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

Document AVC-65R
May 31, 1991

SOURCE : CHAIRMAN
TITLE : REPORT OF THE SECOND MEETING OF THE EXPERTS GROUP FOR ATM VIDEO CODING IN PARIS (May 23-31, 1991)
Purpose: Report

PART I - INDEPENDENT SESSIONS

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

PART II - JOINT SESSIONS WITH MPEG

1. Requirement Sub-group
2. Test Sub-group
3. Video Sub-group
4. System Sub-group
5. Implementation Sub-group

PART I - INDEPENDENT SESSIONS

1. General

The second meeting of the Experts Group was held in Paris (France) at the kind invitation of CNET and ENST. The first part of the meeting, held at CNET during May 23-24, consisted of CCITT independent sessions, while the second part, held at ENST during May 27-31, 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 at CNET, Mr. Jean-Paul Bloch made a welcome address on behalf of the hosting organization.

The following changes of the coordinating member were informed of the group;

- FRG: Mr. Franz May (Daimler-Benz) has been added as the second member.
- Canada: Mr. Denis Lemay (BNR) has replaced Mr. S. Sabri.
- Switzerland: Mr. P.A. Probst provisionally replaces Mr. H. Keller until a new member is appointed.

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, 43 AVC-numbered documents and 12 temporary documents were available as listed in Annex 1.

3. Tape demonstration (TD4)

A number of video tape demonstrations were given with DI or U-matic to present experimental results as detailed in Annex 2.

4. Discussion

4.1 Report of the meetings relevant to the Experts Group

4.1.1 SGXVIII Matsuyama meeting - November/December 1990 (AVC-24,25)

Mr. Biggar reported that coordination among standardization groups involved in video coding study had been initiated by SGXVIII, and that some replies to our questions were given as a liaison statement. It was also reported that "IVS Baseline Document" as in AVC-25 had been created as a vehicle to achieve the coordination mentioned above.

4.1.2 MPEG Berlin meeting - December 1990 (AVC-23,26)

Mr. Okubo reported that MPEG had supported to have joint sessions in areas of joint concern with the Experts Group as we proposed. Milestones of the MPEG Phase 2 work and test procedures to find promising video coding algorithms were also reported. It was stressed that we should identify all the technical requirements for the high quality video coding standard from the CCITT point of view.

4.1.3 WPXV/1 Geneva meeting - February 1991 (AVC-27)

Mr. Okubo reported the outcome of the meeting of our higher body highlighting the slight extension of our "terms of reference".

4.1.4 CMTT/2 Tokyo meeting - March 1991 (AVC-28)

Mr. Carbiere reported that TG CMTT/2 had identified common areas of interest between CMTT/2 and SGXV and that they seeks practical collaboration through the Special Rapporteur.

4.2 Picture format (AVC-29,36,46,59,60,64; TD8)

The six documents were presented addressing the following questions;

- Do we use a single coding format or multiple ones for the high quality video coding?
- What parameter values are possible? How are they related to the existing CIF? How are they related to larger formats such as EDTV and HDTV?
- What framework is the best for the service integration on B-ISDN?
- Do we take the initiative to adopt the single picture format approach to other groups if proved viable with evidence?

During the discussion, various views were expressed as follows;

- Discussion of regional boundaries are not appropriate if we consider the globalization of communications. The argument may also be valid for broadcast and video database services.

- We are deciding the transmission format which should be distinguished from interface specifications.
- Since services are market-driven, "flexibility" is the key word for this format issue.
- A single format is desirable for both of inter- and intra-regional communications, but the burden of coding efficiency and hardware should be well evaluated.
- Multi-point and bridging capability of a single picture format is also desirable.
- Adoption of square-pel shape will permit direct connectivity with computer workstations and encourages desktop videoconferencing.
- For high quality applications, the current CIF requires improvement. CMTT is concerned with compatibilities with new EDTV and HDTV with digital input.
- The current CIF provides not too bad quality if higher bit rates are allowed. It will satisfy interregional communication needs.
- 60 Hz progressive pictures converted from local standards are already degraded. Adding pels at the encoder input and removal at the decoder output does not lead to coding gains. In what time range do progressive cameras and display become widely available?
- Progressive scan ameras are questionable but displays have no problems even today.
- We are coding "pictures" but not "pels".
- We should seek worldwide unification in picture coding format by providing better definition than CCIR601, compatibility with the current CIF and advantages for digital signal processing.
- Since picture quality due to frame rate conversion (from interlaced to non-interlaced) is not sufficient, the progressive format solution may be premature if it assumes progressive scan cameras.

After the discussion, Mr. Haskell undertook to coordinate a small group for establishing an action plan toward decision at the earliest occasion. The outcome is contained in Annex 3. Participants are requested to make contribution according to this work plan.

4.3 Framework for H.26X

4.3.1 Requirements (Annex 7/AVC-22R; AVC-37,51,57)

The following items were recognized as possible requirements for our future video coding study;

- Multipoint consideration taking into account B-ISDN capabilities such as listed in §3/AVC-37
- Capability to operate in intraframe mode only may offer advantages in some situations.
- Provision for both backward/forward and downward/upward compatibilities and adaptability to future extension

Early consideration of the first item and reflection to the coding framework were felt necessary. As to the second item, there was some discussion what tariff structure would be adopted for B-ISDN with respect to the bit rate and communication distance. There are no clear answers at the moment.

These items are input to the joint sessions with MPEG from the Experts Group.

4.3.2 Architecture (AVC-34,35,50,55)

"Flexible Layering" video coding architecture was addressed in AVC-34,35 which exploits B-ISDN characteristics and provides service integration. The idea was recognized interesting and obtained general support. There was expressed some concern about loss of coding efficiency due to layering which could be counted against service interworking.

Since cell loss is one of the key characteristics in ATM networks, it was dealt with in the architecture discussion. Questions were;

- What degree of cell loss should we expect for high/low priority cells?
- Is simple recovery from rare cell loss sufficient or is sophisticated protection against frequent cell loss required?

Some delegates expressed that cell loss ratio of around 10^{-8} or 10^{-9} may be obtained for the high priority class, but the total scope remains still ambiguous. AVC-50 listed up various cell loss protection and recovery methods while AVC-55 showed an example of two-layer coding with highly cell loss resilient enhancement layer.

Note to §4.3 - The meeting confirmed that the aim of H.26X is to cover a range of video applications, bit rates, resolutions, qualities, and services for B-ISDN, and that compatibility between H.26X and H.261 should be highly respected (see §7.1 and §6.3/AVC-22R).

4.4 VBR vs CBR

4.4.1 Comparison study (AVC-38,41,47,48,56,62)

Several studies including simulation experiments were presented on the following topics;

- Statistical multiplex gain (AVC-38,41,47)
- Picture quality comparison (AVC-38)
- Delay and impact of source periodicity based on a single network model and a 30 minute long VBR video data (AVC-62)
- Guideline for further simulation works under restrictions of network's UPC (AVC-48,38)
- Analysis of allowable information generation at the encoder for a VBR channel (AVC-56)

The meeting had a question and answer session, during which it was suggested that we should pay attention to the buffer size in the comparison of VBR/CBR performances and that a test material with noise may be required. It was also noted that Document AVC-62 points out the ambiguity of multiplexing gain, stating that due to statistical multiplexing gain different sources may experience different cell loss ratio which in turn may impact the definition of statistical multiplexing gain.

4.4.2 Statistics (AVC-44,49,61)

Some statistics for VBR coded data were presented in the form of bit rates measured with various time windows. It was found that a relatively small buffer makes a significant difference to the shape of source, and that the number of cells per frame for videoconferencing scene with moderate motion and no scene cuts or changes follows a Gamma dsitribution when measured in an open loop VBR coding.

It was also addressed for what pictures VBR can be most effective. VBR picture quality advantage in Mr. Biggar's tape demonstration was pointed out to correspond to the illustration in Figure 5/AVC-49.

4.4.3 Network model (AVC-43,61)

Four different network models were presented for information. It was clarified that the CLR (Cell Loss Ratio) in the first simplified network model contained in Annex 4 to Document AVC-22R should read P_{sat}, probability of saturation, and that P in AVC-43 should read PVBR.

The meeting feels that this model is not sufficient due to the following facts;

- The aggregate model does not take into account correlation between arriving frames.
- Video source cannot be accurately modeled by a memoryless ON/OFF model.
- Document AVC-61 shows that a two-state model which takes into account correlation overestimates cell loss ratio.
- A second order AR (autoregressive) model underestimates cell loss ratio.
- It does not take into account dynamics of statistical multiplexing (i.e. source periodicity effect).

The necessary improvements, however, require further detailed studies.

4.4.4 Framework for further study (TD7)

After the discussion of the above items regarding the variable bit rate video coding study, Mr. Verbiest undertook to coordinate a small group to establish a framework for further study. The outcome is contained in Annex 4. Contributions are awaited toward the next meeting.

4.5 Layered coding (AVC-31; AVC-33,35,45,55,58)

Impact of layering to the coding efficiency was presented in AVC-31. It was noted that this particular architecture suffered from some ineffectiveness due to VLC and interframe prediction accuracy.

Other 5 documents also addressed layered coding, but they were discussed in more directly relevant items.

4.6 Video coding algorithms (AVC-30; AVC-33,45,58)

Extensive study results were presented in AVC-30 concerning possible new elements of source coding. The meeting appreciated this information. During the questions and answers, the following facts were clarified;

- Line conversion filters with small number of taps are well suited for picture coding.
- The quantizer trick described in AVC-30 has been found effective also in the video codec of the Belgian Broadband Experiments.
- A self adaptive VLC (the U-VLC) has been defined in the Belgian experiments, whose adaptivity provides a high efficiency.
- Difference in picture quality in frames with different quantizers (P1 and P2 pictures on p.6/AVC-30) are noticeable for single frame display but not for sequence display.

- One of the reasons for effectiveness of the MPEG1 bi-directional prediction may be better prediction for uncovered backgrounds.

4.7 Compatibilities with other standards

4.7.1 Definition (AVC-32)

The meeting supported the proposed definitions for the following terms;

- Upward/downward, forward/backward compatibilities
- Methods to implement the compatibility - simulcasting, embedded bit stream, syntactic extension, switchable encoder, standard families

Members are recommended to use these terms for their future work. During the discussion it was pointed out that "layered coding" corresponds to either of the "embedded bit stream" or the "syntactic extension".

4.7.2 Specific methods (AVC-33,45,58; AVC-35,51,55)

Three schemes were presented in AVC-33, 45 and 58 for information which implemented upward/downward (CCIR601 vs CIF or SIF) and forward/backward (H.261/MPEG1 vs H.26X/MPEG2) compatibilities with multi-layered coding by using H.261 or MPEG1 as the base layer.

During the discussion, it was pointed out that we need not be restricted by the existing standards, we should rather seek the most optimized solution for the B-ISDN functionalities, the interworking between the N-ISDN and B-ISDN can be implemented through the gateway. Several opposing opinions, such that the cascade connection of H.261 and H.26X may cause additional delay and picture quality degradation, were expressed to this view.

