as shown in Fig.3. Therefore, we cannot control peak cell rate at the T reference point. We have two questions;

Question 1: What is the definition for peak cell rate at the S reference point?
Question 2: What technique does SGXVIII recommend for multiplexing in the adapter to keep the peak cell rate at the S reference point?

3.4 Requirements for AAL Type 1

We are concerned about the circuit emulation mode for existing standard audiovisual terminals. Some tentative requirements have been identified and are listed below. Further requirements may be identified as the work of the Experts Group progress.

3.4.1 Interleaving

CMTT suggested to SG XVIII that the CS layer should be capable of interleaving. Considering that the delay produced by the interleaving processing depends on transmission rate, the interleaving function should be optional, not mandatory.

3.4.2 Cell loss notification

Since not all erroneous information can be corrected by AAL, cell loss notification is indispensable for the decoder to lessen the damage to the reconstructed picture.

3.4.3 8 kHz timing

When conventional terminals are used, 8 kHz timing is necessary to synchronize the first bit of each octet between the sender and the receiver. CMTT also requires 8 kHz timing on behalf of conventional codecs, so SG XV also requires 8 kHz timing for the same reason.

3.5 AAL Type 2 SAR

The major user of AAL type 2 will be video services. Therefore we agree that we have responsibility for providing the major inputs to SG XVIII leading to the definition of AAL type 2.

Given the necessity to support a wide range of video services with different requirements, rates, etc., it appears that the fields given as examples in I.363 AAL Type 2 example may be restrictive. For example, an AAL Type 2 with minimum functionality may offer the flexibility to accommodate a wide and diverse range of video services, but the minimum functionality is now under discussion.

Commonality of the SAR-Sublayer for CBR & VBR video

It is the common view held by the Experts Group that issues in relation to SAR functionality to support VBR video using AAL Type 2 apply equally to the support of CBR video. Therefore, in line with the Experts Group's desire to contribute to the development of requirements of the AAL Type 2 for the support of VBR video, AAL Type 2 will be developed within the Experts Group to support both VBR and CBR video services.

3.6 Network interworking

1) When network provides interworking function between N-ISDN and B-ISDN by network gateway as shown in Fig.4 (reproduction of Fig.1/AVC-91), what types of AAL are required for B-ISDN side terminal?

2) How does B-ISDN intend to provide transparent N-ISDN circuit emulation especially those for cell loss sensitive and time delay critical services such as visual telephone using H.261, H.221 etc.?

3) What slip rate is expected when providing N-ISDN circuit emulation between N-ISDNs via B-ISDN?

4) The Experts Group is considering the conversion of N-ISDN user multiplexed signals to B-ISDN VC multiplexed signals either in Terminal Adapters (TA) or B-ISDN/N-ISDN Inter-Working Units (IWU). Current user multiplex structures (e.g. H.221) can reconfigure their internal rate allocation in the order of 20msec. The Experts Group requires information on the possibility of;

a. Associating a group of virtual channels with different QOS requirements with a a single resource allocation, and

b. Resource allocation renegotiation in the order of 20msec.

5) What N-ISDN bit rates will be supported by the B-ISDN circuit emulation mode?

3.7 Signaling for multimedia synchronization

One obvious consequence of mixing media on a single virtual path is that the Quality of Service (QOS) required must correspond to that of the most sensitive service, and for many applications this may not be cost effective solution (i.e. mixing loss sensitive data and delay sensitive video traffic) and multiple virtual paths may be required. Multiplexing all services onto a single VP results in zero cross media delay at the cost of a potential mismatch of QOS. Separate VPs ensure a QOS matched exactly to the media.

We are considering to use one VC for each medium for each service, in other words, each service component (multiplex in ATM layer). For multimedia communications, a cross media maximum differential delay should be guaranteed. The typical case is the lip-sync between video and audio. For this requirement it seems that multimedia call should be marked/indicated. Signalling for call establishment and for the addition and deletion of media components must therefore be capable of indicating that particular services are associated for the purpose of synchronization. Further study is requested for signaling and control to handle the cross media delay to be minimum.

3.8 Technique to support low bitrate information

We intend to use multiplex in ATM layer as mentioned above. However there exists very low bitrate information such as pointing or telewriting. What technique does SGXVIII recommend to transmit that kind of low bitrate information (e.g. 300 bit/s) in multimedia connections?

4. Conclusion

This document is including some comments to IVS Baseline Document and has raised some important questions and requests concerning the network issues. The SGXV Experts Group for ATM Video Coding intends to continue close relation to SGXVIII for the development of video services.