The meeting confirmed that the Experts Group should provide means for interworking between H.320 terminals connected to the N-ISDN and H.32X terminals connected to the B-ISDN. Appropriate means to achieve this objective are open at the moment.

4.8 Multimedia multiplexing (AVC-39,42,53)

Having heard the study results on multimedia multiplexing methods in the ATM environments, the meeting agreed to use the VCI method as a reference of our future work which separates a multimedia connection into several virtual channels. In order to confirm its suitability, the following items should be further studied;

- How to assure cross media synchronization
- Penalty in the use of network resource (Note: Tariff is related to this consideration, which is recognized difficult to handle.)
- Maximum number of VCIs for a multimedia connection
- Existence of user level multiplex to a single bit stream such as N-ISDN audiovisual systems and MPEG systems
- Impact of VBR coding and UPC

4.9 Network issues (AVC-24,25,40,52,54; TD10)

The meeting endorsed the IVS Baseline Document approach which had been proposed by SGXVIII and confirmed to contribute actively to its upgrading. As a first step, we collected materials from AVC-40 and 52 which should be sent to SGXVIII. We also picked up a few items which should be included in

our liaison statement to SGXVIII. Mr. Biggar undertook this drafting work with cooperation of some volunteers. The outcome is contained in Annex 5.

AVC-54 addressed the timing recovery for the B-ISDN audiovisual codecs and means of transmitting required timing information. Due to the lack of available time, we could not have detailed discussion. Members are requested to review this document and submit contributions toward the next meeting.

5. Work plan (AVC-34,57)

Chairman requested understanding of the members for a change of the work method leading to the first reference model due to the joint work with MPEG. Instead of "informal observation tests", we will use the subjective assessment of promising techniques (Kurihama tests) to quantify the subjective picture quality of candidate algorithms. Submission of simulation results to this Kurihama tests are recommended. It was stressed that the objective of this subjective test is to find promising techniques for further collaborative elaboration.

Some concern was expressed whether B-ISDN characteristics such as cell loss can properly be included in the evaluation, and whether some schemes such as layered coding may be precluded.

It was clarified that the Kurihama tests are for source coding and necessary adaptation to the transmission channels should be studied and optimized in parallel and subsequently.

The meeting agreed to make an input to the joint sessions which contains the following requirements from the communication applications standpoint;

- Cell loss resilience
- Short coding/decoding delay (≦～150ms)
- Multipoint consideration
- When compatible coding is tested, the base layer bit rate should be set as guidance to a value lower than the primary rate, otherwise there is no ways to transport the base layer for interworking with the existing systems.
- Test sequences of progressively scanned materials. There may be a danger that coding algorithms are optimized only for interlaced materials.

6. Actions to other groups

6.1 SGXVIII (TD10)

The Experts Group sends a liaison statement as contained in Annex 5.

6.2 CMTT/2 (TD9)

The Experts Group sends a liaison statement as contained in Annex 5.

6.3 MPEG (TD5,11)

The meeting discussed ways of coordinated collaboration with MPEG, related to the document submission to the joint sessions from the Experts group. The followings obtained consensus as its conclusion;

- "Proposal" documents should be supported by the group as a whole, and sourced by the Experts Group. It causes confusion if differing proposals are brought independently.
- As there have been made no decisions relevant to the joint work, only informational documents, relabeled as "Purpose: Information" if necessary, are submitted this time. Specific documents are AVC-30, 32, 33, 34, 35, 51, 56 and 58.

Representatives to MPEG subgroups (Video, System, Requirements, Test, Implementation) were appointed as in Annex 7.

The Experts Group sent an input document to the joint sessions, summarizing the discussion in its sole sessions as contained in Annex 8.

At the closing session held on May 31, we reviewed the organization of this meeting, particularly the way of collaboration with MPEG we tried the first time here. Some delegates expressed as follows;

- Two days for the independent sessions are definitely too short. Sufficient discussion was not possible.
- Having a technical session on ATM aspects during the MPEG week may be effective.
- The closing session should be held at an early occasion so that the participation in the joint sessions become more flexible.
- The current MPEG activities include much of MPEG-1, thus joint sessions are not efficient for the Experts Group.
- Method of using liaison statements may be appropriate.

Chairman clarified that the joint sessions are not only part of the MPEG meeting, but also part of the Experts Group meeting, and that we are having physically one meeting but it should be considered logically as two meetings, thus the closing session should review the joint sessions as well. He also stressed the importance of working together from the early stage toward joint development of the universal (or generic in MPEG term) high quality video coding standard and the importance of our proposing candidate algorithms to the Kurihama test for this purpose, even though there is some inefficiency due to the mixture of MPEG-1 and MPEG-2 works at the moment.

The meeting finally agreed to try again in August this way of meeting organization, but extending the independent sessions to three days.

7. Others

7.1 Status report (TD3.6)

The meeting agreed to update the preparatory draft in TD3 by incorporating the achievements obtained at this meeting. Editors who are in charge of updating the document were appointed as in Annex 8.

7.2 Next meetings

- 3rd meeting: August 14-16 (independent sessions), August 19-23 (joint sessions with MPEG) in Santa Clara, U.S.
- 4th meeting: November 1991 in Yokosuka, Japan
- 5th meeting (provisional): January 1991 in Singapore

END

PART II - JOINT SESSIONS

1. Requirement Sub-group (by Sakae Okubo)

1.1 Documentation

1.1.1 General requirements - §3/016

MPEG91/011,012,021,042,056,060,065,071,075,076,079

1.1.2 Compatibility - §3.4 11)/016

MPEG91/011,017,071,081

1.1.3 Kurihama test conditions - §6.2.1/016

MPEG91/021,049

1.1.4 Test methods for picture quality - §6.2.1 2)/016

MPEG91/019,023,024,025,026,027,028

1.2 Discussion schedule

- Requirements (Okubo)	Tuesday	9-13, 14-18
- Test methods (Hidaka)	Wednesday	10-13, 14-18
- PPD (Okubo)	Thursday	9-13

1.3 Agreements

1.3.1 General requirements

1) We will incorporate all the requirements identified in various documents (011,012,042,2/060,071,075,076,079)) into §3 of PPD, as far as they are not contradictory. If there may be any contradictory requirements, they should be solved in the application standards.

2) We have confirmed that these requirements be met by the standard for high quality video coding as a log range target, namely in the course of Committee Draft development.

3) The following tests are to be be considered in the collaboration phase work;

- Artificial patterns to check particular elements in the coding algorithm such as presented in MPEG91/021.
- Coding performance for progressively scanned materials. For this purpose, provision of test sequences and monitors should be further considered.
- Conversion from CMTT to MPEG coding as in MPEG91/065.

4) Layered coding is suggested in MPEG/056,071,076 for realizing compatibility with existing standards, flexibility to the quality/bit rate tradeoff, and flexibility to the differing characteristics of transmission/storage media.

4) An editorial work was carried out by several volunteers to extract appropriate materials in the received contributions which should be

reflected in the PPD document (MPEG91/016). The outcome is given as part of the meeting report.

1.3.2 Compatibility

1) We will use the terminology given in MPEG91/081 for future discussion of the compatibility issue.

2) We have confirmed the following previous decisions toward defining the first "Test Model", thus toward developing the standard;

- We seek "compatibility" to the maximum extent.
- For competition purpose, we will initially concentrate on the picture quality. If we succeed to narrow down the number of candidates from the picture quality measurement, we will apply functionality criteria including compatibility.
- Every coding algorithm proposal should describe what compatibility features it has and demonstrate the processed pictures in the claimed compatibility mode(s) such as illustrated in Figure 1(a).

3) The greatest degree of compatibility would be achieved by a core MPEG1 decoder operating on a bit stream in the range of 1.0 - 1.5 Mbit/s.

1.3.3 Kurihama test conditions

1) Selection of test sequences

According to the feel for difficulty of coding, the agreed 8 test sequences were ordered as in Figure 2.

We gave priority to the four sequences which are to be used commonly for both of 4 Mbit/s and 9 Mbit/s.

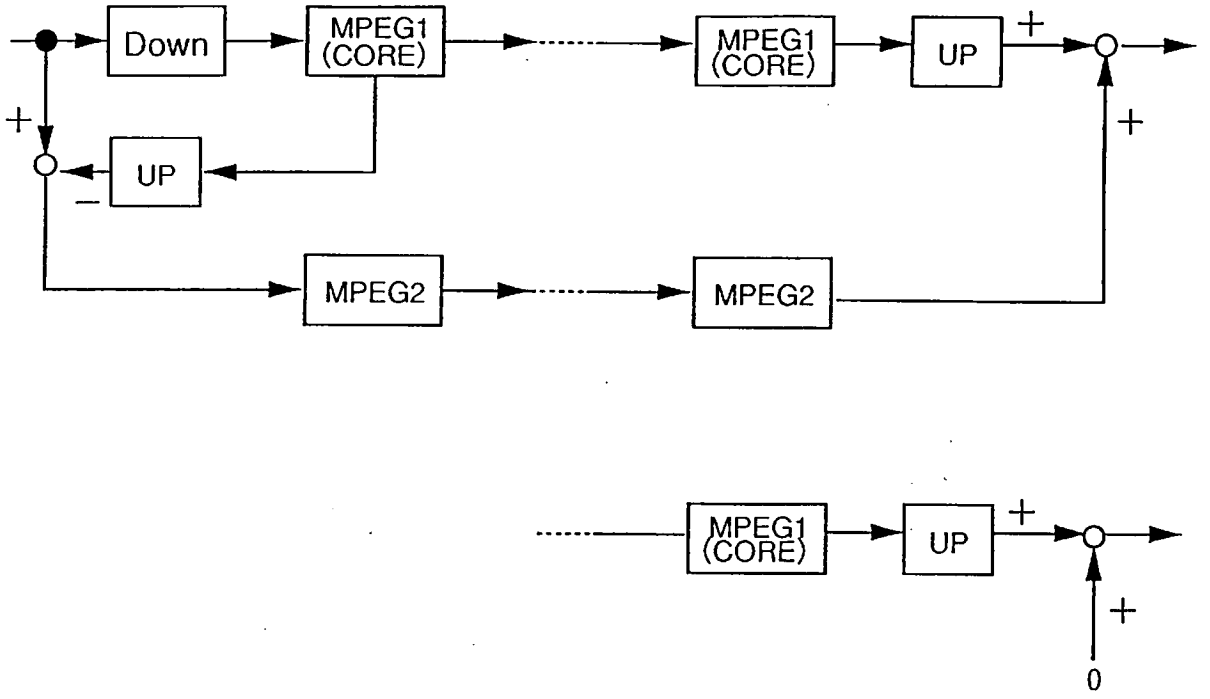
We selected test sequences for the three cases where 2, 3 and 4 overlapped sequences as in Table 1 according to the guideline to pick up other necessary number of sequences from easy ones for 4 Mbit/s and difficult ones for 9 Mbit/s.

The selection of the number of overlapped sequences depends upon the number of proposals, namely the capacity of testing facilities and testing hours.

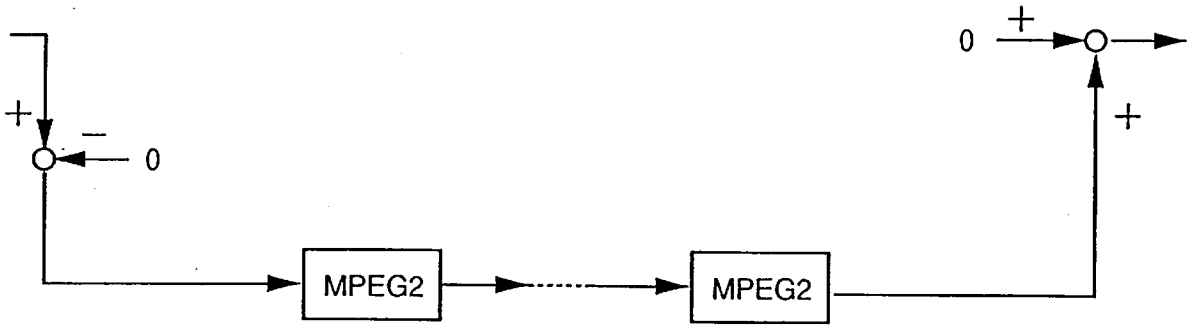
After having reviewed various coded pictures, there were raised some questions whether bit rate values and selected sequences in Table 1 produce sufficient difference among proposed algorithms, particularly at 9 Mbit/s. This matter may be reconsidered if achievements by August indicate no difference at all between original and coded pictures.

2) Resolution

For the Kurihama test purposes, the input and output signals are both CCIR 601 4:2:2 ones. Some coding algorithms may subsample the input signal, which should be stated in the coding algorithm description. Different parameters or even different algorithms may be switched for 4 Mbit/s and 9 Mbit/s, but the bit stream should contain all the necessary bits for the purpose so that the decoder can correctly identify these parameters and operate.



a) Compatible mode



b) Non-Compatible mode

Figure 1 Operational modes

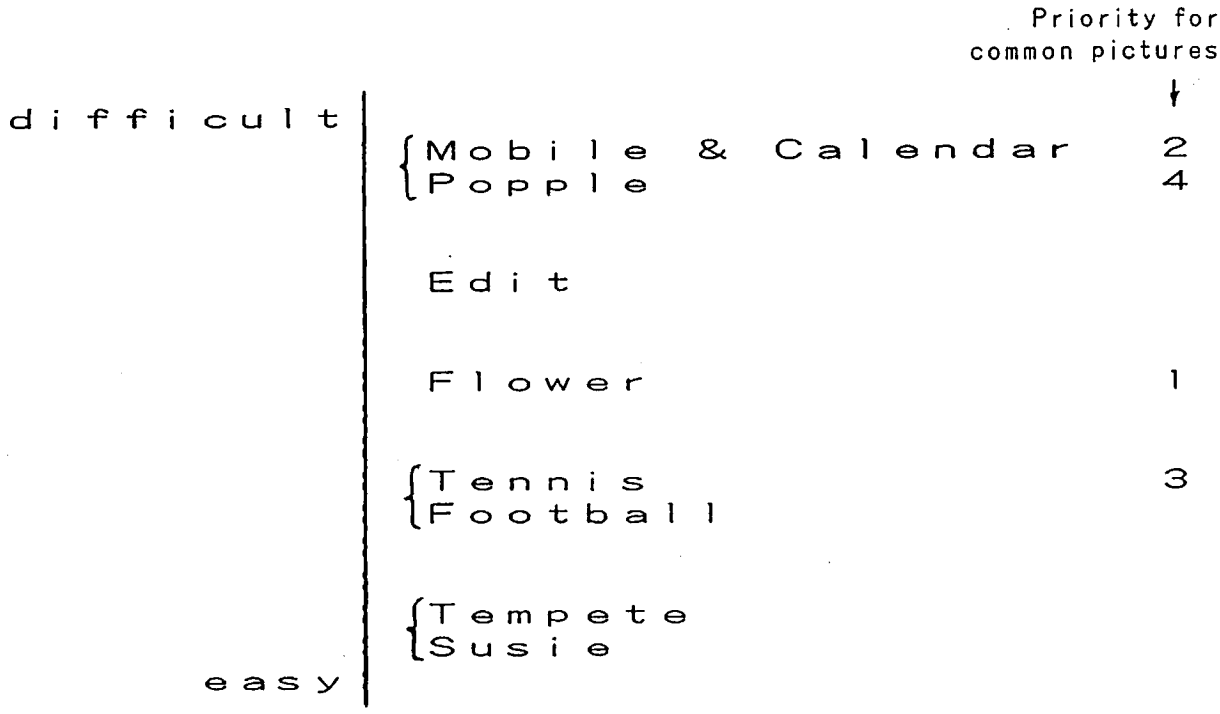


Figure 2 Feel for order of coding difficulty

Table 1. Test sequences

Picture \ No. of common pictures / Bit rate	2		3		4	
	4 M	9 M	4 M	9 M	4 M	9 M
A : Flower Garden	X	X	X	X	X	X
B : Suzie	X		X		X	
C : Popple		X		X	X	X
D : Table Tennis		X	X	X	X	X
E : Mobil and Calender	X	X	X	X	X	X
F : Tempete	X		X		X	
G : Edit		X		X		X
H : Football	X		X			X
NUMBER of TEST PICTURES	5	5	6	5	6	6

Note - This conclusion is based on the technical settlements at a joint session between the Video and Requirement/Test subgroups on Wednesday. Since this interpretation differs from the one agreed at the Tuesday session of the Requirement/Test subgroup which was based on the approved report of the Berlin meeting, the final decision supporting the above mentioned settlements was made at the WG11 plenary on Friday, May 31.

3) Coding and decoding delay should be stated.

4) Random access delay addresses "frame (2 fields in a set)".

1.3.4 Materials to be submitted

1) Description

- Algorithm including block diagram and syntax diagram

- Compatibility feature
- Random access feature
- Coding/decoding delay
- Any other functionalities
- VLC, FLC tables employed for coding of classification related overhead, motion vectors, coefficient data, various synchronization words, etc.

- Statistics
    * number of bits and SNR for each frame
    * cumulative bit count once every 0.4 second (excluding the last 0.2 second) for each sequence
    * several items (such as motion vector count, luminance and chrominance bit counts, overhead bits) averaged over each sequence following the formats in SM3/RM8 tables as a guideline

2) D-1 tape for subjective tests of normal playback for agreed test sequences at 4 Mbit/s and 9 Mbit/s

3) D-1 tape for demonstration excluding the normal playback pictures

- fast forward
- fast reverse
- compatibilities if claimed
- low coding/decoding delay mode pictures if claimed
- any other functionalities if claimed

4) Verification of decoded pictures

Each picture to be tested at Kurihama should be reconstructed from a coded bit stream. A paper listing should be given for each sequence which indicates the corresponding coded bit stream file in a format such as UNIX "ls -l" output.

Decoder executable codes should be made available upon request of MPEG. If this requirement is not met, the proposal can not be considered as part of promising schemes.

5) Implementation aspects - see §5 below of this report

Detailed algorithm descriptions are required. Some tables to be filled in may be provided at the next meeting in August 1991.

2. Test Sub-group (by Sakae Okubo)

This sub-group dealt with procedures for the Kurihama test which measures subjective picture quality of the proposed video coding algorithms.

1) Test method for picture quality was agreed as described in MPEG91/024,028 (Double stimulus continuous quality-scale method as per CCIR Rec. 500-3).

2) Test sequences and bit rates were agreed as in Table 1/§1.3.3 above.

3) Format for the D1 tape format for proposal submission was agreed as in MPEG91/027.

4) Schedule toward the Kurihama test was clarified as follows;

   - Pre-registration: June 30, 1991. Proposers are requested to send a written indication of participation to Dr. L. Chiariglione. About 26 provisional indications (10 from Europe, 4 from U.S., 12 from Japan) were given at this meeting.
   - D1 tape submission to JVC Kurihama: October 18, 1991. Tape editing for the subjective tests will follow the tape reception.
   - Subjective tests: November 18-22 or 21-27, 1991.

The meeting also considered the EBU request to provide MPEG-1 processed pictures for picture quality comparison with VHS and other pictures, but concluded it not appropriate for MPEG to provide such materials mainly on the ground that MPEG specifies only those items for proper decoder operation, not such items to guarantee picture quality performance.

3. Video Sub-group (by Gisle Bjoentegaard)

The Video group met four times during the week.

One session of two hours was devoted to tape demonstrations of coded pictures and oral presentation of accompanying documents. This was the only part devoted to the matters relevant to MPEG2/H.26X

The rest of the time was spent on matters relevant to finalizing MPEG1. The key words for this activity are:

- Editorial matters concerning the CD (Committee Draft).
- Conformance testing. The work was initiated and will be a major point also for the next meeting.
- Clearification of the differences between JPEG and MPEG-INTRA.
- MPEG report. This is a document to help understanding of the MPEG coding method. The report will be finalized at the next meeting.

COMMENTS (from G. Bjoentegaard) to the time schedule for the coming meetings in the Video group:

It is foreseen that much time will be spent on MPEG1 matters also at the next meeting. MPEG2/H.26X matters will be more heavily focused after the KURIHAMA test. It is proposed, however, that some time is spent during the next meeting to discuss working methods with particular emphasis on collaboration between MPEG and CCITT after the Kurihama test.

4. System Sub-group (by Barry G. Haskell)

The WG11 (MPEG) Systems Committee met in Paris May 27-31, 1991. During this period a number of improvements and simplifications were made to the multiplexing specifications, culminating in Revision 8 of the Committee Draft (CD).

In particular,

1) A System target Decoder (STD) was defined for demultiplexing data packets into individual buffers, one for each stream. Decoder buffer sizes are assumed known to the encode/multiplex system, and it is the responsibility of that system to not overflow or underflow the decoder buffers of the STD.

2) A Reference Presentation Model RPM) was defined for audio and video that allows for Presentation Units (PUs) and Presentation Times of these PUs.

3) An STD for variable transmission rates was proposed, including a Target Channel whose rate is known to the encode/multiplex system. As above, the encoder is responsible for managing the decoder buffers.

4) Syntax and semantics were defined that allow for time synchronization, data packetization, different stream types, etc.

5) Prior restrictions were loosened to allow for constant bit-rate per stream, as well as arbitrary interleaving of packets of different types.

6) System Clock Reference data is sent periodically in order to reset or synchronize a System Time Clock.

Further study and refinement of these and other aspects of multiplexing continue.

5. Implementation Sub-group

The group met in the afternoon of 29 May 1991 and in the morning of the 30th.

The following items were on the agenda:

1) Berlin meeting report
2) Implementation issues affecting MPEG-1
3) Verification of the MPEG-1 CD
4) Working method for MPEG-2 and contribution to the Proposal Package Description
5) AOB

5.1 Berlin meeting report

(omitted)

5.2 Implementation issues affecting MPEG-1

In the Video Group, Savatier had proposed an amendment to the coding of extended range motion vectors. After confirming that there was a real possibility of such a change being adopted if the Implementation Studies Group supported it, the topic was discussed.