END

Table 1 SERVICE AND NETWORK REQUIREMENTS

Service	Bit rate	QOS requirements (***)	Required BER/CLR without error handling in AAL	AAL type	Required BER/CLR after single bit error correction on cell basis in AAL (*)	Required BER/CLR after single bit EC on cell basis and addit. cell loss correction in AAL (**)
Communication						
videophone	64kbps/2Mbps FBR (H261)	30 min error free	BER<1.e-6 CLR<1.e-7 (BCH(511,493) FEC in user layer)	type 1	in user layer	BER<... CLR<8.e-5
videophone	2Mbps VBR	30 min error free	BER<3e-10 CLR<1e-7	type 2	BER<1.2e-6 CLR<1e-7	BER<2.3e-5 (CLR=1e-6) CLR<8e-5
videoconference	5Mbps VBR	30 min error free	BER<1e-10 CLR<4e-8	type 2	BER<8e-7 CLR<4e-8	BER<1.8e-5 (CLR=1e-6) CLR<5e-5
videodistribution						
TV distribution	20-50Mbps VBR	2 hours error free	BER<3e-12 CLR<1e-9	type 2	BER<1.2e-7 CLR<1e-9	BER<6e-6 (CLR=1e-6) CLR<8e-6
MPEG1 core	1.5Mbps VBR	30 min error free	BER<4e-10 CLR<1e-7	type 2	BER<1.4e-6 CLR<1e-7	BER<2.5e-5 (CLR=1.e-6) CLR<9.5e-5
MPEG2 core	10Mbps VBR	30 min error free	BER<6e-11 CLR<2e-8	type 2	BER<5.4e-7 CLR<2e-8	BER<1.5e-5 (CLR=1.e-6) CLR<4.e-5

(*) Payload scrambling polynomial 1+x**43 produces double, correlated bit errors.
(**) Based on parity cell built from 31 consecutive data cells (see further in annex 1). The cell losses are assumed to be isolated. With this simple correction scheme, single cell losses can be corrected if combined with cell loss detection by cell numbering. Also non-corrected but detected bit errors in a cell are handled by replacing this faulty cell by a dummy cell followed by correction of this cell by the cell parity mechanism. The BER calculations are done in the assumption that all double ATM link errors (2 times 2 correlated errors due to payload scrambling) can be detected.
(***) QOS requirements, as visualized by viewers; not directly related to channel errors.

Notes

- These values are calculated under the assumption that cell losses are isolated. If cell losses tend to occur successively, another cell loss ratio and another cell loss correction technique may be required.

- We assumed that one cell loss always causes a picture degradation. The visual perception of the picture, however, may be acceptable even if cell loss concealment technique is not used. Therefore there is a possibility that these requirements will be relaxed.