It was recognised that implementations would be simplified except that the possible range of motion vectors which a decoder would have to accept would be larger. It was suggested that for bitstreams with the constrained parameters flag set, the vectors could be limited to the range available under the old scheme. With this proviso, the change was supported.

There was a short discussion on buffering. The Video Buffer Verifier (VBV) in the CD is only required to be met between sequence headers. A decoder may not be able to play continuously across a sequence boundary if the buffer conditions on each side of it are unfavourable. It was also pointed out that editing of coded video using cut and paste techniques could generate material which did not satisfy the VBV even though the originals did. Failure of systems under these circumstances should not be blamed on decoders. The group wished to ensure that these facts were known and appreciated by MPEG generally and so they were specifically highlighted in the closing plenary on the afternoon of 31 May.

5.3 CD Verification

This item was generated by the wish of MPEG to have real time verification of the CD before releasing it for general comment. The implementation studies group agreed with this desire but did not accept that fulfillment of it was the responsibility of the group. They would however act as an information and coordination point.

To this end, an analysis was done of the current situation. A decoding system operating in real-time is essential. A real-time encoder would be an advantage but is not essential.

The possibility of a decoder was examined. For the video part, no organisation claimed to have a hardware decoder which conformed to the latest version of the CD. Several decoders were known to exist which approached the CD to a greater or lesser extent, but only for one was a date offered as to when it might be fully conformant. This was the programmable decoder decoder being put together by some COMIS partners and the end of August was the target date.

For the system part, essentially the demultiplexing function, the only declared activity was again the COMIS project and it was envisaged that this would be ready in the same timeframe as the video decoder.

For MPEG audio the situation appeared somewhat better with two hardware decoders identified. One of these was followed up in more detail and this revealed that interfacing it to the COMIS demultiplexer would require some extra interfacing circuitry extending beyond simple level shifters to clock generators/phase locked loops and buffering between intermittent and

continuous data rates. It was not known if such work was in progress or planned.

On the encoder side, it was thought that coded video could be produced fairly easily by computer simulation, although some minor changes to the CD had been made at the Paris meeting. It had become recommended practice in the Video group to produce bitstreams and several participants had successfully exchanged these. No activity on the system multiplexer was known to be in progress. This was thought to be of low computational complexity (but see later).

For the audio encoder both the options of a real-time hardware encoder and an off-line computer simulation appeared available. However, it was found that the simulation programs had not been written to produce coded bitstreams, only decoded audio, and the hardware encoder had never been interfaced to a storage device. A floppy disk or tape cartridge containing a coded audio bitstream did not exist.

Another potential problem identified concerned the synchronisation of audio and video by the system multiplexer. Unlike the video specification, the audio one does not have timecodes embedded in the compressed bitstream. Thus there is no method currently available to get the timecodes relating to the uncompressed audio tracks accompanying the video on a D1 recorder to the output side of the audio encoder. This will cause difficulties for the multiplexer which must combine appropriate sections of video with audio. The simple method will be to assume that the separately encoded audio and video bitstreams begin at the same time point and then to work forward by dead reckoning.

There was a definite feeling that the issue of hardware verification of the draft CD had been left rather late in the day and information was sought from those with experience of the CCITT H.261 activity on the timescale and procedure adopted there. The validity of such a comparison was questionable because of MPEG's target of a much more highly integrated silicon solution. Nevertheless sufficient time for the verification phase should be built into the MPEG programme.

As the Implementation Studies group has no power to produce a hardware demonstrator, the group's view was that it could not accept responsibility for the verification of the CD. It was suggested that this function should fall elsewhere within MPEG. However this was not pursued because shifting the work to another group would not solve the underlying problems and it would still be the same individuals who were involved.

5.4 MPEG-2 complexity analysis

The previous meeting in Berlin had come to the conclusion that the complexity assessment procedure used for MPEG-1 should not be repeated for MPEG-2. It had been an objective process which produced hard numbers. However, there were severe doubts about the accuracy of such numbers. There would also be the difficulty of converting these numbers into agreed units which could be combined with the results from the picture quality tests etc.

The meeting agreed to use a subjective process in which the proposals would be rank ordered. The first stage would involve assessment by implementation experts working individually. Their rankings would then be compared. Hopefully these would be similar but if not, discussions would

take place to reach a common view.

It was thought to be too demanding to assess in detail all the candidates as some 20 to 30 are expected. Some preselection will therefore be required. The group felt strongly that simply taking those which did best in the picture quality tests should not be the preselection method.

The aim of the complexity assessment would be to provide information to enable MPEG to progress after the November tests. The Implementation Studies group would in effect seek to classify proposals into three groupings:

- algorithms which are much simpler than average to implement. Even if their picture quality were not among the best these should not automatically be discarded. The collaborative efforts of MPEG might be able to improve their quality while retaining some or all of their simplicity.

- algorithms which are much more complex than average to implement. Even if their picture quality were among the best these should not automatically be retained. MPEG would have to decide whether the extra picture quality was worth the extra complexity and whether other simpler approaches could be improved to be competitive.

- algorithms which are of average complexity to implement. For these the implementation complexity would not be a major factor in deciding to retain or discard them.

In addition to the descriptions, block diagrams, flow charts etc. which will accompany proposals some other information could be helpful to assessors. It was suggested that the group devise a questionnaire for proposers to complete.

Further work on the details of the process were left to be worked out at the next meeting subject to approval of the outline proposed methodology by MPEG in plenary session.

5.5 Other business

Astle raised the interesting hypothesis that processing was moving towards architectures employing parallelism and that some algorithms could be more or less favourable for these implementations. This topic was placed on the agenda for the next meeting and written contributions invited.

Annexes to Document AVC-65R

Annex 1 Documents for the second meeting of the Experts Group
Annex 2 List of tape demonstrations
Annex 3 Action plan for ATM picture format
Annex 4 Framework for further study on comparison of VBR/CBR coding
Annex 5 Liaison statement to SGXVIII
Annex 6 Liaison statement to TG CMTT/2
Annex 7 Representatives to MPEG Sub-groups
Annex 8 Input to the joint sessions with MPEG
Annex 9 Editors for "Status Report"

List of Participants of the second meeting
of the Experts Group for ATM Video Coding
(23 -31 May 1991, Paris)

FRG	Mr. F. May	Daimler-Benz Research	CM
	Mr. G. Zedler	DBP Telecom	CM
Australia	Mr. M. Biggar	Telecom Australia	CM
Belgium	Mr. L. Elewaut	Alcatel Bell Telephone	
	Mr. O. Poncin	University of Louvain	
	Mr. W. Verbiest	Alcatel Bell Telephone	CM
Canada	Mr. D. Lemay	BNR	CM
USA	Mr. P. Alexander	PictureTel	
	Mr. B.G. Haskell	AT&T Bell Labs	
	Mr. A. Deutermann	DIS	(CM)
	Mr. A.J. Tabatabai	Bellcore	CM
	Mr. J. Zdepski	David Sarnoff Research Center	
France	Mr. G. Eude	France Telecom	
	Mr. J. Guichard	France Telecom	CM
Italy	Mr. B. Riolfo	CSELT	(CM)
Japan	Mr. S. Hattori	Mitsubishi Electric	
	Mr. Y. Katayama	GCT	
	Mr. K. Matsuda	Fujitsu	
	Mr. T. Odaka	Toshiba	
	Mr. S. Okubo	NTT	Chairman
	Mr. T. Tanaka	NTT	CM
	Mr. M. Wada	KDD	CM
	Mr. M. Yano	NEC	
	Mr. T. Yukitake	Matsushita Communication	
	Mr. H. Watanabe	NTT	
Norway	Mr. G. Bjoentegaard	Norwegian Telecom	
	Mr. H. Sandgrind	Norwegian Telecom	CM
Netherlands	Mr. H. Carbiere	PTT Research	LR (CMTT)
	Mr. D. Schinkel	PTT Research	CM
UK	Mr. M.D. Carr	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 second meeting of the Experts Group

Normal Documents

AVC-22R REPORT OF THE FIRST MEETING OF THE EXPERTS GROUP FOR ATM VIDEO CODING IN THE HAGUE (CHAIRMAN)

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

AVC-23 REPORT OF MPEG BERLIN MEETING (CHAIRMAN)

The following points of our concern are extracted from the MPEG meeting outcomes;

- joint sessions with CCITT Experts Group are to be held,
- MPEG Phase 2 work plan and milestones,
- technical requirements from the CCITT point of view are to be further clarified,
- test procedures for promising video coding algorithms.

AVC-24 EXCERPT FROM WPXVIII/8 MEETING REPORT (CHAIRMAN)

The following points of our concern are extracted from the WPXVIII/8 meeting report;

- coordination of video coding aspects was initiated,
- IVS baseline document (AVC-25) will be used as a vehicle to achieve this coordination,
- some answers to our questions on the B-ISDN characteristics were provided with respect to network resource management and cell loss performance.

AVC-25 INTEGRATED VIDEO SERVICES - IVS - BASELINE DOCUMENT (WORKING PARTY XVIII/8)

This living document is intended to provide a framework for ongoing studies on the video service aspects of B-ISDN in order to ensure consistency with B-ISDN among the works of different standardization bodies. It is proposed that those groups have joint ownership of this document and that it be used as a vehicle to facilitate and promote discussion, liaison and agreements for IVS in B-ISDN.

AVC-26 REPORT OF THE 13TH MEETING IN BERLIN (MPEG)

This is reproduction of the complete report of the MPEG Berlin meeting held in December 1990.

AVC-27 EXCERPT FROM THE REPORT OF THE GENEVA MEETING (WORKING PARTY XV/1)

The following points of our concern are extracted from the WPXV/1 meeting report;

- the first progress report of the Experts Group was approved,
- "terms of reference" of the group was slightly extended to allow

direct interaction with other CCITT Groups,
- a comment was given on the balance between commonality and optimization of the video coding algorithm.

AVC-28 LIAISON STATEMENT TO CCITT STUDY GROUP XV (TG CMTT/2)

Common areas of interest between CCIR/CCITT TG CMTT/2 and Study Group XV are identified, leading to a practical collaboration method through the "Special Rapporteur for the second distribution of digital TV and HDTV."

AVC-29 COMMON PROGRESSIVE PICTURE FORMAT FOR HIGH QUALITY APPLICATIONS (BELGIUM, FRANCE, FRG, ITALY, NORWAY, THE NETHERLANDS, UK)

It is proposed that a common worldwide picture format be adopted also for high quality video applications, which has the following parameter values;

- 60 frames/second
- 576/288/288 lines for Y/U/V
- 720/360/360 pels for Y/U/V
- progressive.

AVC-30 IMPROVEMENTS OF HYBRID DCT CODING (NORWAY)

The following ideas have been tested for improving the coding performance of hybrid DCT coding schemes;

- optimized quantizers for transform coefficients
- less filtering for interpolating fractional pel positions
- adaptive use of four different two-dimensional VLCs having 1-4 bits of EOB
- prediction from two frames as alternative to interpolative coding
- use of progressive images as input to the source coder

Simulation results are presented in SNR vs bitrate as well as in processed pictures.

AVC-31 ON BIT RATES IN A TWO-LAYER CODING SCHEME (RTT BELGIUM)

Experimental data are given to the loss of coding efficiency for a 2-layer coding against a 1-layer coding in terms of bit rate overhead vs stepsize ratio between the two layers. VLC efficiency loss (in intra mode only) and impact of poor prediction due to low-accuracy loop (in inter/intra mode) are addressed.

AVC-32 COMPATIBILITY METHODS FOR VIDEO CODING SYSTEMS (THE NETHERLANDS, FRG, NORWAY, ITALY, UK, SWEDEN, FRANCE, BELGIUM)

Definitions are first given to "upward/downward compatibility" between different picture resolutions and "forward/backward compatibility" between different coding standards. Then the following methods of achieving these compatibilities are defined and discussed; simulcasting, embedded bit stream, syntactic extension, switchable encoder and standard families.

It is proposed that the definitions form a basis for further discussions on the compatibility issue.

AVC-33 SET UP OF CCIR 601 MULTI-PURPOSE CODING SCHEME (PTT RESEARCH, THE NETHERLANDS)

The set up of a multi purpose coding scheme (MUPCOS) for CCIR 601 video signals is presented, where SIF signal for odd fields coded as MPEG-1 bit stream form a base layer. The second layer transmits information for even fields as well as information for additional quantization accuracy of the SIF signal. Simulation results are provided in the form of statistical data and processed pictures.

This scheme features compatibility with H.261 on hardware level and compatibility with MPEG-1 on video-multiplex level. It is concluded that this compatibility has to be supported since the price for it is low.

AVC-34 FRAMEWORK FOR STANDARDISATION OF VIDEO SERVICES ON THE B-ISDN (AUSTRALIA)

This document identifies the long term objectives for video service provision on B-ISDN with its fundamental characteristics (cell based transport, very large capacity, great transport flexibility) considered and proposes a specific short term workplan to achieve these objectives, stressing the alignment with the B-ISDN developments.

It is also stressed to have close collaboration with SGXVIII for ensuring that the network developments accommodate the features required to achieve desired functionality for the video services.

AVC-35 ARCHITECTURE OF VIDEO SERVICE INTEGRATION ON THE B-ISDN (AUSTRALIA)

After analyzing what integration means and comparing several methods (negotiation, simulcast, layered) to achieve it on B-ISDN, "flexible layering" method is proposed as a framework, where as many layers as necessary, practical or economical for a given service are used. It is also proposed to encourage other parties to adopt this framework.

AVC-36 PICTURE FORMATS SUPPORTED BY VIDEO CODECS ON THE B-ISDN (AUSTRALIA)

It is pointed out that an early decision of the picture formats which a coder will be capable of dealing with is essential for video services integration on B-ISDN. The following resolution capabilities are suggested as a basis of this decision:

- videophone ≦192x144 luminance, ≦15Hz frame rate
- videoconference ≦384x288 luminance, ≦30Hz frame rate
- TV ≦768x576 luminance, ≦30Hz frame rate
- HDTV ≦2048x1152 luminance, ≦60Hz frame rate

AVC-37 MULTI-POINT VIDEO COMMUNICATION FOR B-ISDN (AUSTRALIA)

Early consideration of multipoint systems is proposed to exploit B-ISDN characteristics such as bandwidth-on-demand, multi-casting, selective routing, dynamic adaptation of bandwidth and time-sliced decoding and multimedia multiplexing. It is proposed that these considerations should lead to development of appropriate signalling protocols by SGXI.

AVC-38 A COMPARISON STUDY OF VBR vs CBR FOR CONVERSATIONAL SERVICES (AUSTRALIA)

The advantages and new capabilities offered by VBR video transmission are

first described. Then, experimental results are given on comparison of required network resources between VBR and CBR, reporting that VBR has an overall performance gain and a significant statistical multiplex gain on a subjective quality basis.

It is also suggested that the VBR transmission should be supported by the new functionalities in signalling protocols.

AVC-39 VIRTUAL CHANNELS FOR MULTIMEDIA SUPPORT IN THE B-ISDN (AUSTRALIA)

It is proposed that early definition of arrangements for multimedia multiparty support should include the separation of multimedia connections into separate virtual channels. This method is characterized by the separation of call and connection control, individual usage monitoring for virtual channels, service specific processing of the network, and easy support for layered coding. A case study is given to the cross media delay for multiple virtual channels.

AVC-40 RESPONSE TO INTEGRATED VIDEO SERVICES - IVS - BASELINE DOCUMENT (AUSTRALIA)

It is recommended that the group formally endorse the IVS baseline document and establish a significant role in its evolution to coordinate between video service and network developments. Some texts are proposed for updating the baseline document with respect to the video service interworking methods and the network issues.

AVC-41 STATISTICAL MULTIPLEX GAIN FOR VARIABLE BIT RATE VIDEO (RTT BELGIUM)

It is argued that if both provides the same quality, VBR has always larger statistical multiplex gain than CBR since VBR is an "eroded" version of CBR.

Several factors impacting the statistical multiplex gain are listed up; codec adaptability, noise in source, source bit rate, link bit rate, change in image contents, integration periods. It is concluded that there is no need to make a generic choice between CBR and VBR; CBR is a particular case of VBR.

AVC-42 MULTIMEDIA MULTIPLEX IN ATM NETWORKS USED IN THE BELGIAN BROADBAND EXPERIMENT (BELGIUM)

Multimedia multiplexing based on VCI multiplex is concluded as appropriate for B-ISDN because of the features; easy addition/deletion of service components during a call, service integration, information share among subscribers. Requirements on differential delay are analyzed with respect to delay due to transmission and routing through the ATM network and that due to packetization, coding and AAL. VP concept is concluded as not useful due to its quasi-static control.

A solution in the Belgian Broadband Experiment is given which is based on the service component concept to meet the differential delay requirement.

AVC-43 ATM NETWORK MODEL (SWEDEN, UK)

The following three ATM network models are presented which provide the congestion probability;

- Method of large deviation (as in the Annex 4 to AVC-22R)

- Gaussian (Normal Distribution) model
- Method of equivalent bursts

AVC-44 CELL LEVEL STATISTICS FOR A TWO-LAYER CODING SCHEME (UK)

Statistical data for information generation of a two-layer coding are presented, concluding that even for a videophone type sequence the source can be bursty, and that a relatively small buffer makes a significant difference to the shape of source.

AVC-45 DESCRIPTION OF A COMPATIBLE CODING APPROACH FOR MPEG1 AND MPEG2 (UK)

A compatible coding scheme are presented with coded results which codes CIF/SIF sized pictures and CCIR601 sized pictures. CCIR601 picture is first down converted to the SIF and then coded by MPEG1 coder as the base layer, then the difference between the original CCIR601 signal and the upconverted version of the local decoded base layer signal is coded by MPEG2 codes as the second layer. This scheme offers both forward and backward compatibilities between MPEG1 and MPEG2 (similarly H.261 and H.26X).

AVC-46 CONSIDERATIONS ON PICTURE FORMAT IN ATM NETWORKS (JAPAN)

It is proposed that the following items should be further investigated and confirmed toward defining an SCIF (Super CIF):

- picture quality degradation due to format conversion
- loss of coding efficiency by use of SCIF
- delay due to format conversion.

Some preliminary investigation results are presented for these items. Comments are also given on multiple format approaches which may eventually be used and on the areas where SCIF be adopted.

AVC-47 CONSIDERATIONS ON STATISTICAL MULTIPLEX GAIN ACCORDING TO THE FIRST SIMPLIFIED NETWORK MODEL (JAPAN)

Statistical multiplex gain (SMG) curves for VBR coding are provided based on the first CCITT network model. It is discussed that SMG becomes larger as network grows if we assume the link capacity increases accordingly, that the increase of SMG by allowing higher cell loss probability is rather limited and becomes even smaller as network grows, and that a service class which provides with reduced charge but with high cell loss may not be attractive.

It is stressed that subjective evaluation of the VBR effectiveness against CBR is important, particularly under the restriction of Usage Parameter Control of the network.

AVC-48 VBR CODING UNDER USAGE PARAMETER CONTROL (JAPAN)

One of the possible methods for UPC is first described. Then, the following study items are suggested as essential for the study of VBR coding under the UPC imposed by the network:

- averaging window size
- coding parameter control under UPC
- VBR framework which includes CBR as a particular case
- end-to-end delay.

AVC-49 SOME OBSERVATIONS ON VARIABLE BIT RATE CODED VIDEO SIGNALS (JAPAN)

Observed average bit rates are provided for various sizes of sliding window; small (up to 0.1 frame period) and large (up to 300 frames period), concluding that instantaneous peak bit rate can be reduced significantly by a small buffer, and that some scenes show a large deviation of average rate but others not. Some considerations are also given on to what cases VBR becomes effective.

AVC-50 CONSIDERATIONS ON CELL LOSS IN ATM NETWORKS (JAPAN)

Requirements for cell loss ratio are first given. Then, several methods are described which cope with not ignorable cell losses; particularly, cell interleaving which is applicable only to higher bit rate coding, packetization which should be used in any case for quick recovery from the damage and layered coding which needs evaluation of coding efficiency.

AVC-51 REQUIREMENTS OF THE HIGH QUALITY VIDEO CODING STANDARD H.26X - CONSIDERATION OF MULTIPOINT SYSTEMS, DISTRIBUTION SERVICES AND FUTURE ENHANCEMENT (JAPAN)

The following items are provided to discuss the requirements for high quality video coding standard H.26X:

- realization of multipoint systems, taking into account possibility that layered coding may be a solution,
- inclusion of an intraframe only video codec in the scope of the new standard,
- consideration of the future enhancement by means of the syntax structure.

AVC-52 REVISION TO THE ANNEX 3 TO DOC. AVC-22R (JAPAN)

Some enhancements to the questions for SGXVIII are proposed which further clarify the points of our concern by adding recent findings in required cell loss performance, statistical multiplex gain, VBR considerations with respect to UPC, multimedia multiplexing, etc.

AVC-53 INVESTIGATION OF MULTIMEDIA MULTIPLEX ON ATM NETWORKS (JAPAN)

In order to make discussion points clearer, it is suggested to first clarify the requirements on ATM networks from audiovisual terminal point of view. Required functions for an intermediate virtual "MUX" layer between "CS" layer and "User" layer are listed up for identifying those appropriate for networks.

A preliminary delay analysis is also presented for multiplexing in CS, pointing out that the size of CS-PDU relative to the bit rate is essential.

AVC-54 CLOCK RECOVERY FOR VARIABLE BIT RATE AUDIOVISUAL CODING (JAPAN)

Several clock recovery methods are discussed attempting to clarify what is needed for variable bit rate audiovisual coding and what is to be reflected in the AAL Type 2. There are four cases; CS having no clock recovery function, clock recovery in one VC, clock recovery between multiple VCs from a terminal, clock recovery between multiple VCs from different terminals.