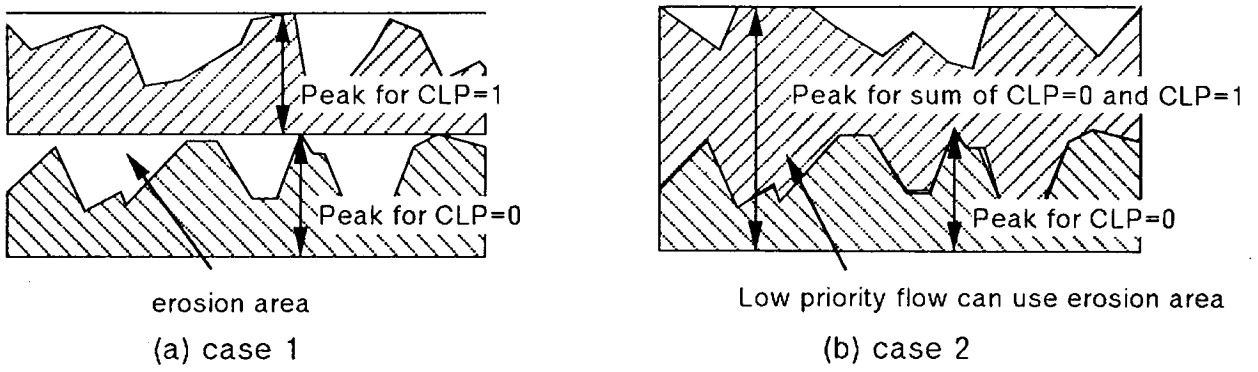


Fig.1 Peak bit rate negotiation

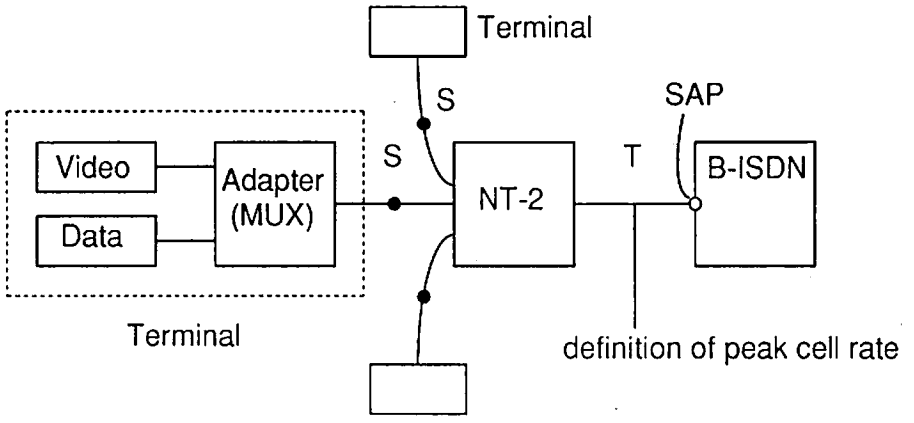


Fig2. An example of system configuration

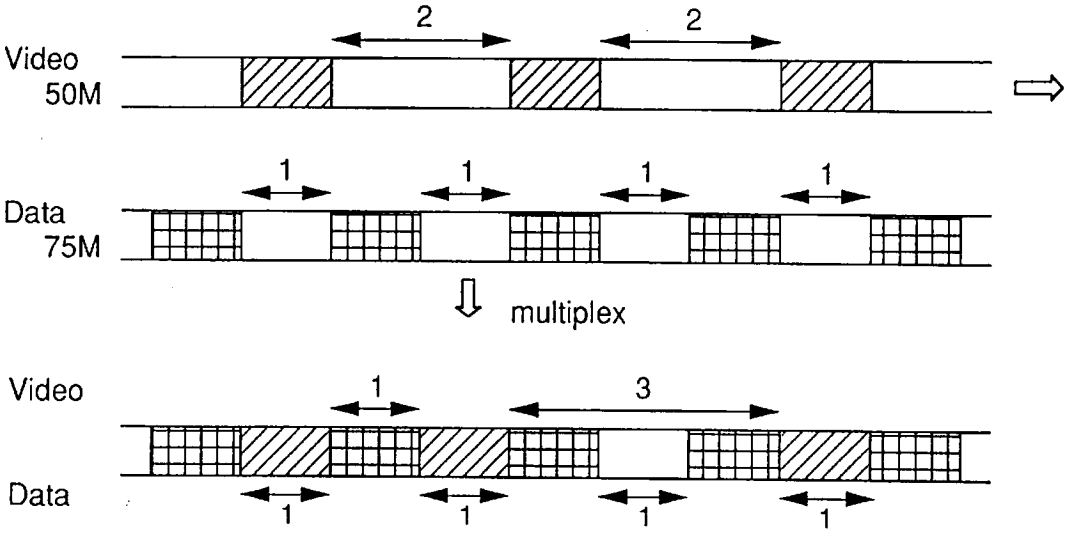


Fig3. The variation of peak cell rate caused by multplex

LIAISON STATEMENTS TO TG CMTT/2

SOURCE : Expert Group for ATM Video coding
TITLE : Liaison statement to Task Group CMTT/2 concerning requirements for secondary TV and HDTV distribution
PURPOSE: For action

At the third meeting of the CCITT SG XV Experts Group for ATM Video coding held in Santa Clara (USA), the Liaison Statement from the Special Rapporteur of Task Group CMTT/2 for Secondary distribution of digital TV and HDTV signals was discussed. Special attention was given to the annex of the Liaison Statement containing the Preliminary Requirements for secondary distribution of TV and HDTV signals.

As a result of the discussions the Expert Group brings to the attention of the Task Group CMTT/2 the following:

1. The phenomena of channel hopping, frequently carried out in TV broadcast services, may impose particular requirements on the systems used for these services. It is therefor suggested to take these requirements also into account in updating the text for the functional requirements for secondary distribution of TV and HDTV signals.

2. It is the view of the Experts Group for ATM Video Coding that the foreseen integration of services in a B-ISDN environment will desire terminals (H.32x) which could handle both signals coming from a H.26x codec and signals coming from digital TV and HDTV distribution codecs. The implication of a level of compatibility amongst both may be a requirement to consider.

   See Figure in the attached list of H.26X requirements.

3. To enable a better understanding of the requirements of systems for secondary distribution of digital TV and HDTV signals it is considered useful to provide a reference configuration from the source to the receiver. We would like to study the commonality of the secondary distribution service terminal and our H.32X terminal for communication purposes.

Attachment: H.26X requirements (Annex 5 of this report)

SOURCE : Expert Group for ATM Video coding
TITLE : Liaison statement to Task Group CMTT/2 concerning harmonisation of the work
PURPOSE: For action

In the interest of service integration all terminals should be capable of handling different signals. It is therefor strongly desirable that CMTT, CCITT and ISO/IEC jointly develop an appropriate video coding method.

This process is already under way between CCITT and ISO/IEC and joint meetings have been held. An overall list of requirements have been identified and preliminary assessments and test procedures devised.

CCITT SG XV Experts Group for ATM Video Coding is of the opinion that an increased level of participation of TG CMTT/2 at all meetings is highly desirable.

END