AVC-55 H.261 COMPATIBLE 2-LAYER VIDEO CODEC WITH HIGH CELL LOSS RESILIENCE (DAIMLER-BENZ RESEARCH, FRG)

Coding results are presented for a two-layer coding scheme where the first pass encodes the input original signal according to H.261 and the coded data packets are transmitted with high priority, while the second pass encodes the difference between the original signal and the locally decoded signal of the first pass with the identical H.261 coder and the resulting coded data packets are transmitted with low priority. This scheme is compatible with H.261 and very resilient to cell loss in the second layer, up to 10E-1.

AVC-56 CONSTRAINTS ON VARIABLE BIT-RATE VIDEO FOR ATM NETWORKS (AT&T BELL LABS)

Conditions are analyzed with inequality equations which ensure that the video encoder and decoder buffers do not overflow and underflow when the channel can transmit a variable bit rate. Based on this analysis, allowable variability in terms of number of bits per frame are given as a function of the network policing parameters. The existing constant bit rate channel case is treated as part of this generalized analysis. Finally there is described a means to select jointly the number of encoded bits for each video frame and the number of bits transmitted across the variable rate channel.

AVC-57 PREPARATORY DRAFT PROPOSAL PACKAGE DESCRIPTION FOR MPEG PHASE 2 (MPEG)

This is a collection of materials agreed or to be discussed for the MPEG Phase 2 work. Overall plan, requirements and picture quality testing method for video coding candidates are described.

AVC-58 SIMULATION RESULTS FROM A SUBBAND SPLITTING CODING SCHEME COMPATIBLE WITH MPEG1/H261 (CNET)

Coded results are presented for a coding scheme which encodes CCIR601 pictures maintaining compatibility with H.261 and MPEG1 standards. The input picture is first split into four subband sequences of SIF resolution by Hadamard transform matrixes. The base layer for the LL component conforms to H.261/MPEG1, the enhancement layers transmit coded data for the remaining three subbands as well as additional data to the base layer. In the current experiments, SM3 are used for all the four subbands.

It is concluded that more investigations are needed in order to definitively know the interest of such a simple method, in particular in terms of tradeoff between loss of efficiency and simplicity.

AVC-59 PICTURE FORMATS FOR HIGH QUALITY APPLICATIONS (CANADA)

The following two picture formats are proposed for a single format for all high quality applications within a region:

	525-line format	625-line format
Frame rate	30/sec	25/sec
Interlace	progressive	progressive
No. of pels (Y/Cr/Cb)	720/360/360	720/360/360
No. of significant pels/line	704/352/352	704/352/352
No. of lines/frame (Y/Cr/Cb)	480/240/240	576/288/288

It is also proposed to reach agreement among CCITT, CMTT and ISO to support these formats for high quality applications.

AVC-60 PICTURE FORMAT FOR HIGH QUALITY INTERACTIVE VIDEO SERVICES (BELLCORE)

After having analyzed some fundamental requirements for selection of appropriate picture format(s), a common picture format with square pixel geometry is concluded as desirable to facilitate inter-region connections, to ease multipoint and bridging operations, and to realize integrated multimedia terminal. The parameter values are 528 lines/picture and 704 pels/line, 59.94 progressive pictures/sec for ATM teleconferencing.

AVC-61 STATISTICAL ANALYSIS OF VIDEO TELECONFERENCE TRAFFIC IN ATM NETWORKS (BELLCORE)

VBR coded data for a 30 minute sequence of video teleconferencing are analyzed to answer the questions of appropriate statistical model to represent coded data and appropriate video source model to be used for traffic studies. The major conclusions are as follows:

- The number of cells per frame follows a gamma distribution, which is a stationary process in the absence of scene cuts and changes.
- For traffic studies, neither an autoregressive model of order 2 nor a two-state Markov chain model is good, though the former fits the data well in a statistical sense.
- A detailed Markov chain model with about 60 states is sufficiently accurate for use in traffic studies.

AVC-62 A SIMULATION STUDY OF VIDEO TELECONFERENCE TRAFFIC IN ATM NETWORKS (BELLCORE)

Using VBR coded data for a 30 minute sequence of video teleconferencing, cell loss and delay simulation results are provided for a case where 16 sources are transmitted through a single stage multiplexer with buffer of 4 ms and 5 ms delay. It is concluded that different sources with identical statistical characteristics can experience widely different cell loss rates, and that this difference is due to the inherent periodicity of video traffic which can be alleviated by a simple buffer scheduling mechanism.

AVC-63 LIAISON STATEMENT TO CCITT WORKING PARTY XVIII/8 (TG CMTT/3) .

TG CMTT/3 gives an update for "Annex 4 - Video service interworking" of the "IVS Baseline Document", indicating several interworking techniques and advantages/disadvantages of the layered coding. Compatibility is also discussed in the light of "contribution" applications.

AVC-64 ASPECTS ON PICTURE FORMAT FOR HIGH QUALITY APPLICATIONS (SWEDEN)

Several aspects are listed up which impact the decision of a new picture format; application, compatibility, parameters, equipment. It is concluded that as much compatibility as possible shall exist among different applications, and that "distribution" and "future HDTV" aspects shall be given heavy weight in definition of a new picture format. A principle for compatibility between various applications, ranging from videophone to HDTV, is also presented.

Temporary Documents

TD-1 Agenda for the second meeting in Paris (Chairman)
TD-2 Available documents (Chairman)
TD-3 Draft status report on ATM video coding standardization (Experts Group)
TD-4 List of tape demonstrations (Chairman)
TD-5 Representatives to MPEG sub-groups (Chairman)
TD-6 Editors for "Status Report" (Chairman)
TD-7 Comparison of VBR/CBR coding - Framework for further study (Small group on VBR/CBR study)
TD-8 Action plan for ATM picture format (Small group on picture format)
TD-9 Draft liaison statement (Liaison Representative to CMTT/2)
TD-10 Liaison to SGXVIII from SGXV Experts Group on Video Coding for ATM Networks (Small group on network issues)
TD-11 Discussion results of the second meeting in Paris (Experts Group)
TD-12 Draft report of the second meeting of the Experts Group for ATM Video Coding in Paris (Chairman)

END

List of Tape Demonstrations
(Thursday, 23 May 1991)

No	Organization	Topics	Tape	Doc.
a.	Alcatel Bell Tel.	Average VBR sequences	U	
b.	GCT	Line number conversion (5→6→5)	D	AVC-46
c.	NHK	Field rate conversion (5→6→5)	D	AVC-46
d.	UCL-Belgium	BBE video codec	D	AVC-19
e.	Norwegian Telecom	Improvements of hybrid coding	D	AVC-30
f.	PTT Research	Multi-purpose coding	D	AVC-33
g.	Matsushita Comm.	Comparison of the image quality of VBR/CBR	D	AVC-48
h.	CNET	Layered coding	U	AVC-58
i.	Australian Telecom.	Cell loss protection of layered coding	U	AVC-35
j.	Australian Telecom.	VBR/CBR comparison	U	AVC-38
k.	Daimler-Benz	Cell loss, layered encoding, H.261 compatibility	U	AVC-55

ACTION PLAN for ATM PICTURE FORMAT

QUESTIONS TO BE CONSIDERED

1. Should we define a small number (1?) of formats in addition to QCIF & CIF?

2. Should we focus mainly on conversation services as a first effort?

3 Should we consider other than the following formats?

    a) SCIF; e.g. 2x2x2 Progressive, 2x2x1 Interlaced
    b) CCIR 601, 50 Hz
    c) CCIR 601, 59.97 Hz
    d) Square Pixels in a)
    e) Picture Aspect Ratio 16:9
    f) 25/30 Hz Progressive

WORK FOR AUGUST

1. SIMULATIONS

2. PROS & CONS

3. CAMERA? DISPLAY?

4. SOURCE MATERIAL

END

COMPARISON OF VBR/CBR CODING FRAMEWORK FOR FURTHER STUDY

1 - INTRODUCTION

During the meeting, the relevant contributions (TD No.1, §4.4) were scanned for all issues related to VBR/CBR coding and its comparison. These issues are listed in this document in a more or less ordered structure. Some issues were analysed into more detail, other issues not. Some suggestions are given to help compare VBR/CBR comparison results with minimal ambiguity.

The document also suggests issues for further study, an order of priority could be added. Due to the limited time budget the document is not complete. Refinements are necessary, some issues may be missing. Probably the document can be used as a living document, that can be updated at future meetings.

2 - PRESENTATION OF VBR/CBR COMPARISON RESULTS

Up to now, multiple contributions were received comparing CBR vs VBR. Comparison of these results are difficult because:

1) A lot of variables are changed at the same time (e.g. different bit rate, different picture quality, ...).

2) Different input sequences are used. Therefore it is suggested, in order to be able to compare the results, and to come to a consensus, that only one variable is changed at a time, or at least as less variables as possible.

It is also felt beneficial to define a video sequence that can be used to compare statistical results (simulations, measurements).

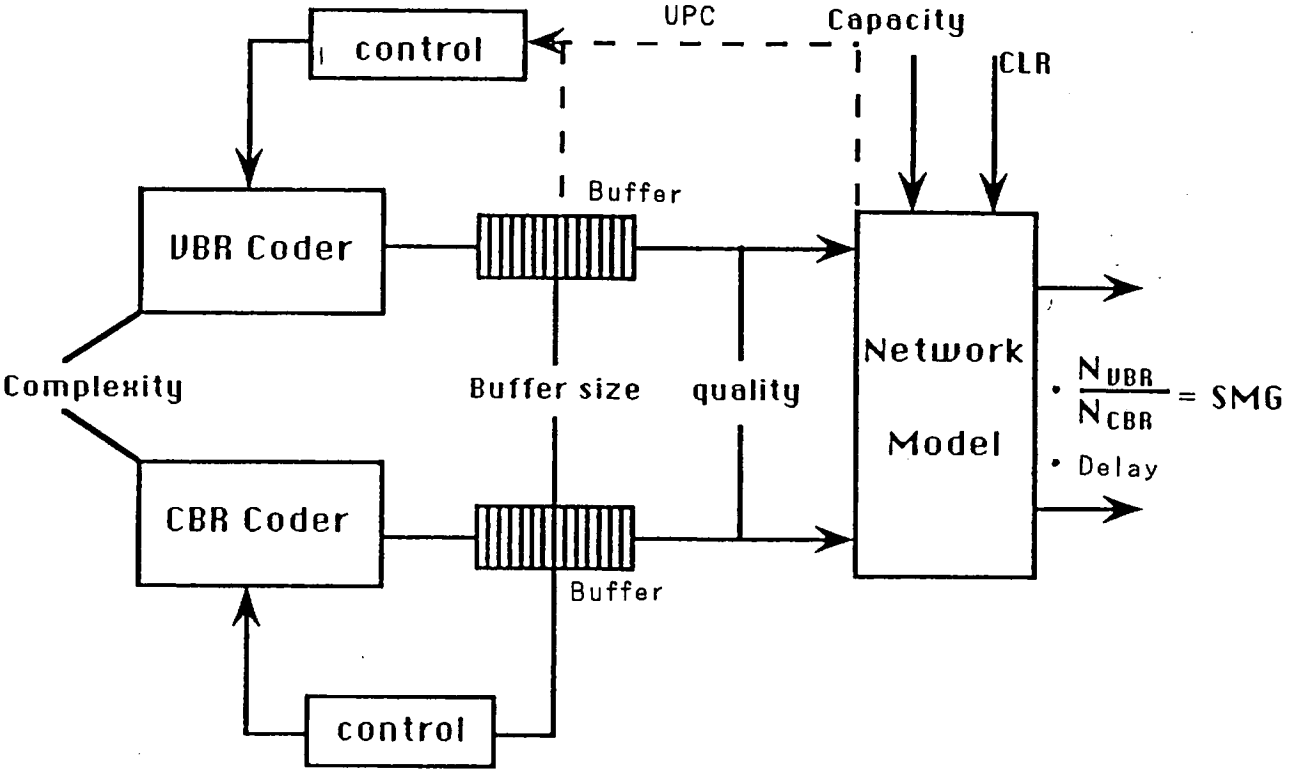
2.1. Variables

Following variables were identified, influencing the VBR/CBR comparison results:

1) Buffer size (delay)
2) Picture quality (e.g. subjective, SNR)
3) Bit rate (related to network model)
4) Codec complexity (related to coder efficiency, ...).

These variables are dependent, there are less than 4 degrees of freedom. Other variables are searched for. It is suggested that for further study, 3 variables are frozen, in order to determine the relationship between the SMG and the 4-th variable. (e.g. to compare a CBR and VBR codec with respect to bit rate, where both coders have the same buffer size, subjective picture quality and coding algorithm, in order to determine the relationship between bit rate and SMG).

In the next figure, these variables are mapped into Fig. AVC-38/1.



2.2. Reference sequence(s)

It is not the intention to create a sequence for study of coding algorithms (typical critical sequence), as a lot already exist. The idea is to provide a relatively long sequence for statistical evaluations. First of all, the requirements for such a sequence should be defined:

- length
- burstiness (+ definition how to measure it)
- interactive services (highest priority)
- listening and active speakers
- pointing to graphics; panning; switching to document, between persons; ...
- noisy camera, good lighting, ...
- input auto-focus, auto-iris, ...
- single sequence or multiple, number?
- suitability for VBR coding
- format
- format for physical distribution (e.g. D1).

It is proposed to use the CIF format as it is felt that the format will have little impact on VBR/CBR comparison results and as it solves the 30 Hz/25 Hz conversion problem.

For the generation of the sequence following procedure is proposed:

1) Agreement on contents
2) Shooting of sequence on D1, 50 or 60 Hz
3) Conversion to CIF (HW, SW)
4) Conversion back to D1, 50 & 60 Hz
5) Distribution

Volunteers are searched to take up one (or more) of these tasks.

3 - STUDY OF ISSUES IMPACTING ON SMG RESULTS

Following issues were identified that have an impact on SMG results. It is proposed to invite contributions on these topics.

3.1. Use of priority bit and layered coding. Impact on SMG, and on the choice of VBR or CBR.

3.2. Will the B-ISDN network be able of offering different QOS's, what is the possible impact on SMG's?

3.3. Relation between SMG and CLR

- impact on network model
- impact on picture quality
- blocking probability vs average cell loss
- impact of CLR behaviour (evenly spread or bursty) on experience by individual source, SMG and service degradation

3.4. Correlation. Different sources of correlation were identified:

- source periodicity
  * frame basis
  * MPEG intrafield 1:15
- multimedia?
- video sequence contents?

3.5. Control of VBR. Multiple contributions emphasized the need for a controlled behaviour of a VBR coder. Following study issues are identified:

- averaging windows
  * size
  * jumping vs sliding (or triggered jumping)
  * network & coder desires (requirements, where to meet?)
- network constraints, UPC, ...
- control strategies within the encoder: credit building, ...

3.6. Network model

- comparison of model with measured data (simulation, HW experiments)
- use of single source model
  * generate synthetic bit rate files
  * use for statistical multiplexing experiments
- refinement of the model
- ...

4 - STUDY OF OTHER ISSUES, RELATED TO VBR/CBR COMPARISON

Following issues are not directly related to SMG, but may impact the selection of VBR/CBR.

4.1. Clock recovery

- does VBR requires dedicated clock recovery schemes between

encoder and decoder? What is the impact on complexity and performance?

- do layered coding schemes require special clock recovery schemes? Impact on complexity and performance?

4.2. Can any VBR coder act as a CBR coder?

- relation with buffer length
- symmetry?
- CBR as a special case of VBR:
  * go directly for VBR, CBR as fall back solution?
- ...

END

LIAISON STATEMENT TO SGXVIII

CCITT Temporary Document (XVIII/8)
STUDY GROUP XVIII
Geneva, 11-28 June 1991

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

SOURCE : EXPERTS GROUP FOR ATM VIDEO CODING IN SGXV
TITLE : LIAISON STATEMENT TO SGXVIII
Purpose: Action

---

1. Introduction

The second meeting of the CCITT SGXV Experts Group for ATM Video Coding was held in Paris, 23-31 May 1991, to progress studies on video coding for services on the B-ISDN.

Many network related issues impact upon the work of the Experts Group, as reflected by the list of questions put to CCITT SGXVIII after the first meeting in The Hague in November 1990. Many of those questions cannot be answered in detail at this stage, but responses from SGXVIII to some of the questions were welcomed. Some additional issues were raised at the second meeting, and these are detailed below in Section 2.

The Experts Group also considered the Integrated Video Services (IVS) Baseline Document initiated by SGXVIII in Matsuyama in Nov./Dec. 1990. The SGXV Experts Group welcomes this initiative taken by SGXVIII under its coordinating role, and wishes to advise that it intends to offer substantial contributions during the evolution of the document. As an initial step, some text is offered in Section 3 below.

2. Network Related Questions

The SGXV Experts Group would welcome a response from SGXVIII on the following issues to assist in the progress of video coding and video system architecture developments.

CLR for services with differing rate behavior

Will VBR and CBR services be subject to the same CLR (in both low and high priority classes)?

Differential delay between virtual channels

The Experts Group recognises the advantages offered by the multiplexing of multimedia connections on the basis of virtual channels (VCs). However, it will be necessary to limit any differential delay between VCs. Is there any technique to limit the difference of delay for multiple VCs? Will the network offer a mechanism whereby a request that multiple VCs should be supported over the same transmission path can be satisfied?

AAL Type 2

The Experts Group is considering the functionality that it may require from the AAL for video services support. Will the function of AAL Type 2 be determined only from the standpoint of video coding? The required functionality may not necessarily be uniform across the range of services, applications and coding methods.

CLP bit

The Experts Group wishes to clarify whether the CLP bit could be changed by the network after it has been set to "high priority" by the user. If this change could occur, it would be of serious concern to the Experts Group.

3. IVS Baseline Document

The SGXV Experts Group welcomes the creation, and recognises the value, of the IVS Baseline Document as a means of coordinating video coding studies for the B-ISDN. Continued support of the document, and contributions to it, will be provided.

3.1 Video Service Interworking

The CCITT SGXV Experts Group for ATM Video Coding proposes that the text of the IVS Baseline Document of Dec. 1990 (Matsuyama) be modified as follows.

> The text contained in Annex 4 (Video Service Interworking) should be deleted, and replaced with the following:
>
> Annex 4. Video Service Interworking
>
> Integration of video services is recognised as a key objective for ATM Video Coding. It is an agreed target for the video coding system under study by the SGXV Experts Group. Several options exist for interworking between services:
>
> Negotiation Approach:
>
> At the commencement of a connection, terminals negotiate a set of parameters with which both can cope. A set of standards of increasing quality would be defined and a basic capability assumed for all terminals.
>
> Simulcast Approach:
>
> Transmitting terminals contain multiple encoders, operating at a variety of resolutions and quality levels so that broad interconnectivity can be achieved. Receiving terminals could be simple devices able to receive one of the bit streams, or could contain multiple decoders allowing a selection.
>
> Layered Signal Approach:
>
> A hierarchical representation of the video signal is defined. Coders transmit a baseband signal which provides a basic quality service. Incremental signals, which can be used along with the baseband to recover a high quality signal, are also transmitted. Receiving terminals utilise the baseband and an appropriate number

of incremental signals to recover the video signal to the quality which they are capable of displaying. Transmitting terminals provide the number of signals which is commensurate with their input signal quality. Note that "embedded bitstream" and "syntactic extension" techniques are also versions of layered coding (see TG CMTT/3 liaison statement to SGXVIII dated 17 April 1991 for the terminology).

A range of issues needs to be considered in comparing these different approaches, including complexity, coding rate penalties and performance. Negotiation would seem inappropriate for multipoint and distribution services, whereas simulcast seems inappropriate for storage applications (e.g. store and forward video mail). Layered coding seems suited to the widest application range. "Flexible layering" in which any number of layers can be used in any particular application, appears to provide broad interworking capability with few restrictions, and is currently one of the options being studied.

It is recognised that to provide easy interworking or conversions between services, and to use common display components on a terminal device intended to access multiple video services, the definition of a family of picture formats would be beneficial. Picture formats represent an important area that will influence video coding and it is being studied actively in the SGXV Experts Group.

- END -

3.2 Network Issues

The CCITT SGXV Experts Group for ATM Video Coding proposes that the text of the IVS Baseline Document of Dec. 1990 (Matsuyama) be modified as follows.

The text contained in Annex 2 (Network Aspects) should note the needs of the Video Coding Experts to be advised of certain parameters having important impact on the coding:

Annex 2. Network Aspects

Add a Section with title "Network Parameters Impacting on Video Coding Definition" as follows:

A number of parameters and operational procedures concerning the B-ISDN network will have significant impact on the definition of appropriate coding schemes for the support of video services. The areas requiring definition are listed below:

Cell loss ratio

This is an important determinant of the quality of service achievable for a video application. It determines the means, and even necessity, for providing cell loss protection for different services. It is recognised that there is a degree of flexibility in this figure, since the network operators have some flexibility to dimension the network to provide certain cell loss ratios if they are considered essential for some video services, while the codec design can also be changed to accommodate different figures. Progress needs to be made, though, perhaps by considering the impact of a range of cell loss ratios on both network and codec. The cell loss ratios for both priority levels

need to be defined. The SGXV Experts Group believes that guaranteed overall cell loss ratios, for both priority levels, will be essential to satisfy video quality of service requirements. Guaranteed performance, at least within certain time intervals, will also be required.

If the cell loss ratio is sufficiently small, no cell loss protection may be necessary. For example, a high quality videoconference connection operating at 10 Mbit/s would suffer only one cell loss every 10 hours with a CLR of 10^{-9}. This may be acceptable even if the cell loss caused visible degradation.

Studies are required to determine the quality of service parameters available to the user, and to relate these to cell loss ratio.

Cell loss burst behavior

It is understood that cell losses may occur in bursts. This impacts on the means of cell loss protection; the use of forward error correction may be too expensive and delay may be excessive for conversational services if multiple consecutive lost cells must be detected and corrected. Cell loss burst behavior may be modeled by the Gilbert model (a two-state Markov model requiring four transition probabilities, with one state representing no cell loss and the other constant cell loss).

Open questions remaining are:

- How will the cell loss burst behavior depend upon the service rate?

- Will the burst behavior of high priority cells differ from that of low priority cells and, if so, how?

- How can we estimate the average interval time, T, in which no cell loss occurs? If T>>1/(bitrate x CLR), the requirement for CLR might be relieved.

Use of CLP bit

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.

Open questions:

- Will there be separate negotiations for the two priority levels?

- Will the usage monitoring structure encourage use of both high and low priority cells?

- What options are available in selecting the quality of service?

Usage parameters

The rate statistics required of a video encoder have a significant impact on its performance (in terms of picture quality and delay). For

circuit switched networks, the target was straightforward; minimise the rate and keep it constant. For the B-ISDN (with the possible advantages of variable rate over constant rate operation), entirely different rate control strategies may be appropriate, and these could have a significant impact on codec performance. At this stage, the only clear decision is that peak rate will be an important parameter that is monitored.

In our group the term "window" means the policing time for the average bit rate. The following methods are considered for policing in the network:

Jumping window:

There is no time interval between two successive windows.

Moving window (sliding window):

The window is sliding at a time step smaller than the window size.

Stepping window:

There is a time interval between two successive windows, which always start at a valid cell.

Leaky bucket:

Cells are put into a buffer and taken from the buffer at an average bit rate. If the buffer overflows, cells are discarded.

If a codec does not know when the network measuring window starts, it should control the bit rate by sliding window (the most severe method). Is there any way in which the starting time of the network measuring window can be known?

Open questions:

- What parameters will be used for policing and admission control?

- What policing mechanism will be used?

- What averaging intervals can be used to measure mean, peak, etc.? Longer intervals (significantly greater than a video frame period which is typically 33-40 ms) are preferred for video services.

- When the network capacity is very large, the bit rate requirements of a single user will be relatively small. In this situation it seems there will be very little difference in the required network resources for low and high priority cell loss classes. Will the high priority cell loss class continue to exist in the future?

Multimedia connections

Multiplexing of multiple media has been carried out within the terminal device for circuit switched networks. The B-ISDN already offers the flexibility to use cell-based or virtual channel based

multiplexing instead. An important factor in the choice between terminal-based or cell-based multiplexing is whether there will be a penalty caused by the use of an ensemble of virtual channels instead of one composite one, although the overall rate characteristic, for example, would be the same. Most importantly, would the two options have the same transmission costs?

Some multimedia connections (most obviously associated audio, stereo in particular, and video channels) require synchronism. A concern arises, therefore, if the differential delay between virtual channels became noticeable in some service applications. This is unlikely to be a problem unless the cumulative differential delay exceeds some tens of milliseconds from end to end.

Open questions:

- How will multimedia services be handled in the B-ISDN?

- What signalling methods are being proposed?

- What kind of multimedia multiplexing method is preferred from the standpoint of network resource management?

Bit error rates

Cell payloads will be subject to a small probability of transmission error on the B-ISDN. The statistics of such errors will determine the need for, and type of, error correction mechanism and the overhead necessary to achieve this. It could also influence approaches to, and efficiency of, video coding and choice of codeword assignment scheme. Estimates of the likely bit error rates are required by those working on video coding schemes for the B-ISDN.

For interworking between video codecs on N-ISDN and B-ISDN networks, the B-ISDN bit error rate must be no greater than that for the N-ISDN. It should also be noted that the H.261 coding scheme for N-ISDN provides bit error correction, so this would not be a necessary function of the AAL in this case.

SGXVIII should work in close collaboration with the video coding experts to define any capability within the AAL concerning bit error detection or correction.

Cell delay and jitter

The fixed component of end-to-end network delay contributes to the total service end-to-end delay and therefore is a determining factor in the overall quality of service. Estimates of the limits of B-ISDN delay are required to quantify such performance and determine its impact on video encoders and decoders.

The variation in delay, or jitter determines the size of receiver buffers necessary for its removal, and therefore again influences total end-to-end delay. The expected statistics of cell delay jitter need to be known to determine the impact on the video coding system and overall quality of service.

- END -

4. Conclusion

This document has raised some important network related questions and offered text for the evolving IVS Baseline Document, as part of continuing collaboration between the SGXV Video Coding Experts Group and SGXVIII on the development of video services for the B-ISDN.

END

LIAISON STATEMENT TO TG CMTT/2

SOURCE : CCITT SGXV EXPERTS GROUP FOR ATM VIDEO CODING
TITLE : LIAISON STATEMENT TO TASK GROUP CMTT/2
Date : May 30, 1991
Purpose: Information

The CCITT SGXV Experts Group for ATM Video Coding appreciates the liaison statement from the TG CMTT/2 concerning common areas of interest between CCIR/CCITT Task Group CMTT/2 and CCITT Study Group XV.

The Experts Group considered the points mentioned in this liaison statement, in particular the appointment of Special Rapporteur and the work plan for studies on digital TV and HDTV secondary distribution.

It is recognized that it is of great importance to take notice of the ongoing work of CMTT/2. In order to proceed according to the objectives set for both groups, the Experts Group welcomes the steps made by the Task Group to advance the mutual collaboration.

END

REPRESENTATIVES TO MPEG SUB-GROUPS

Since the MPEG meetings are split into several sub-groups and operated in parallel, we need a representative to each sub-group. He is in charge of the following tasks;

- reflect the views of the Experts Group in the discussion of concerned items,
- cooperate with MPEG in organizing the meetings,
- report back the discussions (orally, with document if possible) at the closing session,
- provide a text for inclusion in the meeting report (transmit in a week to the chairman via e-mail as far as possible, otherwise via telefax).

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

END

INPUT TO THE JOINT SESSIONS WITH MPEG

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANIZATION INTERNATIONALE DE NORMALISATION

ISO-IEC JTC1/SC2/WG11

CODING OF MOVING PICTURES AND ASSOCIATED AUDIO INFORMATION

ISO-IEC JTC1/SC2/WG11
MPEG91/60
May 27, 1991

Title : Discussion results of the second meeting in Paris
Source : CCITT Experts Group for ATM Video Coding
Purpose: Report/Proposal

The experts Group for for ATM Video Coding held its independent sessions of the second meeting at CNET during May 23-24. Here are described a brief report of those sessions and some points for consideration of the joint sessions.

1. Report

We have discussed mainly on the following items;

a. Report of the meetings relevant to the Experts Group: CCITT SGXV, SGXVIII, TG CMTT/2, MPEG
b. Picture format, particularly possibility of a single format for the high quality video coding
c. Framework for H.26X: requirements and video coding architecture, cell loss consideration, layered coding
d. VBR vs CBR: comparison study in picture quality and network usage, statistical multiplex gain, network model
e. Video coding algorithms: new coding elements
f. Compatibility issue: definition, specific methods using H.261/MPEG1 as the base layer
g. Multimedia multiplexing: Cell based multiplexing as a reference
h. Network issues: coordination in SGXVIII, clarification of network characteristics

2. Requirements for the high quality video coding standard

We propose the following items be included in the requirements for the high quality video coding standard;

a. Resilience for cell loss encountered in ATM networks
b. Short coding/decoding delay (`150ms) for conversational services
c. Multipoint consideration taking into account the B-ISDN capabilities such as listed in 3/AVC-37
d. Intraframe codec which uses only intra mode be allowed (see 3/AVC-51)
e. Provision for backward/forward compatibility and adaptability to future extension by means of syntax structure (see 4/AVC-51) or

additional bit stream component

f. When compatible coding is tested, the base layer bit rate should be set as guidance to a value lower than the primary rate (1.5/2 Mbit/s), otherwise there is no way to transport the base layer for interworking with the existing systems.

3. Test sequences of progressively scanned materials

We propose to consider provision of progressively scanned test materials. There may be a danger that coding algorithms are optimized only for interlaced materials.

4. Definition of terms concerning the compatibility issue

We recommend the terminology contained in AVC-32 be used for the discussion of compatibility issue, where the following terms are defined;

- Upward/downward, forward/backward compatibilities
- Methods to implement the compatibility - simulcasting, embedded bit stream, syntactic extension, switchable encoder, standard families

5. Representatives to MPEG Sub-groups

The following persons act as representative of the Experts Group in the joint session with the MPEG sub-group:

MPEG-VIDEO	G. Bjoentegaard
MPEG-SYSTEM	B.G. Haskell
MPEG-REQUIREMENTS	S. Okubo
MPEG-TESTS	S. Okubo
MPEG-IMPLEMENTATION	D.G. Morrison

6. Documents submitted from the Experts Group

The following 8 documents are submitted for information and discussion purposes;

AVC-30 (MPEG91/078) IMPROVEMENTS OF HYBRID DCT CODING (NORWAY)
AVC-32 (MPEG91/081) COMPATIBILITY METHODS FOR VIDEO CODING SYSTEMS (THE NETHERLANDS, FRG, NORWAY, ITALY, UK, SWEDEN, FRANCE, BELGIUM)
AVC-33 (MPEG91/051) SET UP OF CCIR 601 MULTI-PURPOSE CODING SCHEME (PTT RESEARCH, THE NETHERLANDS)
AVC-34 (MPEG91/079) FRAMEWORK FOR STANDARDISATION OF VIDEO SERVICES ON THE B-ISDN (AUSTRALIA)
AVC-35 (MPEG91/076) ARCHITECTURE OF VIDEO SERVICE INTEGRATION ON THE B-ISDN (AUSTRALIA)
AVC-51 (MPEG91/075) REQUIREMENTS OF THE HIGH QUALITY VIDEO CODING STANDARD H.26X - CONSIDERATION OF MULTIPOINT SYSTEMS, DISTRIBUTION SERVICES AND FUTURE ENHANCEMENT (JAPAN)
AVC-56 (MPEG91/064) CONSTRAINTS ON VARIABLE BIT-RATE VIDEO FOR ATM NETWORKS (AT&T BELL LABS)
AVC-58 (MPEG91/077) SIMULATION RESULTS FROM A SUBBAND SPLITTING CODING SCHEME COMPATIBLE WITH MPEG1/H261 (CNET)

END

EDITORS FOR "STATUS REPORT"

The editor is in charge of the following tasks:

- to collect materials of common understanding,
- to list up items requiring further study indicating different views if any,
- to add any editor's comments in ( ) to encourage further work,
- to return the updated text in two weeks after having received the Paris meeting report, by the end of June.

Chairman will distribute the outcome as an AVC-numbered document as soon as he has received all the texts.

Title : Status Report on ATM Video Coding Standardization

	Editor
1. Introduction	S. Okubo
2. Terminology	R. Schaphorst
3. Applications	A. Tabatabai
4. Boundary conditions for ATM video coding	M. Wada
5. Picture format	G. Bjoentegaard
6. Network model	D.G Morrison
7. Video coding model	M. Biggar
8. VBR vs CBR	W. Verbiest
9. Simulation guidelines for video coding study	D. Schinkel
10. Picture quality assessment	D. Lemay
11. Work plan and work method	S. Okubo
12. Multimedia multiplexing in B-ISDN	T. Tanaka
13. Harmonization with other standardization bodies	S. Okubo
14. Outstanding questions	S. Okubo

END